DANISH MINISTRY
OF THE ENVIRONMENT
Environmental
Protection Agency

Survey of chemical substances in cleaning products for ovens, cookers and ceramic cooktops

Trine Thorup Andersen, Dorte Rasmussen and Karl-Heinz Cohr
DHI group

Dorte Nylén
Danish Toxicology Centre

Survey of Chemical Substances in Consumer Products, No. 106 2010

The Danish Environmental Protection Agency will, when opportunity offers, publish reports and contributions relating to environmental research and development projects financed via the Danish EPA.

Please note that publication does not signify that the contents of the reports necessarily reflect the views of the Danish EPA.

The reports are, however, published because the Danish EPA finds that the studies represent a valuable contribution to the debate on environmental policy in Denmark.

Contents

Preface

A visit to an ordinary supermarket proves that there is a large market for cleaning products for domestic use. The more products marketed the more different products be sold. Furthermore, many cleaning products, e.g. for cleaning of ovens, cookers and ceramic cooktops, are special-purpose products and, therefore, it is not uncommon that consumers have a total of up to 10 - 25 different cleaning products in the household. Often, many of these special-purpose cleaning products are expensive compared to the common cleaning products, e.g. all-purpose cleaning agents, hand-dishwashing agents, sanitary cleaning agents, soft soap, etc. The heavy consumption of cleaning products contributes to the total impact of chemicals on the environment and, furthermore, the products may contain substances hazardous to health. Consumers often find it difficult to assess whether chemical substances forming part of the products may have an impact on health and the environment and whether the available special-purpose products may as well be replaced by common cleaning agents. This report presents the survey of the chemical substances forming part of special-purpose products for cleaning of ovens, cookers and ceramic cooktops and for stainless steel care.

This report was prepared by Trine Thorup Andersen and Dorte Rasmussen, DHI – Institute for Water and Environment, in cooperation with Dorthe Nylén, Danish Toxicology Centre. Chapter 6 of this report ***6 Health assessment of selected substances*** was later revised by Karl-Heinz Cohr, DHI – Water, Environment and Health. Thus, the conclusions of the report do not necessarily express the attitude of the Danish Environmental Agency.

Before publication, the report has been submitted to the producers and importers, whose products are included in the survey.

Summary and conclusions

DHI – Institute for Water & Environment (DHI) and the Danish Toxicology Centre (DTC) carried out a survey of products for cleaning of ovens, cookers and ceramic cooktops and for stainless steel care available in retail shops. From May to July 2005, 21 products were bought in retail shops, and their ingredients were identified on the basis of their listings of ingredients and their safety data sheets.

In the categories oven cleaners and ceramic cooktop cleaners, 14 products were selected for chemical analysis. All 14 products were analysed for contents of organic solvents, while four of the products were further analysed for contents of PFOS (perfluoroctanyl sulfonate) compounds.

Four substances, viz. the solvents: N-methyl-2-pyrrolidone, petroleum distillates, white spirit and dipropylene glycol monomethyl ether, were singled out for a detailed assessment of the potential health and environmental effects associated with the use of the products. No contents were found in any of the four products analysed for PFOS compounds.

The use of cleaning products for ovens, cookers and ceramic cooktops was assessed not to cause any critical impact on neither the user's health nor the environment. However, the health assessments showed that some of the products contained solvents (white spirit) in concentrations, which may be critical for health and environment. These products may cause a health risk if used in confined rooms with poor ventilation. They may also cause a risk for undesirable environmental effects in a limited immediate zone around waste water discharges in areas characterised by a low water flow.

Besides, the environmental and health risk was assessed to be low for products containing high concentrations of N-methyl-2-pyrrolidone (oven cleaner), dipropylene glycol monomethyl ether (oven cleaner) and petroleum distillates (ceramic cooktop cleaner).

It is recommended to use common cleaning products such as hand dishwashing detergents and soft soap instead of special cleaning products for cleaning of ovens and cookers etc. Partly the special cleaning products for ovens and cookers are typically more expensive than common cleaning products, partly the ingredients are generally more aggressive. Finally, it is generally recommended to minimise the number and use of different cleanings products used in private households. The use of the products should be limited as much as possible, and as a precaution during use, good ventilation should be provided and gloves should be used.

1 Introduction

Cleaning products for ovens, cookers and ceramic cooktops constitute a small niche within the large variety of chemical products used in households. While, in recent years, focus has largely been on common cleaning agents and detergents, which as regards volume constitute the major part of the household products, cleaning agents for ovens, cookers and ceramic cooktops (below also called oven and cooktop cleaners) are a product group of which only little knowledge exists of their chemical composition and the potential impact on health and the environment associated with the use of the products.

Compared to more traditional cleaning agents, quite different demands are made to the efficiency of oven and cooktop cleaners, as it is often very greasy enamel or metal surfaces with burnt chunks that must be cleaned. It is thus characteristic of the products that they must have dissolving and degreasing effects. On the market, cleaning products for ovens, cookers and cooktops exist as aerosol products, liquid products, creams and gel products. In January 2005, the German consumer magazine Öko-test published a study of oven cleaners (”Backofenreiniger”), in which 14 products, mainly aerosols, were examined. It appears from this study that these products contain substances such as strong bases, solvents, surfactants, aerosol propellants and fragrances /1/.

Exposure of consumers to oven and cooktop cleaners mainly occurs by skin contact and/or by inhalation. When spray products are used, exposure will mainly occur by inhalation of aerosols. By use of liquid products, creams and gel products, exposure will occur by skin contact but also by inhalation while cleaning. Some oven and cooktop cleaners are used at very high oven temperatures, which results in increased evaporation and thus increased risk of inhalation, e.g. as regards bases and solvents. If the exposure to the chemical substances is combined with the actual cleaning process where the degree of smudge will often require especially thorough cleaning and where consumers are particularly exposed to inhalation of vapours and aerosols, oven and cooktop cleaners may be assumed to belong to the potentially more health hazardous cleaning products in the households.

There is thus a general need for building up publicly available knowledge of the chemistry of oven and cooktop cleaners and of the exposure of consumers to these products.

2 Survey of chemical substances in cleaning products for ovens, cookers and ceramic cooktops

2.1 Definition of products included in the survey

In this project, cleaning products for ovens, cookers and ceramic cooktops are defined as special-purpose products with the main purpose of cleaning ovens (including gridirons, baking trays etc.), grill, ceramic cooktops and cookers. Products marketed for stainless steel care are often placed on the same shelves as products for cleaning of ovens, cookers and ceramic cooktops and are used for e.g. cleaning of kitchen hardware and stainless steel surfaces, including gas and electric cookers. These products are also included in the survey. For some all-purpose cleaning agents and other cleaning products, cleaning of ovens and cookers is stated as one of many possible applications, but the survey does not comprise these types of products. The survey focuses on consumer products, i.e. products that are used in private households and that are available in retail shops. In addition, data were collected on products used within industry, institutions, the catering trade, etc. in order to make a comparison of the composition of consumer products and products for industrial use, respectively.

2.2 Survey

From April to July 2005, a survey was made of the chemical substances in products for cleaning of ovens, cookers and ceramic cooktops sold on the Danish retail market. The survey was performed as a combination of data collection from the listings of ingredients on the products and direct contact to the manufacturers and suppliers stated on the products. Furthermore, manufacturers of products for industrial use were contacted. Internet searches were made in order to obtain supplementary information on manufacturers, suppliers and products on the market.

The products were identified with the following types of retailers:

- Supermarkets/-chains
- Retail shops for kitchen hardware
- Drugstores

Cleaning products for ovens, cookers and ceramic cooktops are primarily sold in supermarkets and retail shops for kitchen hardware. In the periods from 3 to 24 May and 23 June to 4 July 2005, visits to 9 different supermarkets, 2 retail shops for kitchen hardware and a drugstore resulted in 21 different special-purpose products for cleaning of ovens, cookers and ceramic cooktops, including a special-purpose product for cleaning of microwave ovens. It is thus a limited range; six of the twelve visited shops had 1 - 3 different products within the above product range on their shelves, while a

few supermarkets had 6 - 9 different products. To some extent, the products sold in supermarkets were overlapping. The visited discount supermarkets did not handle special-purpose products for oven and cooktop cleaning. The prices of the products were DKK 15 - 69 for 20 - 500 ml corresponding to approx. DKK 60 - 1,100 per litre.

An Internet search (via Google) was made in order to identify potential products not sold in retail shops, but no other products available to consumers were found. It was assessed that the purchased products covered the entire Danish retail market for special-purpose products for cleaning of ovens, cookers and ceramic cooktops in the period from April to July 2005. Table 2.1 gives an overview of the products purchased in retail shops stating the form and function of the products and their classification, if any.

Table 2.1. Purchased products

Product No.	Form of the product	Classification (cf. listing of ingredients)
Oven cleaners		
1	Spray	-
5	Gel (spray)	-
6	Spray	C, R34 (Causes burns)
9	Liquid	-
12	Gel	-
Ceramic cooktop cleaners		
2	Cream	-
3	Cream	-
7	Cream	Xi, R36 (Irritating to eyes)
8	Cream	Xi, R36/38 (Irritating to eyes and skin)
11	Cream	-
13	Cream	-
14	Cream	-
16	Cream	-
17	Cream	-
Cooktop cleaners		
4	Wax	-
10	Cream	-
Microwave oven cleaner		
15	Spray	-
Stainless steel care		
18	Spray	Xi; R48/20, R65, R67, N; R51/53 *
19	Spray	F, R12 (Extremely flammable)
20	Cream	Xi; R48/20, R65, R67, N; R51/53 *
21	Cream	-

* R48/20: Harmful: danger of serious damage to health by prolonged exposure through inhalation, R65: Harmful: may cause lung damage if swallowed, R67: Vapours may cause drowsiness and dizziness, R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

From Table 2.1, it appears that a little less than half of the products (9 of 21 products) belong to the group of ceramic cooktop cleaners while only a few are products for cleaning of electric cooktops. This correlates well with the fact that today most cookers have ceramic cooktops or are gas cookers while cookers with electric cooktops constitute a continuously decreasing share. For (interior) cleaning of ovens, 5 different products were found of which 2 spray products (Nos. 1 and 6) occur most frequently in the retail shops. Many ovens currently marketed are so-called self-cleaning ovens where the cleaning takes place while the oven is used (catalysis, grease and grimes are combusted at temperatures between 200 and 300 ºC) or by use of a special mode for

cleaning the oven (pyrolysis, approx. 500 ºC). In self-cleaning ovens, cleaning agents should thus not be used on the self-cleaning surfaces, which is also specified at the informative labels on the oven cleaners. Cleaning agents may only be used for the non-self-cleaning surfaces, typically the oven bottom and glass front. Cleaning agents for microwave ovens are niche products, which are slightly outside the scope of this survey. In microwave ovens, grease and grimes are not baked on as in ovens; it is more likely that dried-up grimes are to be removed from the surfaces. Only one special-purpose product for cleaning of microwave ovens was found, and the consumption of this type of cleaning agents is considered to be limited. A limited range of products for stainless steel care was found, which are also considered to be niche products with relatively low market share.

Of the 21 purchased products, five were classified with respect to health risks (see Table 2.1). One oven cleaner was classified as 'corrosive' due to its contents of sodium hydroxide. Two products for cleaning of ceramic cooktops were classified as 'irritant', which must be due to their contents of surfactants and/or organic acids. Two stainless steel care products were classified as 'harmful: danger of serious damage to health by prolonged exposure' due to their contents of solvents. Finally, one stainless steel care product was classified as 'extremely flammable'.

Manufacturers and suppliers of cleaning products for ovens, cookers and ceramic cooktops were identified via the purchased products, by Internet searches and by personal contact to the Association of Danish Cosmetics, Toiletries, Soap and Detergent Industries (SPT). Manufacturers and suppliers were contacted by telephone in order to obtain information on volumes sold on the Danish market, market shares (if any), where the products are sold and detailed data on product compositions (specification of concentration ranges for product components). If the company wanted to participate, the initial telephone conversation was followed up by an elaborating e-mail describing the survey study and the product information required.

The direct contact to manufacturers and suppliers resulted in supplementary information in the form of safety data sheets for approximately half of the products. Several of the manufacturing companies did not, however, want to contribute with information on their products or could not spare the time needed to procure the required information.

2.3 Consumption of cleaning products for ovens, cookers and ceramic cooktops in Denmark

It was not possible to obtain detailed information on the total consumption of cleaning products for ovens, cookers and ceramic cooktops in Denmark either via contact to manufacturers, to the Association of Danish Cosmetics, Toiletries, Soap and Detergent Industries (SPT) or via statistics. A conservative estimate of the total consumption of cleaning products for ovens, cookers and ceramic cooktops is that, on an annual basis, 400,000 - 600,000 product units are sold in Denmark, of which products for ceramic cooktops constitute more than 50 %, while the remaining part is made up of products for oven cleaning (based on confidential sales figures from manufacturers and statistics from purchasers). Furthermore, no data were available on the consumption of products for stainless steel care, products for electric cooktops and for microwave ovens in Denmark.

2.4 Ingredients in the products

It was common for all the purchased products that their listings of ingredients mainly stated group names for certain types of ingredients, e.g. preservatives, anionic surfactants, non-ionic surfactants, polycarboxylates, etc. without specifying the individual constituents (as provided by EC recommendation of 1989 /7/, which applied during the period of the purchase of the products). On a few products, other types of ingredients are specified to some extent. On three of 21 products, no listings of ingredients on the packaging were found. The products can be divided into five different product types (see Table 2.2).

Table 2.2. Oven and ceramic cooktop cleaners - product types

Product type	Typical ingredients	Application/product description
Oven cleaner	Surfactants Solvents Aerosol propellants (spray products) Acids Bases Polishing agents/ abrasives Surface-active agents	Cleaning of electric and gas ovens, grills, gridirons, baking trays/tins and non-self-cleaning surfaces in self-cleaning ovens (typically oven bottoms). Used for removing slightly baked-on grimes and grease.
Ceramic cooktop cleaners	Surfactants Solvents Preservatives Complex binders Silicone compounds Polishing agents/ abrasives Acids Thickening agents Fragrance	Cleaning of ceramic cooktops. Used for removing backed-on grimes, grease and calcareous deposits on ceramic cooktops. May also be used for cleaning of stainless steel and other metal surfaces or chromium-plated parts.
Electric cooktop cleaners	Wax/lubricating oils Graphite	Cleaning and blackening/protection of electric cooktops. Maintains the matt black surface of the hot-plates and protects against corrosive attacks.
Stainless steel care	Surfactants Solvents Preservatives	Cleaning of kitchen hardware, stainless steel and metal surfaces or chromium-plated parts, including electric and gas cookers, pots and pans, etc. Used for removing dirt and traces of greasy fingers.
Microwave oven cleaners	Surfactants Solvents Fragrance	Cleaning of microwave ovens. Used for removing grimes.

Table 2.3 gives on overview of the different types of ingredients that form part of the products stating their function in the products.

Table 2.3. Types of ingredients and their function in oven and ceramic cooktop cleaners

Groups of substances identified on the basis of listings of ingredients	Function in product
Surfactants	Surface-active substances, dissolves and removes grease and dirt from surfaces
Solvents	Degreasing, cleaning and polishing effect
Preservatives	Prevent bacterial and fungal growth in the product, prolong the product life time
Complex binders	Bind calcium, increase the cleaning efficiency by binding and inactivating metal ions
Acids	Regulating acidity (buffer), dissolve calcium oxide
Bases, alkali	Regulating acidity (buffer), grease loosening
Abrasives/polishing agents	Substances (particles, grains) with abrasive or polishing effect
Thickening agents	Firming agent
Silicone compounds	Produce a non-gloss surface and a protective water-repellent film. Make boil-over easy to remove
Surface-active agent	Prevents that stains/stripes are left on cleaned surfaces
Fragrance	Fragrance
Wax/lubricating oils	Lubricate and nurse electric/ceramic cooktops. Produce a protective water-repellent film and prevent corrosive attacks
Propellants	Aerosol or liquid substance making the content of aerosol dispensers discharge as solid/liquid particles or foam
Graphite	Leave a protective film, lubricate and blacken hot-plates

Appendix A gives a list of the ingredients declared on each product and the classification and labelling of the products.

Cleaning products for ovens, cookers and ceramic cooktops typically contain substances such as surfactantc (non-ionic and anionic surfactants, fatty acid soaps), solvents, acidity regulators (acids, bases), abrasives/polishing agents, preservatives, silicone compounds, thickening agents and fragrance (see Table 2.2). The ingredients vary in accordance with the application area and form (spray, gel, liquid) of the product. E.g. silicone, abrasives and thickening agents primarily form part of products for cleaning of ceramic cooktops, while solvents mainly occur in oven cleaners and stainless steel care. Oven cleaners are the only product group that contains corrosive substances (sodium hydroxide). Oven cleaners as sprays also contain propellants.

Six of the products stated a content of fragrance in their listings of ingredients. Two of the products not stating a content of fragrance had, however, a distinct odour, which indicated that fragrances presumably formed part of the products. Based on their odour, the remaining products were assessed not to contain fragrances. No content of colorants was declared on any of the products. A few products had a turquoise blue colour indicating that these products may contain colorants. Table 2.4 gives the specific ingredients that were identifiable on the basis of the listings of ingredients of the products and the safety data sheets received.

Table 2.4 is assessed to contain a representative section of the substances that form part of the products, although detailed information was not available on all of the purchased products. CAS numbers and classifications of substances (List of dangerous substances /2/) were added when they did not appear from the listings of ingredients or safety data sheets (SDS) of the products.

2.4.1 Petroleum distillates/white spirit

Three solvents of the petroleum distillate type form part of five of the tested products. The three petroleum distillates are identified with the CAS-numbers 64742-82-1, 64742-48-9 respectively 64742-47-8, cf. Table 2.4. The two first mentioned are different types of white spirit, which WHO name white spirit type 1 respectively type 3 /30/. The third petroleum distillate is produced in the same way as white spirit type 3, but it has a higher boiling point interval. Thus it is closely related to the two types of white spirit. In the later health assessment, these petroleum distillates will be assessed as white spirit. However, in Chapter 4 Chemical analyses the term “petroleum” is used.

According to WHO /30/, the term white spirit covers five types of petroleum distillates, which are very similar (types 0, 1, 2, 3 and Stoddard solvent). In the EU type 1 (CAS No. 64742-82-1 - Naphtha (petroleum), hydrodesulfurized heavy) is the most commonly used petroleum distillate, the American variant of which is called Stoddard solvent (CAS No. 8052-41-3). However, according to LODS /2/, there is a difference in the demands to classification of the different variants of white spirit. According to LODS, Stoddard solvent must be classified with R48/20 (Harmful: danger of serious damage to health by prolonged exposure through inhalation), while this classification is not stated for European variant of white spirit (type 1). This is due to the fact that here the classification is solely made with regard to carcinogenic effect (Carc. cat. 2) and with regard to the risk of aspiration into the lungs (R65). In LODS, the term white spirit includes both Stoddard solvent and white spirit, which is not treated apart from the distillation (type 0, CAS No. 64742-88-7). These two types are classified in Denmark with R48/20-65, among others, according to the safety clause in the Directive on classification and labelling (67/548/EEC).

Compared to the health and environmental assessments in Chapter 5 it is, however, worth mentioning that certain products, which according to the listing of ingredients contain white spirit of other variants than those, which are classifiable according to LODS, are classified with R48/20 anyway. It seems probable that this is due to the self classification of the producers. In this connection the use of R48/20 must be taken into consideration regardless the fact that this classification is not stated in LODS.

Table 2.4. Identified ingredients in oven and ceramic cooktop cleaners (purchased products)

Type of substance	Name	CAS No.	Conc. range	Classification	Source
Non-ionic surfactants	Alcohol ethoxylate	24938-91-8	1-5%	Xi; R41, N; R50	SDS[1]
	Alcohol ethoxylate, C12-18	68439-50-9	1-5%	Xi; R36/38, N; R50*	SDS
	Alcohol ethoxylate, C13-iso	9043-30-5	1-5%	Xi; R36/38*	SDS
	Alcohol ethoxylate, C12-14, 4EO	68439-50-9 5274-68-0	1-5%	Xi; R41, N; R50	SDS
	Alcohol ethoxylate, C12-14, 6EO	68439-50-9	1-5%	Xn; R22, Xi; R41	SDS
	Alcohol ethoxylate, C9-11	68439-46-3	1-5%	Xn; R22 Xi; 38-41 N; R51/53	SDS
	Lauryl amine, ethoxylated	No data	1-5%	Xn; R22 Xi; R41	SDS
Anionic surfactants	Secondary alkane sulphonate	97489-15-1	1-5%	Xi; R38-41	SDS
	Fatty acid soaps, not specified	No data	10-20%	No data	
Amphoteric surfactants	Cocopropylene diamine triproprionate	97659-50-2	1-5%	Xi; R36	SDS
Solvents	2-aminoethanol	141-43-5	5-10%	Xn; R20/21/22 C, R34	LODS[2]
	2-propanol	67-63-0	1-5%	F; R11 Xi; R36, R67	LODS
	Butyl diglycol	112-34-5	-	Xi; R36	LODS
	Heterocyclic compounds	No data	1-5%	Xi; R36/38	SDS
	Petroleum distillates (Aliphatic hydrocarbons)	64742-47-8	10-50%	Xn; R65	LODS
	Propylene glycol	57-55-6	1-5%	-	
	Ethanol	64-17-5	1-5%	F; R11	LODS
	N-methyl-2-pyrrolidone	872-50-4	1-5%	Xi; R36/38	LODS
	Naphtha (crude oil), hydrodesulphurized, heavy	64742-82-1	-	(Carc2;R45) [3] Xn; R65 (conc. ≥10%)	LODS
	Naphtha (crude oil), hydrotreated, heavy	64742-82-1	-	(Carc2;R45) [3] Xn; R65 (konc. 10%)	LODS
	White spirit [4]	8052-41-3	-	(Carc2;R45) [3] Xn;R48/20-65 (conc. ≥10%)	LODS
Complex binders	Polycarboxylates	No data	-	No data	
	Trisodium citrate	6858-44-2	-	-	
	IDS (iminodisuccinate)	144538-83- 0	-	No data	
Acids	Citric acid	77-92-9, 5949-29-1	1-5%	Xi; R36	SDS
	Glycolic acid	79-14-1	-	-	
Bases, alkali	Sodium hydroxide	1310-73-2	1-5%	C; R35 (conc. ≥5%)	LODS
Abrasives/ polishing agents	Aluminium oxide	1344-28-1	25-50%	-	
	Potassium carbonate	584-08-7	1-5%	Xi; R36/37/38	SDS
Thickening agents	Xanthane rubber	11138-66-2	-	-	
	Polysaccharides	-	-	-	
Silicone compounds	Poly(dimethyl siloxane)	No data	-	No data	
	Silicone	No data	1-5%	No data	
	Silicone oil	63148-62-9	-	-	

Type of substance	Name	CAS No.	Conc. range	Classification	Source
Surface-active agent	Unspecified	No data	-	No data	
Fragrance	Unspecified	No data	1-5%	No data	
Wax/ lubricating oils	Mineral oil	8042-47-5	20-50%	-	
	Ozokerite wax	8001-75-0	50%	-	
Propellants	Propane	74-98-6	1-5%	Fx; R12	LODS
	Butane	106-97-8	1-5%	Fx; R12	LODS

1 SDS: Safety data sheet, self classification
2 LODS: List of dangerous substances /2/
3 White spirit type 1 /30/
4 White spirit type 3 /30/
5 Classification with Carc2, R45 is only allocated when > 0.1 % benzene form part of the raw material, which is extremely rare
* Previous CESIO classifications, not updated
(CESIO=Comité Européen des agents de Surface et de leurs Intermédiaires Organiques)

2.5 Comparison of products for private and industrial use

As a supplement to the information gathered in the survey of products on the retail market, selected companies manufacturing or supplying products for industrial cleaning of cookers, ceramic cooktops and ovens were contacted. The selected companies are some of the main stakeholders in the professional market in Denmark and their products are thus considered representative for this market. In general, manufacturers and suppliers for the professional market have, to a larger extent, easily accessible data on their products (supplier's safety data sheets) on their websites, which made it much easier to obtain information on the composition of products for industrial use. 16 products for industrial use were identified comprising 14 products for oven and grill cleaning, one product for ceramic cooktops (identical with Product No. 16 in Table 2.1) and one product for stainless steel care.

To a high degree, the types of chemicals substances forming part of products for private and industrial use, respectively, were coinciding. The products primarily contained the same surfactants, solvents, acids and bases, while the frequency and concentration with which the substances occurred in consumer products and professional products varied. The most pronounced difference was that the oven cleaners for industrial use were generally more aggressive as almost all of them were strongly alkaline (containing sodium hydroxide or potassium hydroxide at concentrations of up to 30 %). The pH values of these products were typically between 13 and 14.

Table 2.5 shows the classification of the identified products for industrial use.

Table 2.5. Products for industrial use

Product No.	Form of the product	Classification (cf. safety data sheet)
Oven/barbecue cleaners		
A	Liquid	C; R35 (Causes severe burns)
B	Liquid	C; R34 (Causes burns)
C	Liquid	C; R35 (Causes severe burns)
D	Liquid	C; R35 (Causes severe burns)
E	Liquid	C; R35 (Causes severe burns)
F	Liquid	C; R35 (Causes severe burns)
G	Liquid	-
H	Liquid	C; R35 (Causes severe burns)
I	Liquid	C; R35 (Causes severe burns)
J	Spray	F; R12, Xi; R38-41 (Extremely flammable, Irritating to skin, Risk of serious damage to eyes)
K	Liquid	Xi; R36/38 (Irritating to eyes and skin)
L	Liquid	C; R35 (Causes severe burns)
M	Liquid	C; R35 (Causes severe burns)
N	Liquid	C; R35 (Causes severe burns)
Ceramic cooktop cleaners		
O	Cream	-
Stainless steel care products		
P	Liquid	-

Of the 14 oven cleaners for industrial use, 11 products were classified as corrosive and 2 were classified as irritant. For comparison, only 1 of the 5 oven cleaners identified on the retail market was classified as corrosive (Table 2.1).

For cleaning products for industrial use, the supplier is obliged to prepare a safety data sheet. This SDS includes information on correct handling of the product and potential use of personal protective equipment. In companies working with dangerous substances and materials, the employer is under obligation to prepare workplace instructions and distribute these to the employees together with instructions in correct and safe use. Employees handling dangerous substances and materials should thus always be informed about the way in which the products should be handled and the personal protective equipment that must be used.

For products sold in retail shops, the consumers may read information on the use and safe handling of the product together with environmental and health hazards on the product label.

3 Legislation and regulations

Cleaning products for ovens, cookers and ceramic cooktops are covered by the Danish EPA's regulation on classification and labelling, regulation on detergents and cleaning agents, regulation on the use of propellants and solvents in aerosol dispensers /2, 3, 4, 5/ and the EC regulation on detergents, which came into force on 8 October 2005, i.e. after the period during which the products assessed in this report were purchased /6/. Below the effect of the above regulations on the labelling of the products is briefly described[1].

3.1 Regulations for classification and labelling of products

Products, which contain hazardous substances and which must be classified as dangerous, must carry a label in Danish stating the trade name of the substance or product, the volume of the product, chemical names of hazardous substance, hazard class designation, hazard symbols and related R- and S-phrases. Furthermore, the products must be labelled with company name and address of the manufacturer or the company responsible for the marketing of the product.

For products, which must be classified as very toxic, toxic, harmful, corrosive, carcinogenic, mutagenic or reproduction toxic (CMR) in categories 1, 2 or 3, or sensitising, the constituents causing this classification must be stated if they occur in concentrations higher than or similar to the lower concentration limit for classification. Products labelled very toxic or toxic (including CMR substances in cat. 1 and 2) must not be sold to private consumers.

Products not classified as sensitising, but containing a sensitising substance in a concentration above 0.1 %, must be labelled with the name of the substance and information that it may produce an allergic reaction.

If the products are for industrial use, there are further demands to the preparation of safety data sheets/supplier's instructions for the products (Danish Executive Order No. 559 issued by the National Working Environment Authority on 4 July 2002 on Special Duties of Manufacturers, Suppliers and Importers, etc. of Substances and Materials pursuant to the Danish Working Environment Act). Classified products for industrial use sold in volumes of more than 100 kg per year must be registered in the Danish Product Register by the manufacturer/importer/distributor before the product is released on the market.

3.2 Regulations for detergents and cleaning agents

According to the statutory order on detergents and cleaning agents, which applied during the period of the purchase of the products (Danish Statutory Order No. 884, 2002), the packaging of a product should be labelled in

[1] Please note that the regulations mentioned were in force in 2006. The existing regulation may be found at www.retsinfo.dk or www.mst.dk

Danish with the aim of application together with name/company name and address or registered trade mark belonging to the company responsible for the marketing. The primary biodegradation of the surface-active substances (surfactants) in the products must be at least 90 % (measured as the removal of surface-active properties). Furthermore, the EU Commission has made a recommendation of 13 September 1989 on labelling of detergents and cleaning products /7/), that the contents expressed in percentages of a number of constituents, including a.o. surfactants, are declared on the packaging within fixed ranges. Preservatives/disinfectants must be stated irrespective of concentration.

The Danish Statutory Order No. 884 and the EU Recommendation were as from 8 October 2005 replaced by the Regulation of the European Parliament and of the Council No. 648/2004 on washing and cleaning products (the detergent regulation) /6/), in which it is specified that the contents of selected substances must be stated in weight percentage ranges. The contents of aromatic/aliphatic hydrocarbons, which are some of the substances identified in this survey, must be stated on the packaging if the contents exceed 0.2 weight percentages of the product. Enzymes, disinfectants, optical brighteners and fragrance must be stated irrespective of their concentration. Furthermore, preservatives must be stated using their INCI names (International Nomenclature Cosmetic Ingredient: common nomenclature for cosmetics), if possible. Furthermore, there is a demand for supplementary labelling of the products regarding 26 named allergenic fragrances. If they are used in concentrations larger than 0.01 weight percentage, it must be stated on the packaging. For surfactants used in the products, requirements are made to complete aerobic biodegradability.

3.3 Regulations for propellants and solvents in aerosol dispensers

Oven cleaners as sprays (aerosols) are comprised by the statutory order on the use of propellants and solvents in aerosol dispensers (Danish Statutory Order No. 571, 1984). In annex 1 of the order, the propellants and solvents that can be used in aerosol dispensers are specified together with the limitations and conditions for their use. The list contains 36 different substances. In addition, the products are comprised by the executive order on aerosols issued by the National Working Environment Authority (Danish Executive Order No. 844, 1994), which gives the rules for correct labelling of aerosol dispensers.

3.4 Assessment of purchased products according to labelling rules

An assessment of the information available in the listings of ingredients and safety data sheets of the products and chemical analyses indicates that 4 of the 21 purchased products were not correctly labelled and classified in accordance with the regulations of classification and labelling of chemical substances and products /3/. According to the chemical analysis, product no. 1 contained solvents in a concentration causing the product to be labelled ‘Irritant’, while for products 6, 18 and 20 there was no obvious consistency between risk phrases and labelling. The products 18 and 20 were labelled with risk phrases showing that the products contained solvents in concentrations that caused the products to be labelled ‘Harmful’ and ‘Dangerous for the Environment’, respectively. For the remaining products, no violation of the regulations on classification and labelling was observed.

Based on the available data, two of the products (products nos. 4 and 6) were assessed to comply with the labelling regulations in the EC regulation on detergents, which came into force on 8 October 2005, at the time of their purchase (May - July 2005).

4 Chemical analyses

4.1 Selection of products for chemical analysis

As the knowledge of contents and concentrations of chemical substances in oven and cooktop cleaners is limited, a number of the products identified in the survey were selected for analysis for specific constituents. The following selection criteria for the products for analysis were established in concert with the Danish EPA:

- The market share of the products. Ceramic cooktop cleaners and oven cleaners were assessed to constitute the largest market share within the product group. The products for stainless steel care, microwave oven and electric cooktop cleaners are expected to constitute a minor market share and were thus not included in the analysis programme.

- Contents of health hazardous solvents. On a few products, contents of health hazardous solvents were declared (2-aminoethanol, various hydrocarbon distillates) while, in most of the products, the contents of specific solvents were unknown. The products were analysed for the total contents of organic solvents.

- Products for cleaning of ceramic cooktops, which, based on their listings of ingredients, did not contain silicone compounds, were analysed for contents of PFOS (perfluoroctanyl sulfonate) compounds (see subsection 4.1.2).

All the surfactants that were identifiable in the products were assessed to be completely biodegradable. Surfactants were thus not included in the analytical programme. Several of the retail products contained fragrances. A large number of fragrances are currently in focus because of their allergenic effects. As they are not leave-on products, where users are frequently exposed via skin contact, and as exposure to fragrances in oven and ceramic cooktop cleaners is considered to be limited compared to the total exposure to fragrances in consumer products, analyses for fragrances were not included.

Based on the preliminary survey of the chemical constituents in oven and ceramic cooktop cleaners, 14 of 21 products were selected for chemical analysis. All 14 products were analysed for their contents of solvents, while 4 of the products were also analysed for their contents of PFOS (perfluoroctanyl sulfonate) compounds. Table 4.1 shows the selected product types.

Table 4.1. Products selected for analysis

Product No.	Type of analysis	Product type
1	Solvents	Oven cleaner (spray)
2	Solvents	Ceramic cooktop cleaner
3	Solvents	Ceramic cooktop cleaner
5	Solvents	Oven cleaner (gel)
6	Solvents	Oven cleaner (spray)
7	Solvents, PFOS	Ceramic cooktop cleaner
8	Solvents	Ceramic cooktop cleaner
9	Solvents	Oven cleaner (liquid)
11	Solvents	Ceramic cooktop cleaner
12	Solvents	Oven cleaner (gel)
13	Solvents, PFOS	Ceramic cooktop cleaner
14	Solvents, PFOS	Ceramic cooktop cleaner
16	Solvents, PFOS	Ceramic cooktop cleaner
17	Solvents	Ceramic cooktop cleaner

4.1.1 Solvents

Solvents are used in oven and ceramic cooktop cleaners in order to dissolve grime and grease. Furthermore, solvents improve the effect of surfactants in the products. As smudging will usually be more pronounced in ovens and on ceramic cooktops compared to other surfaces, the concentration of solvents in oven and ceramic cooktop cleaners may be expected to be higher or the composition of solvents may be different from that of common cleaning agents.

4.1.2 PFOS compounds

PFOS compounds and their metabolites are persistent in the environment. All PFOS compounds may potentially degrade to perfluorooctyl sulfonate, which degrades very slowly in the environment, and may bioaccumulate in animals and humans. PFOS is still used in cleaning agents as spray for cleaning of glass (perfluoroalkyl sulfonate) and in a number of polishing products /8/. PFOS compounds have surface-active as well as polishing properties. PFOS increases the fluidity of the product, which makes the product disperse evenly. The function of PFOS is thus an increase of the cleaning effect and the adhesion.

In most of the cleaning products, in which PFOS has a polishing or impregnating function, PFOS may be replaced by silicone-based substances, which have a similar function in the products. The majority of the products for cleaning of ceramic cooktops contained silicone substances according to their listings of ingredients. Only the products, for which silicone substances did not appear from their listings of ingredients, were analysed for their potential contents of PFOS compounds.

4.2 Analytical methods

4.2.1 Solvents

A subsample was extracted with DMF (dimethyl formamide) with addition of internal standards. A subsample of the extract was taken out and directly analysed by combining gas chromatography and mass spectrometry (GC/MS) by scanning a larger mass area. All identifications of substances were made on the basis of the mass spectrum compared with mass spectra in a data library.

The contents were calculated quantitatively by use of an external standard and response factors for external standards.

For spray products with contents of propellants (propane/butane), the analysis was made after the propellant had evaporated.

Analyses were made as repeat determinations and were calculated as the mean of the two determinations.

The reporting limit was 500 mg kg^{-1} and the analytical uncertainty was approx. 15 % RSD (relative standard deviation).

4.2.2 PFOS

A subsample was extracted with methanol followed by direct analysis of the extract by reverse phase column liquid chromatography with mass spectrometric detector (HPLC-MS). The detection was made by electrospray ionization in negative mode. The calibration was made with external standards analysed in series with the sample.

One of the samples (product no. 7) was not dissolvable/suspendable in methanol. Instead a mixture of methanol and aqueous ammonium acetate was used. The analyses were made as repeat determinations and were calculated as the mean of the two determinations.

The detection limit was 0.1 mg kg^{-1} and the analytical uncertainty was 10 - 15 % RSD.

The analysis included the following components: Perfluorobutane sulfonate, perfluorohexane sulfonate, perfluorooctan sulfonate, perfluorodecane sulfonate, perfluorooctane sulfonamide, N-ethyl perfluorooctane sulfonamide, perfluoroheptane acid, perfluorooctane acid and perfluorononane acid.

4.3 Results

4.3.1 Solvents

All 14 products were analysed for solvents. Table 4.2 shows the results of the analyses. Values are given in weight percentages. In two of the products (nos. 2 and 9), no solvents could be detected.

Table 4.2. Results of analysis for solvents (mean of repeat determinations). The results are stated in weight %

Product No.	1	2	3	5	6	7	8	9	11	12	13	14	16	17
Ethanol/isopropanol	-	-	-	-	-	-	-	-	-	0.94	-	4.1	2.2	-
Ethyl acetate	-	-	-	-	-	-	-	-	-	-	-	-	0.12	-
Dipropylene glycol monomethyl ether	-	-	-	13	13	-	-	-	-	-	-	0.05	-	-
N-methyl-2-pyrrolidone	15	-	-	4.1	-	-	-	-	-	-	-	-	-	-
Tripropylene glycol monomethyl ether	-	-	-	16	-	-	-	-	-	-	-	-	-	-
Butyl diglycol	-	-	-	-	-	-	-	-	5.6	-	-	3.4	-	2.6
Petroleum	-	-	13	-	-	-	-	-	-	-	8.7	-	-	-
Alkylised furandione*	0.87	-	-	-	-	-	0.56	-	-	-	-	-	-	-
Sum of organic acids including acetic acid	-	-	-	-	-	2.3	-	-	-	-	-	-	-	-

-: less than the stated detection limit (500 mg/kg)
*: semiquantitatively determined

4.3.2 PFOS

Four of the products were analysed for 9 specific PFOS compounds. No PFOS compounds were detectable in any of the four products (detection limit: 0.1 mg kg^{-1}).

4.4 Summary of results of analyses

4.4.1 Solvents

Solvents form part of the analysed products in varying concentrations. Table 4.3 shows the sum of the solvents identified by analysing products for cleaning of ovens and ceramic cooktops, respectively.

Table 4.3. Total contents of analysed organic solvents in oven cleaners and ceramic cooktop cleaners (in weight %)

Oven cleaners		Ceramic cooktop cleaners	
Product No.	Total concentration of solvents in weight %	Product No.	Total concentration of solvents in weight %
1 (spray)	16	2 (cream)	-
5 (gel, spray)	33	3 (cream)	13
6 (spray)	13	7 (cream)	2.3
9 (liquid)	-	8 (cream)	0.56
12 (gel)	0.94	11 (cream)	5.6
		13 (cream)	8.7
		14 (cream)	7.6
		16 (cream)	2.3
		17 (cream)	2.6
Average	12.6	Average	4.8

Note: Analyses of spray products have been made after evaporation of the propellant

As expected, the products for cleaning of ovens contained the highest concentrations of solvents, up to 33 % based on weight. According to the analyses, the oven cleaners on spray form had high contents of organic solvents (13 – 33 %), whereas the two other oven cleaners contained < 1 % or no organic solvents.

For spray products the real concentration of solvents in the total product, including the propellant, is lower than shown in Table 4.3, as the analysis as mentioned was made after evaporation of the propellant.

In the products for ceramic cooktops, organic solvents were identified in 8 of the 9 analysed products. In product no. 2, no solvents were identified by chemical analysis. The solvents were found in concentrations of 0.56 - 13 % (based on weight).

Of the solvents identified by analyses, six of the substances were classified in accordance with the Danish EPA's List of dangerous substances (LODS) as stated in Table 4.4.

Table 4.4. Classified solvents analysed in the products

Chemical name	CAS No.	Classification, substance
Petroleum	Various CAS Nos., e.g. 8008-20-6	Xn, R65*
Ethanol	64-17-5	F; R11
Isopropanol	67-63-0	F; R11 Xi; R36 R67
N-methyl-2-pyrrolidon	872-50-4	Xi; R36/38*
Butyl diglycol	112-34-5	Xi; R36
Maleic acid anhydride (2,5-furandione)**	108-31-6	Xn; R22 C; R34 R42/43

* Lower concentration limit for classification of product: 10 %

** In the analyses,"alkylised furandione" was identified. The exact identity of the substance could not be determined.

In product no. 1 (oven cleaner, spray), the contents of N-methyl-2-pyrrolidone were measured to 15 % after evaporation of the propellant. The amount of propellant is stated in the safety data sheet to be max. 10 %, which gives a concentration of N-methyl-2-pyrrolidone of 13.5 % in the total product, including the propellant. A product must be classified and labelled as 'Irritant' (Xi) when the contents of N-methyl-2-pyrrolidone are more than 10 %. In accordance with the 31st adaptation to the Dangerous Substance Directive (67/548/EC), which has not yet been adopted, it has been discussed to classify N-methyl-2-pyrrolidone as reproduction toxic (T;R61 May cause harm to the unborn child), and consequently also products containing N-methyl-2-pyrrolidone.

Product No. 3 contains 13 % of petroleum. For products with a viscosity of less than 7×10^{-6} m^2 sec^{-1}, a petroleum content of > 10 % will result in a classification of a product as "Harmful" (Xn) with R65 (Harmful: may cause lung damage if swallowed). As the product, however, is a cream product with high viscosity, the product will not have to be classified due to its contents of petroleum.

None of the other solvents in Table 4.4 are contained in concentrations resulting in a classification of the products.

4.4.2 PFOS compounds

No contents of PFOS compounds above the detection limit (0.1 mg/kg) were found in any of the 4 analysed products (products nos. 7, 13, 14 and 16). All of the analysed products are ceramic cooktop cleaners.

According to their listings of ingredients, the other products for cleaning of ceramic cooktops (not analysed for PFOS) contained silicone compounds

(polydimethyl siloxanes). As already mentioned, silicone compounds have the same function in the products as PFOS compounds, and are used as an alternative to PFOS.

4.5 Summary of results of chemical analyses and available product information

In Table 4.5, the results of the chemical analyses are compared with the information on the composition of the products found in their listings of ingredients and in their safety data sheets (SDS). For each product, comments are made on the concord of these data.

Table 4.5. Comparison of results of chemical analyses and information from suppliers

Product no.	Type of product	Substances identified by chemical analysis (% in the product)	Comments
1	Oven cleaner (spray)	N-methyl-2-pyrrolidone (15%) Alkylised furandione (0.87%) (Both substances are heterocyclic aromatic compounds)	A content of "solvents" was stated in its listing of ingredients. Its SDS stated "heterocyclic compounds" in a concentration of 1 – 5 % with the classification Xi; R36/38. The data disagree as the concentration of the heterocyclic compounds found at the analysis exceeded 1 – 5 %. There will be a demand for labelling of the product if the contents of N-methyl-2-pyrrolidone is above 10 % (Xi;R36/38).
2	Ceramic cooktop cleaner	-	According to its listing of ingredients, the product contained citric acid. No organic acids > 0.05 % were found at the analysis.
3	Ceramic cooktop cleaner	Petroleum (13 %)	According to its listing of ingredients, the product contained petroleum distillates, which agreed with the analysis. Its SDS stated 25 - 50 % aliphatic hydrocarbons, which exceeded the content found at the analysis. Furthermore, a content of citric acid < 1 % was stated in its SDB (not identified at the analysis > 0.05 %).
5	Oven cleaner (spray)	N-methyl-2-pyrrolidone (heterocyclic compound) (4.1 %) Dipropylene glycol monomethyl ether (13 %) Tripropylene glycol monomethyl ether (16 %)	Its listing of ingredients did not state any contents of organic solvents. According to its SDS, the product contained 1 - 5 % N-methyl-2-pyrrolidone, which agreed with the content of 4.1 % determined at the chemical analysis.
6	Oven cleaner (spray)	Dipropylene glycol monomethyl ether (13 %)	Its listing of ingredients did not state any contents of organic solvents.
7	Ceramic cooktop cleaner	Organic acids (2.3 %)	Its listing of ingredients did not state any contents of organic solvents. According to its SDS, the product contained 1 - 5 % citric acid, which agreed with the contents of 2.3 % organic acids determined at the analysis.

Product no.	Type of product	Substances identified by chemical analysis (% in the product)	Comments
8	Ceramic cooktop cleaner	Alkylised furandione (heterocyclic compound) (0.56 %)	Its listing of ingredients stated an organic solvent. According to its SDS, the product contained 1 - 5% citric acid. No organic solvents > 0.05% were found by chemical analysis. There was no information of a content of heterocyclic compounds.
9	Oven cleaner (liquid)	-	Its listing of ingredients stated a content of organic solvent. No organic solvents > 0.05 % were found by chemical analysis.
11	Ceramic cooktop cleaner	Butyl diglycol (5.6 %)	Its listing of ingredients stated a content of butyl diglycol, which agreed with the results of the chemical analysis.
12	Oven cleaner (gel)	Ethanol/isopropanol (0.94 %)	According to its SDS, the product contained < 2 % isopropanol, which agreed with the results of the chemical analysis.
13	Ceramic cooktop cleaner	Petroleum (8.7 %)	No listing of ingredients/SDS
14	Ceramic cooktop cleaner	Ethanol/propanol (4.1 %) Dipropylene glycol monomethyl ether (0.05 %) Butyldiglycol (3,4 %)	No listing of ingredients/SDS
16	Ceramic cooktop cleaner	Ethanol/propanol (2.2 %) Ethyl acetate (0.12 %)	According to its listing of ingredients and SDS, the product contained citric acid (1 – 5 %). No organic acids > 0.05 % were found by chemical analysis. According to its listing of ingredients, the product contained alcohol, which agreed with the content of 2.2 % ethanol/isopropanol identified by the chemical analysis.
17	Ceramic cooktop cleaner	Butyl diglycol (2.6 %)	According to its listing of ingredients, the product contained alcohol, which agreed with the results of the analysis.

SDS: Safety data sheet

Table 4.5 shows that a few of the available listings of ingredients do not agree with the analytical data on solvents.

In general, no large amounts of dangerous substances were identified by the analyses. For several products, the results of the chemical analysis are the only data, as no information was available on the product labels or in the safety data sheets (SDS). Aromatic/aliphatic hydrocarbons were identified as petroleum, N-methyl-2-pyrrolidone or alkylised furandione in five of the products (nos. 1, 3, 5, 8 and 13).

The analysed parameters indicate that the share and composition of solvents vary according to the application area and form of a product. The highest concentrations of organic solvents were thus found in spray products for oven cleaning, whereas the concentrations in the other analysed produces were lower. The data material, however, is not extensive enough to draw unambiguous conclusions on the composition and contents of solvents according to the different types of products.

4.6 Comparison with scouring cream

A sub-objective of this survey and the chemical analyses of oven and ceramic cooktop cleaners were to compare the contents of ceramic cooktop cleaners with common scouring creams. The purpose of this comparison was to assess whether it is the same substances that form part of these two types of products, especially with respect to the use of abrasives. Depending on the grain size of the abrasive particles, the abrasives may scratch the surfaces cleaned.

For this purpose, three common scouring creams were purchased in May - July 2005. Table 4.6 shows the typical constituents of scouring creams identified on the basis of the listings of ingredients of the three products.

Table 4.6. Identified constituents in common scouring creams

Type of substance	Name	CAS No.	Conc. range	Substance identified in ceramic cooktop cleaners
Non-ionic surfactants	Alcohol ethoxylate, C13-iso, 3EO	9043-30-5	< 5 %	Yes
	Alcohol ethoxylate, C13, 10EO	24938-91-8	1-5 %	(Yes) Similar surfactant formed part of product
	PEG-3 Oleamide	-	< 5 %	No
	Alcohol ethoxylate	No data	< 5 %	Yes
Anionic surfactants	Sodium lauryl ether sulfate	85711-69-9	1-5 %	No
	Alkane sulfonate, C13-17	No data	< 5 %	(Yes) Similar surfactant formed part of product
Amphoteric surfactants	Cocamidopropyl betaine	61789-40-0	< 5 %	No (another amphoteric surfactant formed part of product)
Solvents	Propylene carbonate	108-32-7	< 5 %	No
Complex binders	Polycarboxylate	No data	< 5 %	Yes
Preservatives	Methylisothiazolinone	2682-20-4	< 5 %	No
	Methylchloroisothiazolinone	26172-55-4	< 5 %	No
Abrasives	Calcium carbonate	471-34-1	> 30 %*	No
	Aluminium silicate	1335-30-4	< 5 %	No
Thickening agents	Xanthane rubber	11138-66-2	< 5 %	Yes
	Sodium chloride	7647-14-5	< 5 %	-
Fragrance	Unspecified	-	< 5 %	Yes

* According to its listing of ingredients, > 30 % water and calcium carbonate form part of the product

Table 4.6 indicates a certain coincidence of chemical substances used in scouring creams and ceramic cooktop cleaners, respectively, e.g. regarding surfactants (surface-active substances). The available information on the specific composition of the products is, however, limited and the comparison is only based on a small number of products. It is thus possible that the overlap in the contents of chemical substances is even larger than indicated in Table 4.6. A substantial difference between the two types of products is that silicone does not form part of the scouring creams. The concentration of solvents in scouring creams is only stated for one of three products, which contains less than 5 % of solvent. If this level is representative of scouring creams, it corresponds to the average concentration of solvents quantified in ceramic cooktop cleaners (4.8 %), see Table 4.3.

Various abrasives are used for scouring creams and ceramic cooktop cleaners. In scouring creams, calcium carbonate (chalk) is typically used in considerable amounts together with aluminium silicate. In ceramic cooktop cleaners, mainly aluminium oxide and potassium carbonate (potash) are applied as shown in Table 4.7.

Table 4.7. Abrasives used in scouring creams and ceramic cooktop cleaners, respectively

Product	Abrasive	Concentration interval	Molecular formula
Scouring creams	Calcium carbonate (chalk)	> 30 %*	$CaCO_3$
	Aluminium silicate (kaolin)	< 5 %	$Al_6O_{13}Si_2$
Ceramic cooktop cleaners	Aluminium oxide	25-50 %	Al_2O_3
	Potassium carbonate (potash)	< 5 %	K_2CO_3

* According to its listing of ingredients, > 30 % water and calcium carbonate form part of the product

It was not possible to get any information on the grain size of the different abrasives. It appears that in both types of products, abrasives may constitute a considerable part. For all of the purchased scouring creams, the labels specifically states that the products should not be used for ceramic cooktops and number of other surfaces (i.e. chromium-plated tabs, painted/lacquered surfaces, plastic, marble etc.). The possible applications of the scouring creams are limited to hard surfaces such as tiles, stainless steel, enamel, bathtubs and sanitary ware etc. It is thus assumed that the abrasives contained in common scouring creams may scratch the surface of ceramic cooktops and surfaces that are “softer” than enamel, stainless steel and tiles etc.

5 Health and environmental assessment of ingredients

5.1 Health and environmental assessment of ingredients identified by the survey

Below, the various types of ingredients identified by the survey were screened with respect to their health and environmental hazard. The screening was made on e.g. the basis of the general rules for labelling and classification of chemical substances and the Danish EPA's guidance on self classification of dangerous substances /3, 9/. When mentioned below that a substance is not classified in the List of dangerous substances (LODS), it is important to realize that it cannot necessarily be concluded that the substance cannot have dangerous properties. The reason for the lack of classification may be that the substance has not been evaluated by the authorities.

5.1.1 Surface-active substances (surfactants)

At least 10 of the 21 products contained non-ionic surfactants and at least 12 products contained anionic surfactants. One product contained amphoteric surfactants. The surfactants form part of the products in concentrations of 1 - 5 %. However, fatty acid soaps (anionic surfactants) occurred in concentrations of 10 - 20 % in a single product. The non-ionic surfactants mainly consist of alcohol ethoxylates with varying numbers of ethoxylate(EO)groups. The anionic surfactants consist of secondary alkane sulfate and fatty acid soaps.

Surfactants are irritating to skin and eyes, and often they have a degreasing effect on the skin. In general, the anionic surfactants are the most irritating; the amphoteric surfactants are less irritating. According to CESIO (Comité Européen des agents de Surface et de leurs Intermédiaires Organiques), it is recommended to classify alcohol ethoxylates as Harmful (Xn) with R22 (Harmful if swallowed) (5 -15 EO) and Irritant (Xi) with R41 (Risk of serious damage to eyes). The potential for irritation depends on the degree of ethoxylation and the length of the alkyl chain. It is recommended to classify the anionic surfactants as Irritant (Xi) with R38-41 (Irritating to skin - Risk of serious damage to eyes) and to classify the amphoteric surfactants as Irritant (Xi) with R36 (Irritating to eyes).

As regards the environmental properties, all of the identified surfactants are considered readily degradable. Only a very small part is thus expected to be discharged into the environment with treated waste water after retention in a waste water treatment plant. Several of the non-ionic surfactants have high acute toxicity. For alcohol ethoxylates, the lowest EC/LC_{50} values are < 1 mg/L in standard tests with algae, crustaceans and fish /10/. The identified surfactants are not considered bioaccumable. The toxicity varies with the chemical structure of the substances, but most of the alcohol ethoxylates will be classified as Hazardous to the environment (N) with R50 (Very toxic to aquatic organisms). Generally, the anionic surfactants are less toxic than the

non-ionic surfactants (EC/LC$_{50}$ > 1 mg L^{-1}) /10/, and they are not considered environmentally hazardous as the substances are readily biodegradable. No data are available on the toxicity of the amphoteric surfactant to aquatic organisms.

Surfactants form part of the vast majority of the cleaning products. The surfactants identified in cleaning products for ovens, cookers and ceramic cooktops do not differ from those used in other types of cleaning products.

5.1.2 Solvents

The following solvents are identified in the products:

- ethanol/isopropanol
- ethyl acetate
- dipropylene glycol monomethyl ether
- tripropylene glycolmonomethyl ether
- N-methyl-2-pyrrolidone
- butyl diglycol
- petroleum
- alkylated furandione
- organic acids (including acetic acid, citric acid)
- naphtha (petroleum), hydrodesulfurized, heavy (white spirit, type 1)
- naphtha (petroleum), hydrotreated, heavy (white spirit, type 3)

In general, organic solvents have irritating and degreasing effects on skin. Irritating effects on eyes and respiratory system have also been observed. Inhalation of high concentrations of vapours has irritating effects on the respiratory system and may cause headache, dizziness and malaise. Prolonged or repeated exposure to high concentrations may cause damages to the nervous system.

Petroleum distillates are identified in 5 of the 21 purchased products (products nos. 3, 13, 18, 19 and 20). Petroleum distillates have only been officially assessed as regards carcinogenic effect (Carc2;R45) and their ability to cause chemically induced pneumonia. Other effects must be self-assessed. The classification with Carc2;R45 is only relevant if the petroleum distillate contains > 0.1 % of benzene, which is very rare. Petroleum distillates also comprise products better known as white spirit.

The health hazardous effects of the petroleum distillates depend on the method and degree of refining. In general, distillates with a high content of aromatic compounds are more irritating to skin and eyes than types with a low content of aromatic compounds. Petroleum distillates have a degreasing effect on skin, and repeated or prolonged exposure may cause dryness and cracking of the skin.

As mentioned, certain types of white spirit are classified with Xn;R48/20 (Harmful: danger of serious damage to health by prolonged exposure through inhalation) and R65 (Harmful: may cause lung damage if swallowed), see subsection 2.5.1. Ingestion of white spirit causes stomach trouble and symptoms as if inhaled. If white spirit enters the lungs due to vomiting after ingestion, it may provoke chemically induced pneumonia.

Of the 14 products analysed for contents of solvents, 3 products contained glycol ethers. The glycol ethers found are di- and tripropylene glycol

monomethyl ether. Most glycol ethers have low acute toxicity and a relatively low irritating effect on skin and eyes /11/. Specifically, propylene glycol ethers have low volatility and low acute toxicity when inhaled. The glycol ethers found by analysis are not classified according to LODS.

None of the solvents found are classified as environmentally hazardous in LODS. Petroleum distillates and white spirit are, however, not readily degradable and they are toxic to aquatic organisms with lowest EC/LC_{50} values in the interval of 1 - 10 mg/L /12, 13/. Both substances consist of complex mixtures of hydrocarbons with different chain lengths, and the physico-chemical and environmental properties of the substances will depend on the mixture ratio and chemical structures (chain lengths and branching) of the hydrocarbons. The estimated log P_{OW} values of the substances are stated as intervals with log P_{OW} 3.3 - 8.7 for petroleum distillates and log P_{OW} 2.1 - 6 for white spirit /12/. Based on the estimated log P_{OW} values, both petroleum distillates and white spirit are considered potentially bioaccumulable. The substances could thus be classified as Hazardous to the environment (N) with R51/53 (Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment). The other identified solvents are assessed to be of little hazard to the environment.

5.1.3 Preservatives

According to the listings of ingredients of the products, preservatives form part of 5 of the 21 products in concentrations < 5 %. It was not possible to identify the applied preservatives. Many of the preservatives used in cleaning products are allergenic to humans and toxic to aquatic organisms.

5.1.4 Acids/bases

The following acids and bases are identified in the products:

Acids:
- citric acid
- glycolic acid

Bases:
- sodium hydroxide

Generally, acids and bases are irritating or corrosive depending on the concentration. At the same time, bases have a degreasing effect on skin, which may mean that other substances with irreversible effects may more easily be absorbed through the skin, e.g. allergenic substances. Sodium hydroxide is classified as corrosive at concentrations as low as 2 %. Below 2 % and down to 0.5 %, sodium hydroxide is classified as irritating.

Citric acid has low acute toxicity, but may cause irritation to eyes /36/. Neither glycolic acid nor citric acid is found in LODS.

The identified acids and bases are not considered to constitute any environmental risk.

5.1.5 Abrasives

The following abrasives were identified in the products:

- aluminium oxide
- potassium carbonate (potash)

These substances are not considered hazardous to health in the concentrations used in the products. As a 100 % powder, the substances cause irritation/corrosion of skin, eyes and mucosa.

The abrasives are not considered hazardous to the environment.

5.1.6 Silicone compounds

The following silicone compounds were identified in the products:

- silicone
- silicone oil
- polydimethyl siloxane (silicone polymers)

Polydimethyl siloxanes (silicone) are synthetic polymers manufactured by polymerising silanes. The polydimethyl siloxanes are not classifiable according the Danish EPA regulations and are not considered hazardous to health.

None of the silicone substances are classified as environmentally hazardous. The substances are considered not readily degradable, but they have low acute toxicity to aquatic organisms. The silicone substances are thus considered not to cause adverse long-term effects in the environment.

5.1.7 Fragrance

Fragrance forms part of at least 6 of the 21 products. Many fragrance substances may provoke allergy. The EU has listed 26 allergenic fragrances, which, from the adoption of the statutory order on detergents in October 2005, must be stated in the listing of ingredients of detergents and cleaning products if they form part of the product in concentrations above 0.01 %.

None of the products contained any information on concentration of fragrance substances or on which fragrances that formed part of the product. The risk of allergy could thus not be assessed.

The environmental properties of the fragrances are inadequately elucidated. Furthermore, the composition of fragrance mixtures is rarely known, which is also the case for the products in this project. As some fragrances are environmentally hazardous, the low concentrations (< 1 %) of fragrance in the examined cleaning products do not provide a certain proof for acquitting the fragrances as potentially hazardous substances in the aquatic environment.

5.1.8 Propellants

The following propellants were identified in the products:

- butane
- propane

Butane and propane are classified as Extremely flammable (Fx;R12). This applies to butane containing < 0.1 % of butadiene. Butane containing more than 0.1 % of butadiene is extremely rare and must be further classified as carcinogenic (Carc1;R45 (May cause cancer)) and mutagenic (Mut2;R46 (May cause heritable genetic damage)).

Butane and propane are not classified as environmentally hazardous.

5.1.9 Other substances

The other substances identified in the products belong to the following groups:

Complex binders:

- polycarboxylates
- trisodium citrate
- iminodisuccinate

Thickening agents:

- xanthane rubber
- polysaccharides

Surface-active agent:

- unspecified

Wax and lubricating oils:

- mineral oil
- ozokerite wax

None of the complex binders found are classified according to LODS. Polycarboxylates have shown low acute toxicity if ingested and vaguely irritating effects on skin and eyes. Data on the health hazardous properties of the identified complex binders are limited.

Mineral oils may form irritating oil mist when heated and cause indisposition if ingested. Furthermore, prolonged contact with used oils may cause skin irritation, e.g. itching, flushing, eczema and oil acne.

None of the other substances are considered hazardous to health.

None of the substances are considered hazardous to the environment.

6 Health assessment of selected substances

6.1 Substances selected for assessment

Based on the screening of the occurrence of the chemical substances in the products and their hazards, the following substances were selected for a more detailed assessment of the exposure of humans and the environment, respectively:

- N-Methyl-2-pyrrolidone
- Dipropylene glycol monomethyl ether
- Petroleum distillates
- White spirit

As mentioned in subsection 2.4.1, three different petroleum distillates were found in five products. Two of the petroleum distillates have been identified as types of white spirit (WHO type 1 and type 3). The third petroleum distillate is chemically closely related to white spirit type 3. In the following assessments the three petroleum distillates will be regarded as white spirit, however, considering the higher boiling point of petroleum distillate, and thus lower vapour pressure and slower evaporation.

The substances are found in cleaning products for ovens, ceramic cooktops and stainless steel. Table 6.1 gives an overview of the product types included in the exposure assessment.

Table 6.1. Exposure to critical substances by use of cleaning products for ovens, ceramic cooktops and stainless steel

Product No.	Type of product	Hazardous substance in product
1	Oven cleaners (spray with propellant)	N-methyl-2-pyrrolidone
5	Over cleaners (gel in pump)	DPGME*
3	Ceramic cooktop cleaners	Petroleum distillates
20	Stainless steel care	White spirit

* Dipropylene glycol monomethyl ether

6.2 Risk evaluation of the selected substances

6.2.1 N-Methyl-2-pyrrolidone

6.2.1.1 Identification and physico-chemical data for N-methyl-2-pyrrolidone

Table 6.2. Identification

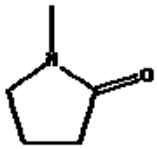
Chemical name	N-methyl-2-pyrrolidone
Synonyms	2-pyrrolidinone, 1-methyl-, 1-methyl-2-pyrrolidinone, methylpyrrolidone
CAS No.	872-50-4
EINECS No.	212-828-1
Molecular formula	C5H9NO
Molecular structure	
Legislation: Classification according to the Danish EPA List of dangerous substances (Danish Statutory Order No. 439 of 3 June 2002)/2/	Xi; R36/38 (> 10 %)
List of Undesirable Substances. The Danish EPA /15/	Not on the list
Danish National Working Environment Authority's limit value /16/	5 ppm/20 $mg \cdot m^{-3}$

Table 6.3. Physico-chemical properties

Physical state	Transparent liquid /17/
Molecular weight (g/mol)	99.13
Melting point (°C)	26 /19/
Boiling point (°C)	202 /19/
Vapour pressure (Pa, 25 ºC)	70 /18/
Octanol-water partition coefficient (log P_{OW})	-0.11 /19/
Water solubility (mg/L)	2.48×10^{-5} /19/

Furthermore, N-methyl-2-pyrrolidone has low volatility and high water absorbing properties.

6.2.1.2 Health assessment of N-methyl-2-pyrrolidone

Acute toxicity

N-Methyl-2-pyrrolidone can be absorbed in the body by inhalation, through the skin and through the gastro-intestinal system and is moderately toxic by all routes of exposure /20/.

The inhalation studies made have either shown no mortality or very low mortality in the exposed animals. No LD_{50} values have been reported /20/.

Table 6.4. Toxicological data for N-methyl-2-pyrrolidone

Study	Effect concentration	Reference
LD_{50}, rat, oral	3,914 $mg \cdot kg_{bw}^{-1}$	/21/
LD_{50}, rabbit, dermal	8,000 $mg \cdot kg_{bw}^{-1}$	/21/
NOAEL, rat, ingestion, 90-day study	169-217 $mg \cdot kg_{bw}^{-1}$	/22/
Reproduction toxicity		
NOEL, rat, inhalation (embryonic weight)	56 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$	/23/
LOEL, rat, inhalation (embryonic weight)	130 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$	/23/
NOEL, rabbit, dermal (mother-toxicity and embryonic mortality)	300 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$	/23/
LOEL, rabbit, dermal (mother-toxicity and embryonic mortality)	1,000 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$	/23/

Irritation of skin and eyes

N-methyl-2-pyrrolidone has a mild skin irritating effect. Prolonged and repeated contact may cause skin irritation /24/. N-Methyl-2-pyrrolidone has high skin permeability and may increase transport of other substances through the skin /20/.

Eye irritation, corneal lesions and conjunctivitis in humans exposed to N-methyl-2-pyrrolidone have been reported /21/. N-Methyl-2-pyrrolidone in concentrations up to 50 $mg \cdot m^{-3}$ did not show irritation of the mucous membranes of the eyes and the respiratory system in humans /39/.

Sensibilisation

No data were found indicating that N-methyl-2-pyrrolidone may cause allergy.

Toxicity and repeated exposure

Inhalation of aerosols of N-methyl-2-pyrrolidone (0, 100, 500 or 1000 $mg \cdot m^{-3}$, 6 hours/day, 5 days/week, 4 weeks) caused drowsiness and irregular breathing in all animals after 3 - 4 hours of exposure. The only hazardous effect was found in the respiratory system at the highest exposure level /20/. No effect was found in the respiratory system by inhalation of 20, 40 or 400 $mg \cdot m^{-3}$, mainly vapours /20/.

Long-term effects

Studies on reproduction toxicity show that N-methyl-2-pyrrolidone may cause harm to the unborn child /20/. After skin contact with N-methyl-2-pyrrolidone at a concentration of 750 $mg \cdot kg_{bw}^{-1}$, pregnant rats have shown toxic effects in both dam and embryo /22/. In reproduction studies, exposure doses with no or mild toxic effects on female rats (NOAEL 620 $mg \cdot m^{-3}$, 6 hours) have shown harmful developmental effects on the rat embryos (NOAEL 360 $mg \cdot m^{-3}$, 6 hours) /20/.

In connection with the preparation of the 31st adaptation of the Substance Directive, it was discussed, as mentioned earlier, to classify N-methyl-2-pyrrolidone as reproduction toxic with T;R61 (May cause harm to the unborn child).

No carcinogenic effects of N-methyl-2-pyrrolidone have been observed /20/.

Conclusion

The critical local effect of N-methyl-2-pyrrolidone by short-term exposure is irritation of the mucous membranes of the eyes and the respiratory system in humans.

NOAEL for irritation is 50 $mg \cdot m^{-3}$.

The critical systemic effect of N-methyl-2-pyrrolidone by inhalation is drowsiness and irregular breathing. NOAEL for this effect is 100 $mg \cdot m^{-3}$ after 4 hours, corresponding to 20 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$.

The critical effect at repeated exposure for N-methyl-2-pyrrolidone is effect on embryonic development: NOAEL for this effect is 360 $mg \cdot m^{-3}$, corresponding to approx. 104 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$.

N-methyl-2-pyrrolidone has high skin permeability and may promote the skin permeability of other substances.

6.2.2 Dipropylene glycol monomethyl ether (DPGME)

6.2.2.1 Identification and physico-chemical data

Table 6.5. Identification

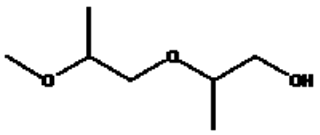
Chemical name	Dipropylene glycol monomethyl ether
Synonyms	DPGME Propanol, (2-methoxymethylethoxy)-, (2-methoxymethylethoxy) propanol,
CAS No.	34590-94-8
EINECS No.	252-104-2
Molecular formula	C7H16O3
Molecular structure	
Legislation: Classification according to the Danish EPA List of dangerous substances (Danish Statutory Order No. 439 of 3 June 2002)/2/ List of Undesirable Substances. The Danish EPA /15/	Not classified Not on the list
Danish National Working Environment Authority's limit value /16/	50 ppm/300 $mg \cdot m^{-3}$ (H)

Table 6.6. Physico-chemical properties

Physical state	Liquid /17/
Molecular weight (g/mol)	148.2
Melting point (°C)	-83 /17/
Boiling point (°C)	190 /17/
Vapour pressure (Pa, 20 ºC)	37- 60 /12/
Octanol-water partition coefficient (log P_{OW})	-0.06 /12/
Water solubility (mg/L)	Miscible /12/

6.2.2.2 Health assessment of dipropylene glycol monomethyl ether (DPGME)

Acute toxicity

DPGME is found on the Danish National Working Environment Authority's list of organic solvents, with a limit value of 50 ppm/300 $mg \cdot m^{-3}$, as a

substance that may be absorbed through the skin /16/. When exposing rats to 500 ppm (3080 mg·m^{-3}) DPGME for 7 hours, a mild narcotic effect (narcosis) was observed. This corresponds to a systemic dose of 1035 mg·kg^{-1} /33/.

Table 6.7. Toxicological data for DPGME

Study	Effect concentration	Reference
LD_{50}, rat, oral	5,600 mg/kg$_{bw}^{-1}$	/21/
LD_{50}, rat, dermal	9,500 mg/kg$_{bw}^{-1}$	/21/

Irritation of skin and eyes

DPGME may cause mild irritation of skin and eyes /21, 34/. DPGME has a degreasing effect on the skin /32/. Repeated skin contact (rabbits, 90 days) caused mild skin irritation /33/.

Vapours of DPGME irritate the eyes and the respiratory system /32/. The limit for irritation of the mucous membranes is reported to be 450 mg·m^{-3} (73 ppm) /34/.

Sensibilisation

No data on sensitising effects or effects on the immune system of DPGME were found. Glycol ethers are generally not considered to be sensitising /33/.

Toxicity at repeated exposure

Oral dosage to rats exposed to 0, 40, 200 or 1000 mg/kg$_{bw}^{-1}$·d^{-1} for 4 weeks caused increased saliva secretion and liver weight with histopathological changes at the highest dose. NOAEL in this study was 200 mg/kg$_{bw}^{-1}$·d^{-1}.

No effects were found in rats or rabbits exposed by inhalation to 200 ppm (1230 mg·m^{-3}) DPGME for 13 weeks. In other inhalation studies, where rats were exposed to concentrations of DPGME of up to 330 ppm (2030 mg·m^{-3}) 6 hours/day for 9 days, a little increase of the liver weight was observed /33/. Exposure of the skin of rabbits to 1 or 10 ml/kg$_{bw}^{-1}$·d^{-1}, 5 days/week for 90 days (950, 9500 mg/kg$_{bw}^{-1}$·d^{-1}, respectively) DPGME caused narcosis and death at the highest dose. NOAEL in this study was 950 mg/kg$_{bw}^{-1}$·d^{-1}.

Long-term effects

No indications were found that DPGME has toxic effects on the reproduction or the development. No tests have shown mutagenic and carcinogenic properties of DPGME /33/.

Conclusion

Skin irritation is not considered to be a problem.

The critical local effect by short-term exposure to DPGME is irritation of the mucous membranes of the eyes and respiratory system. NOAEL for irritation is 450 mg·m^{-3}.

The critical systemic effect by short-term exposure to DPGME is the effect on the nervous system. NOAEL for acute effect on the nervous system is 3080 mg·m^{-3}, 7 hours, corresponding to 1035 mg/kg$_{bw}^{-1}$·d^{-1}.

The critical systemic effect by repeated exposure to DPGME is increased liver weight and liver changes; NOAEL for liver effect by repeated exposure is 200 mg/kg$_{bw}^{-1}$·d^{-1} (4 weeks).

6.2.3 Petroleum distillate / white spirit

The name white spirit covers, as mentioned in subsection 2.4.1, several types of similar petroleum distillates. In this assessment, Stoddard solvent is used as a basis, but data from the other substances in this group have also been used.

6.2.3.1 Identification and physico-chemical data for white spirit

Table 6.8. Identification

Chemical name	White spirit
Types	1. White spirit 2. Solvent naphtha (petroleum), medium heavy aliphatic 3. Naphtha (petroleum), hydrodesulfurized heavy 4. Naphtha (petroleum), full-range straight-run 5. Naphtha (petroleum), hydrogentreated heavy 6. Distillates (petroleum), hydrogentreated light
Synonyms	1. Stoddard solvent 2. WHO type 0 3. WHO type 1 4. WHO type 2 5. WHO type 3 6. Petroleum (unspecified)
CAS Nos.	1. 8052-41-3 2. 64742-88-7 3. 64742-82-1 4. 64742-42-0 5. 64742-48-9 6. 64742-47-8
EINECS Nos.	1. 232-489-3 2. 265-191-7 3. 265-185-4 4. 265-042-6 5. 265-150-3 6. 265-149-8
Molecular formula	-
Molecular structure	Complex mixtures of unbranched and branched aliphatic, naphthenic and aromatic hydrocarbons
Legislation: Classification according to the Danish EPA List of dangerous substances (Danish Statutory Order No. 439 of 3 June 2002)/2/ List of Undesirable Substances. The Danish EPA /15/	1. Carc2;R45 Xn;R48/20-65, R10** 2. Xn;R48/20-65 R10 3. Carc2;R45 Xn;R65 *, ** 4. Carc2;R45 Xn;R65 *, ** 5. Carc2;R45 Xn;R65 *, ** 6. Xn;R65 * Not on the list
Danish National Working Environment Authority's limit value /16/	25 ppm / 145 - 180 $mg \cdot m^{-3}$
Odour threshold /28/	0.5 - 5 mg.m-3

* The substances have only been assessed as regards carcinogenic effect (carc cat. 2) and risk of aspiration into the lungs. The classification is valid for product concentrations 10 %.
** The classification as carcinogenic may be omitted if it can be proven that the substance contains less than 0.1 weight percentage of benzene, which is the case for almost all of the types of white spirits forming part of products on the Danish market.

Table 6.9. Physico-chemical properties

Physical state	Liquid
Molecular weight (g/mol)	-
Melting point (°C)	-
Boiling point (°C)	150 - 200 /17/
Vapour pressure (Pa, 25 ºC)	600 /29/
Octanol-water partition coefficient (log P_{OW})	2.1 - 6 /12/*
Water solubility (mg/L)	< 0.1 % /29/

* Estimated on the basis of data on naphtha (petroleum), hydrodesulfurized heavy (CAS No. 64742-82-1 – WHO type 1)

The physico-chemical data depend on the specific type of white spirit.

6.2.3.2 Health assessment of white spirit

Acute toxicity

Exposure to white spirit primarily occurs via inhalation, and white spirit is readily absorbed via the respiratory system. Controlled exposure of humans to 100 ppm (600 mg·m^{-3}) for 7 hours affected the central nervous system (CNS) with symptoms as unsteady walk and prolonged reaction time. Exposure to 4000 mg·m^{-3} for 40 minutes also affected the CNS /30/. Prolonged inhalation of high concentrations of vapours may cause headache, dizziness, intoxication, nausea and convulsions. Exposure to very high concentrations in confined spaces may cause narcotic effects and loss of consciousness /21, 26/.

Ingestion of white spirit may cause risk of aspiration (risk of chemically induced pneumonia) because of its low viscosity and low surface tension /26, 30/. Ingestion will cause malaise in the form of stomach trouble and the same symptoms as when inhaled /21/.

White spirit does not easily penetrate intact skin. Frequent use of hand cleansers containing white spirit has caused systemic effects in the form of liver and bone marrow damage /21/.

Table 6.10. Toxicological data for white spirit

Study	Effect concentration	Reference
LC_{LO}, rat, 8-hour exposure – no mortality	8,200 mg·m^{-3}	/31/
LOEL, inhalation, rat, acute narcotic effect	1,200 mg·m^{-3}	/31/
LD_{50}, rat, oral	>5,000 mg/kg_{bw}^{-1}	/22/

Irritation of skin and eyes

Prolonged and repeated skin contact may result in serious irritation eczema. In skin irritation tests, white spirit has proven slightly to moderately irritating /30/. Degreasing, drying-out properties have been observed in relation to skin contact /21, 26/.

Vapours are slightly irritating to the eyes /26/. In humans, eye irritation has been reported down to 100 ppm, corresponding to 600 mg·m^{-3} /30/.

Sensibilisation

White spirit may cause non-allergic contact eczema, but it has not been found allergenic /27, 31/.

Toxicity at repeated exposure
The classification with R48/20 states that the substance is harmful by prolonged exposure through inhalation. Professional exposure for 13 years to on average 240 $mg \cdot m^{-3}$ (40 ppm) white spirit caused chronic CNS-effects, so called toxic encephalopathy /31/.

Prolonged, repeated exposure (13 weeks) of rats and dogs to white spirit caused effect on liver and kidneys at air concentrations higher than approx. 500 – 900 $mg \cdot m^{-3}$ (90 – 150 ppm) /31/.

Long-term effects
No indication of genotoxicity of white spirit was found in various ***in vitro*** tests /30/. No teratogenic, embryotoxic or reproduction toxic effects of white spirit were found /21, 31, 32/.

White spirit is classified as carcinogenic (carc2;R45), but the risk is defined on the basis of its content of benzene. White spirits with less than 0.1 % benzene do not have to be classified as carcinogenic /2/.

Conclusion
The critical local effect by short-term exposure to white spirit is eye irritation. The irritating effect to the mucous membranes depends on the contents of naphthenes and aromates. In humans, eye irritation has been reported down to 100 ppm (C_{irr} = 600 $mg \cdot m^{-3}$).

The critical systemic effect by short-term exposure (7 hours) to white spirit is the effect on the CNS. In humans, effect on the CNS has been reported at 100 ppm (600 $mg \cdot m^{-3}$, LOAEL). This corresponds to a drawn reference value (RV_{acute}) of 10 $mg/kg_{bw}^{-1} \cdot d^{-1}$ for a 60 kg person, who inhales 24 $L \cdot min^{-1}$ during light work /37/, when the absorption is set to 100 %. An adaptation factor of 10 has been used in order to use LOAEL instead of NOAEL.

The critical effect by repeated exposure to white spirit is the effect on the CNS. In humans, chronic effect on the CNS has been reported by exposure to on average 240 $mg \cdot m^{-3}$ (40 ppm) for 13 years (LOAEL). When assuming the daily work to be 7 hours, this exposure corresponds to a drawn reference value ($RV_{chronic}$) of 4 $mg/kg_{bw}^{-1} \cdot d^{-1}$ for a 60 kg person, who inhales 24 $L \cdot min^{-1}$ during light work /37/, when the absorption is set to 100 %. An adaptation factor of 10 has been used in order to use LOAEL instead of NOAEL.

6.3 Assessment of exposure of the consumer to the selected substances

Oven cleaners are usually used indoors in kitchens. Some products can be used outdoors, e.g. for cleaning of barbecues. In the following assessments, we have only focused on indoor use.

When applying the oven cleaners, the consumer will mainly be exposed by inhalation and skin contact. Exposure by ingestion is regarded as insignificant and has not been included in the assessments. The consumer will experience acute effects on the contact points (skin and mucous membranes of the eyes and respiratory system), and following absorption and distribution in the body

(systemic effects). Furthermore, systemic effects may occur in case of repeated exposure during a long period of time.

The selected substances are individually a component in different products. Two of these products are spray products, aerosol and pump, respectively, applied by spraying. The two other products are liquids, applied with a cloth (application products).

During application of spray products, aerosols of the product will be formed, which may deposit on the skin. During application of application products with a cloth, part of the product comes in contact with the skin. By skin contact, some components may be absorbed through the skin. Volatile components will be liberated into the air and may thus be inhaled.

The health risk in case of exposure to the selected critical substances has been assessed based on worst-case scenarios according to the principles in EU's Technical Guidance Document /14/ and partly in ECHA's Guidance on Information Requirements and Chemical Safety Assessment /38/. In the assessments, exposure by inhalation and skin contact has been taken into consideration.

6.3.1 Exposure scenarios

6.3.1.1 Exposure by inhalation

The amount of inhaled substance depends on the concentration of air. The concentration of air (C_{inh}) depends on the amount of used product (Q_{prod}), the amount of substance in the product (Fc_{prod}) and the volume of air in which the substance is distributed (V_{room}). The concentration of air is calculated based on the equation (6.1) /38/.

$$(6.1) \qquad C_{inh} = \frac{Q_{prod} \cdot Fc_{prod}}{V_{room}} \ kg_{subst} \cdot m^{-3}$$

The inhaled dose (D_{inh}) depends on the concentration in the inhalation air (C_{inh}), the respirable amount of inhaled dose (F_{resp}), the person's respiration velocity (IH_{air}), the time of exposure ($T_{contact}$), the person's body weight (BW) and the number of applications per day (n). The dose is calculated from the concentration of air based on the equation (6.2) /38/.

$$(6.2) \qquad D_{inh} = \frac{F_{resp} \cdot C_{inh} \cdot IH_{air} \cdot T_{contact} \cdot n}{BW} \ kg_{subst} \cdot kg_{bw}^{-1} \cdot d^{-1}$$

In the following calculations, it is assumed that the assessed substances are liberated 100 % to the air. Equations (6.1) and (6.2) may be used for both spray and application products.

Table 6.11 explains the symbols used in equations (6.1) and (6.2). Furthermore, a number of standard values used in the following calculations are stated. The standard values are stated in the references /14, 37, 38/. The room size (V_{room}) is set to 2 m^3 (the person's immediate zone) /38/, because when using oven cleaner it is a question of a short local exposure; the person's body weight (BW) is set to 60 kg, which is the standard weight for women /14/; the respirable amount of inhaled dose (F_{resp}) is set to 1; the respiration

velocity (IH_{air}) is set to 34.6 $m^3 \cdot d^{-1}$ (24 $L \cdot min^{-1}$ during light work) /37/; the number of applications per day (n) varies from product to product.

Tabel 6.11. Explanation of the symbols in equations (6.1) and (6.2)

Parametre	Explanation	Unit	Standard value
C_{inh}	Concentration of substance in air	$kg_{subst} \cdot m^{-3}$	
Q_{prod}	Amount of used product	kg_{prod}	
Fc_{prod}	Amount of substance in the product	$kg_{subst} \cdot kg_{prod}^{-1}$ (%)	
V_{room}	Room size	m^3	2 /38/
D_{inh}	Inhaled dose of the substance	$kg_{subst} \cdot kg_{lgv}^{-1} \cdot d^{-1}$	
F_{resp}	Respirable amount of inhaled dose	-	1 /38/
IH_{air}	Respiration velocity (light work: 24 $L \cdot min^{-1}$)	$m^3 \cdot d^{-1}$	34.6 /37/
$T_{contact}$	Contact time per application	d	
BW	Body weight	kg_{bw}	60 /38/
n	Number of applications per day	d^{-1}	

6.3.1.2 Exposure of mucous membranes

For a substance causing irritation of the mucous membranes of the eyes and respiratory system, the effect depends on the concentration of air of the substance. Equation (6.1) is therefore also used when assessing the irritating effect of substances causing irritation of the mucous membranes in both spray and application products.

6.3.1.3 Exposure by skin contact

Exposure of the skin to a chemical product may cause skin irritation. Furthermore, chemical substances in the product may be absorbed through the skin and cause systemic exposure of the user.

When assessing possible skin irritation, the dermal load must be known, which can be calculated with equation (6.3) /38/. The dermal load (L_{der}) depends on the amount of product used (Q_{prod}), the amount of substance in the product (Fc_{prod}), the amount of product deposited on the skin (Fc_{der}) and the exposed skin area (A_{skin}).

$$(6.3) \qquad L_{der} = \frac{Q_{prod} \cdot Fc_{prod} \cdot Fc_{der}}{A_{skin}} \; kg_{subst} \cdot cm^{-2}$$

When assessing the systemic exposure, the dermal dose must be known, which can be calculated with equation (6.4) /38/. The dermal dose depends on the amount of product used (Q_{prod}), the amount of substance in the product (Fc_{prod}), the amount of product deposited on the skin (Fc_{der}), the person's body weight (BW) and the number of applications per day (n).

$$(6.4) \quad D_{der} = \frac{Q_{prod} \cdot Fc_{prod} \cdot Fc_{der} \cdot n}{BW} \quad kg_{subst} \cdot kg_{bw}^{-1} \cdot d^{-1}$$

Table 6.12 explains the symbols used in equations (6.3) and (6.4). Furthermore, a number of standard values used in the following calculations are stated. The standard values are stated in the references /14, 37, 38/.

Table 6.12. Explanation of the symbols in equations (6.3) and (6.4)

Parametre	Explanation	Unit	Standard value
L_{der}	Amount of substance per skin area	$kg_{subst} \cdot m^{-2}$	
Q_{prod}	Amount of used product	kg_{prod}	
Fc_{prod}	Amount of substance in the product	$kg_{subst} \cdot kg_{prod}^{-1}$	
Fc_{der}	Amount of used product on the skin	-	
A_{skin}	Exposed skin area	cm^2	731 /38/
D_{der}	Dose on the skin that may potentially be absorbed	$kg_{subst} \cdot kg_{bw}^{-1} \cdot d^{-1}$	
BW	Body weight	kg_{bw}	60 /38/
n	Number of application per day	d^{-1}	

For spray products, RIVM has set standard values for the amount of product that stays in the air as drops. The fraction for aerosol sprays is 0.6 and for pump sprays the fraction is 0.2 /37/. In the following calculations it is assumed that 10 % of the amount of product that stays in the air as drops comes into contact with the surface of the hands (A_{skin}), i.e. Fc_{der} = 0.06, 0.02, respectively.

For the use of application products, RIVM has set a standard value of 1 % for the amount of product left on the hands (Fc_{der}) /37/. Furthermore, RIVM assumes that application products come into contact with half of the skin area of the hands (A_{skin} / 2) /37/.

If there is no knowledge of the absorption of a substance through the skin, it is assumed that the amount of substance, which comes into contact with the skin, is 100 % absorbed.

6.3.1.4 Systemic exposure

When estimating the systemic exposure (D_{syst}), the contributions from inhalation (D_{inh}) and skin absorption (D_{der}) must be added, see equation (6.5).

$$(6.5) \quad D_{syst} = D_{inh} + D_{der} \quad kg_{subst} \cdot kg_{bw}^{-1} \cdot d^{-1}$$

6.3.1.5 Risk assessment

In the following assessments, it is assumed that the exposure is determined by further factors.

The cleaning is assumed to last 5 minutes, and the exposure is only assessed in connection with the cleaning, and not possible following exposure by

inhalation. The assessments do not include possible ventilation via cooker hood during the cleaning.

The result of the risk assessment is stated as margin of exposure (MOE), which is expressed by the ratio between the NO(A)EL-value and the exposure to the relevant scenario using the above equations (6.1) – (6.5). If there is no NO(A)EL-value, the LO(A)EL is used. The definition of these concepts is stated in Table 6.13, which is used to express the health effect.

Table 6.13. Parametres used in the exposure calculations

NO(A)EL (No Observed (adverse) Effect Level)	The highest concentration/dose of the substance with no observed effect in exposed individuals compared with a comparable control group.
LO(A)EL (Lowest Observed (adverse) Effect Level)	The highest concentration/dose of the substance with the lowest observed effect in exposed individuals compared with a comparable control group.
MOE (Margin of Exposure)	Is the factor that NO(A)EL is higher than the estimated exposure level for the exposed consumer. The bigger the MOE, the lesser the risk. If NO(A)EL-values are used for calculating MOE, MOE-values of 100 or above will give a reasonable certainty that the consumer will have no effects.

6.3.2 Assessment of N-methyl-2-pyrrolidone in oven cleaners

A cleaning product for ovens (product no. 1) is selected to represent the products containing N-methyl-2-pyrrolidone. The product is an oven cleaner in an aerosol expenser. Tables 6.14 and 6.15 show the parametres, which form the basis for the calculation of exposure to N-methyl-2-pyrrolidone.

Table 6.14. Product data for oven cleaners containing N-methyl-2-pyrrolidone

Product type	Oven cleaner
Product form	Spray with propellant (aerosol spray)
Instructions	Shake the can well and spray at a distance of 25 cm in an even coat into the cold barbecue/oven on all surfaces and grills. Other objects are also sprayed from a distance of 25 cm. Wash away the foam with a damp sponge or cloth.
Specific gravity of the product	Estimated to 0.8 $kg \cdot L^{-1}$.
Concentration in the product (Fc_{prod})	0.15 (15 % after evaporation of the propellant, see Chapter 4).

Table 6.15. Parametres used for calculation of exposure to N-methyl-2-pyrrolidone

Parametre	Symbol	Value
Room size	V_{room}	2 m^3
Body weight	BW	60 kg
Cleaning frequency	n	0,14 d^{-1} (1 once a week)
Used amount per cleaning	Q_{prod}	8 g (10 ml)
Exposure time (estimate)	$T_{contact}$	0.0035 d (5 min)
Respirable fraction	F_{resp}	1
Respiration velocity (light work)	IH_{air}	34.6 $m^3 \cdot d^{-1}$ (24 $L \cdot min^{-1}$) /37/

In the following, the risk of inhalation, skin absorption and the total exposure are assessed by calculating MOE-values for these exposure routes for N-methyl-2-pyrrolidone. N-Methyl-2-pyrrolidone can be absorbed through the skin. Therefore, it is necessary to include skin absorption when calculating the systemic dose.

It is assumed that the product is used once a week for cleaning of oven, which is an expression of a worst-case consumption. As N-methyl-2-pyrrolidone is heavily volatile with a vapour pressure of 70 Pa at 25 °C, it is assumed that only 1 % evaporates during use and may be inhaled.

For products in aerosol cans with a propellant, it is assumed that 60 % of the product stays in the air /37/, and that 10 % of this amount comes into contact with the skin, i.e. 6 % of the used amount. Absorption of N-methyl-2-pyrrolidone through the skin is set to 100 % (worst-case).

The results of the exposure calculation are shown in Table 6.16. When risk assessing, the calculated exposure values are compared with the drawn reference values in Table 6.17.

Table 6.16. Calculated exposure data for N-methyl-2-pyrrolidone

Estimate	Symbol	Calculation [1)]	Value
Concentration in air	C_{inh}	Equation 6.1 [1)]	6 $mg \cdot m^{-3}$
Dose by inhalation	D_{inh}	Equation 6.2 [1)]	0.0017 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Dermal load	L_{der}	Equation 6.3 [2)]	0.1 $mg \cdot cm^{-2}$
Dose by skin contact	D_{der}	Equation 6.4 [2)3)]	0.17 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Systemic dose	D_{syst}	Ligning 6.5	0.172 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$

1) It is assumed that only 1 % of N-methyl-2-pyrrolidone evaporates.
2) It is assumed that 60 % of the product is found in the air as spray mist /37/, and that 10 % comes into contact with the skin, i.e. 6 % of the used amount.
3) N-Methyl-2-pyrrolidone is skin permeable and absorption through the skin is set to (worst-case).

Tabel 6.17. Drawn reference values for exposure to N-methyl-2-pyrrolidone

Critical effect,see subsection 6.2.1	Symbol	Reference value
Irritation of mucous membranes, eyes	-	50 $mg \cdot m^{-3}$
Systemic effect, short-term exposure	RV_{acute}	20 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Systemic effect, repeated exposure	$RV_{chronic}$	105 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$

6.3.2.1 Skin irritation

The estimated dermal load with N-methyl-2-pyrrolidone is 0.1 $mg \cdot cm^{-2}$. No quantitative data were found, which would have enabled an assessment of possible skin irritation. N-Methyl-2-pyrrolidone is readily absorbed through the skin.

6.3.2.2 Exposure of the mucous membranes

The concentration of air of N-methyl-2-pyrrolidone is calculated to 6 $mg \cdot m^{-3}$ for a room size of 2 m^3. This is approx. 8 times lower than the concentration that caused irritation of the mucous membranes in humans (MOE = 8). It is assessed that there is a risk of irritation of the mucous membranes when using N-methyl-pyrrolidone this way.

6.3.2.3 Systemic exposure

N-Methyl-2-pyrrolidone is readily absorbed through the skin. The contribution to the systemic exposure from skin absorption is estimated to 0.17 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$. The contribution to the systemic exposure from inhalation of vapours of N-methyl-2-pyrrolidone is calculated to 0.0017 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$. The total systemic exposure is thus 0.172 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$. When comparing the calculated exposure to the drawn reference value RV_{acute} of 20 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$, MOE = 116 is found. If the calculated exposure is compared to the drawn reference value $RV_{chronic}$ of 105 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$, MOE = 610 is found. It is assessed that there is no risk of acute or chronic effects when using N-methyl-2-pyrrolidone this way.

6.3.3 Evaluation of dipropylene glycol monomethyl ether (DPGME) in oven cleaners

A cleaning product for ovens (product no. 5) has been selected to represent the products containing DPGME. The product is an oven cleaner in a can with a pump. Tables 6.18 and 6.19 show the parameters, which form the basis of the calculation of exposure to DPGME.

Table 6.18. Product data for an oven cleaning product containing DPGME

Product type	Oven cleaner
Product form	Gel in a pump bottle
Application	Spray the gel on the surfaces of the oven. Leave the gel to work for 2-4 hours.
Specific gravity of the product	Not informed
Concentration in product (Fc_{prod})	0.13 (13 %)

Table 6.19. Parametres used for the calculation of exposure to DPGME

Parametre	Symbol	Value
Room size	V_{room}	2 m^3
Body weight	BW	60 kg
Cleaning frequency	n	0.14 d^{-1} (once a week)
Used amount per cleaning	Q_{prod}	5 g
Exposure time (estimate)	$T_{contact}$	0.0035 d (5 min)
Respirable fraction	F_{resp}	1
Respiration velocity (light work)	IH_{air}	34.6 $m^3 \cdot d^{-1}$ (24 $L \cdot min^{-1}$) /37/

In the following, the risk of inhalation, skin absorption and the total exposure are assessed by calculating MOE-values for these exposure routes for DPGME. DPGME can be absorbed through the skin. Therefore, it is necessary to include skin absorption when calculating the systemic dose.

It is assumed that the product is used once a week for cleaning of oven, which is an expression of a worst-case consumption. As DPGME is heavily volatile with a vapour pressure of approx. 37 - 60 Pa at 20 °C, it is assumed that only 1 % DPGME evaporates during use and may be inhaled.

For products in pump spray bottles, it is assumed that 20 % of the product stays in the air as spray mist /37/, and that 10 % of this amount comes into contact with the skin, i.e. 2 % of the used amount. Absorption of DPGME through the skin is set to 100 % (worst-case).

The results of the exposure calculation are shown in Table 6.20. When risk assessing, the calculated exposure values are compared with the drawn reference values in Table 6.21.

Table 6.20. Calculated exposures to DPGME

Estimate	Symbol	Calculation	Value
Concentration in air	C_{inh}	Equation 6.1 1)	3.3 $mg \cdot m^{-3}$
Dose by inhalation	D_{inh}	Equation 6.2 1)	0.00093 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Dermal load	L_{der}	Equation 6.3 2)	0.018 $mg \cdot cm^{-2}$
Dose by skin contact	D_{der}	Equation 6.4 2)3)	0.03 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Systemic dose	D_{syst}	Equation 6.5	0.031 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$

1) It is assumed that only 1 % of DPGME evaporates.
2) It is assumed that 20 % of the product is found in the air as spray mist /37/, and that 10 % comes into contact with the skin, i.e. approx. 2 % of the used amount
3) DPGME is skin permeable and absorption through the skin is set to 100 % (worst-case).

Table 6.21. Drawn reference values for exposure to DPGME

Critical effect, see subsection 6.2.2	Symbol	Reference value
Irritation of mucous membranes, eyes	-	450 $mg \cdot m^{-3}$
Systemic effect, short-term exposure	RV_{acute}	1035 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Systemic effect, repeated exposure	$RV_{chronic}$	200 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$

Skin irritation

The estimated dermal load with DPGME is 0.018 $mg \cdot cm^{-2}$. No quantitative data were found, which would have enabled an assessment of possible skin irritation. DPGME is readily absorbed through the skin.

Exposure of the mucous membranes

The concentration of air of DPGME is calculated to 3.3 $mg \cdot m^{-3}$for a room size of 2 m^3. This is approx. 135 times lower than the concentration that caused irritation of the mucous membranes in humans (MOE = 135). It is assessed that there is a risk of irritation of the mucous membranes when using DPGME this way.

Systemic exposure

DPGME is readily absorbed through the skin. The contribution to the systemic exposure from skin absorption is estimated to 0.03 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$. The contribution to the systemic exposure from inhalation of vapours of DPGME is calculated to 0.00093 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$. The total systemic exposure is thus 0.031 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$. When comparing the calculated exposure to the drawn reference value RV_{acute} of 1035 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$, MOE = 33,400 is found. If the calculated exposure is compared to the drawn reference value $RV_{chronic}$ of 200 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$, MOE = 6450 is found. It is assessed that there is no risk of acute or chronic effects when using DPGME this way.

6.3.4 Petroleum distillate in cleaners for ceramic cooktops

A cleaning product for ceramic cooktops (product no. 3) has been selected to represent the products containing petroleum distillate. The product is applied with a cloth. Tables 6.22 and 6.23 show the parameters, which form the basis of the calculation of exposure to petroleum distillate. For the risk assessment, the drawn RV_{acute} and $RV_{chronic}$ are used for white spirit.

Table 6.22. Product data for a cleaning product for ceramic cooktops containing petroleum distillate

Product type	Ceramic cooktop cleaner
Product form	Relatively thin
Application	Apply and then polish with a soft cloth
Specific gravity of the product	1.07 $kg \cdot L^{-1}$
Concentration in the product (Fc_{prod})	0.13 (13 %)

Table 6.23. Parametres used for the calculation of exposure to petroleum distillate

Parametre	Symbol	Value
Room size	V_{room}	2 m^3
Body weight	BW	60 kg
Cleaning frequency	n	1 d^{-1} (every day)
Used amount per cleaning	Q_{prod}	5.35 g (5 ml)
Exposure time (estimate)	$T_{contact}$	0.0035 d (5 min)
Respirable fraction	F_{resp}	1
Respiration velocity (light work)	IH_{air}	34.6 $m^3 \cdot d^{-1}$ (24 $L \cdot min^{-1}$) /37/

It is assumed that the ceramic cooktops are cleaned once a day after use. As petroleum distillate is heavily volatile with a vapour pressure of approx. 13 - 60 Pa at 20 °C, it is assumed that only 1 % petroleum distillate evaporates during use and may be inhaled.

In the following, the risk of exposure of the mucous membranes and the risk of systemic exposure by inhalation are assessed. No quantitative data were found for absorption through skin of petroleum distillates, but it is known to be very limited through intact skin. It is assessed that absorption through the skin is negligible considering the short contact time. The contribution to the systemic exposure has therefore been set to naught.

The results of the exposure calculation are shown in Table 6.24. When risk assessing, the calculated exposure values are compared with the drawn reference values in Table 6.25.

Table 6.24. Calculated exposures to petroleum distillate

Estimate	Symbol	Calculation	Value
Concentration in air	C_{inh}	Equation 6.1 1)	3.5 $mg \cdot m^{-3}$
Dose by inhalation	D_{inh}	Equation 6.2 1)	0.0070 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Dermal load	L_{der}	Equation 6.3 2)	0.019 $mg \cdot cm^{-2}$
Dose by skin contact	D_{der}	Equation 6.4 2)3)	0 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Systemic dose	D_{syst}	Equation 6.5	0.0070 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$

1) It is assumed that only 1 % of the petroleum distillate evaporates.
2) It is assumed that 1 % of the product comes into contact with half of the surface of the hands (365 cm^2) /37/.
3) Petroleum distillate does not penetrate intact skin. Absorption through skin is set to

Table 6.25. Drawn reference values for exposure to petroleum distillate

Critical effect, see subsection 6.2.3.2	Symbol	Reference value
Irritation of mucous membranes, eyes	-	600 $mg \cdot m^{-3}$
Systemic effect, short-term exposure	RV_{acute}	10.0 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Systemic effect, repeated exposure	$RV_{chronic}$	4.0 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$

Skin irritation

The estimated dermal load with petroleum distillate is 0.019 $mg \cdot cm^{-2}$. No quantitative data were found, which would have enabled an assessment of possible skin irritation. Petroleum distillate may degrease and dry out the skin and thus cause skin irritation. Gloves should be worn during use of the product.

Exposure of the mucous membranes

The concentration of air of petroleum distillate is calculated to 3.5 $mg \cdot m^{-3}$ for a room size of 2 m^3. This is approx. 170 times lower than the concentration that caused eye irritation in humans (MOE = 170). It is assessed that there is no risk of irritation of the mucous membranes when using petroleum distillate this way.

Systemic exposure

No quantitative data were found for the absorption through skin of petroleum distillate, but it is assessed that the absorption is very limited through intact skin. The contribution to the systemic exposure has therefore been set to naught.

The contribution to the systemic exposure from inhalation of vapours of petroleum distillate is calculated to 0.0070 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$. When comparing the calculated exposure to the drawn reference value RV_{acute} of 10 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$, MOE = 1430 is found. If the calculated exposure is compared to the drawn reference value $RV_{chronic}$ of 4 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$, MOE = 570 is found. It is assessed that there is no risk of acute or chronic effects when using petroleum distillate this way.

6.3.5White spirit in stainless steel care products

A stainless steel care product (product no. 20) has been selected to represent the products containing white spirit. The product is applied with a cloth. Tables 6.26 and 6.27 show the parametres, which form the basis of the calculation of exposure to white spirit.

Table 6.26. Product data for a stainless steel care product containing white spirit

Product type	Stainless steel care product
Product form	Fluid
Application	Cleans and polishes stainless steel and lacquered surfaces. Apply with a dry cloth and rub.
Specific gravity of the product	0.92 $kg \cdot L^{-1}$
Concentration in product (Fc_{prod})	60 % /37/

The maximum concentration of white spirit in the product is estimated to 60 % /37/.

Table 6.27. Parametres used for the calculation of exposure to white spirit

Parametre	Symbol	Value
Room size	V_{room}	2 m^3
Body weight	BW	60 kg
Cleaning frequency	n	0.29 d^{-1} (twice a week)
Used amount per cleaning	Q_{prod}	5 g (found during practical testing)
Exposure time	$T_{contact}$	0.0035 d (5 minutes)
Respirable fraction	F_{resp}	1
Respiration volume (light work)	IH_{air}	34.6 $m^3 \cdot d^{-1}$ (24 $L \cdot min^{-1}$) /37/

White spirit is relatively heavily volatile with a vapour pressure of approx. 600 Pa at 25 °C. The evaporation velocity for a substance, and thus the amount of substance that evaporates per time unit, depends on the vapour pressure of the substance among others. The connection is approximately linear at low vapour pressure. The vapour pressure for white spirit is approx. 10 times higher than the vapour pressure for the three other solvents assessed in this report. White spirit is therefore estimated to evaporate approx. 10 times faster than these. As a realistic worst-case in the following exposure calculations, it is assumed that 10 % white spirit evaporates during use.

In the following, the risk of exposure of the mucous membranes and the risk of systemic exposure by inhalation are assessed. No quantitative data were found for absorption through skin of white spirit, but it is known to be very limited through intact skin. It is assessed that absorption through the skin is negligible considering the short contact time. The contribution to the systemic exposure has therefore been set to naught.

The results of the exposure calculation are shown in Table 6.28. When risk assessing, the calculated exposure values are compared with the drawn reference values in Table 6.29.

Table 6.28. Calculated exposures to white spirit

Estimate	Symbol	Calculation	Value
Concentration in air	C_{inh}	Equation 6.1 1)	150 $mg \cdot m^{-3}$
Dose by inhalation	D_{inh}	Equation 6.2 1)	0.088 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Dermal load	L_{der}	Equation 6.3 2)	0.082 $mg \cdot cm^{-2}$
Dose by skin contact	D_{der}	Equation 6.4 2)3)	0 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Systemic dose	D_{syst}	Equation 6.5	0.088 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$

1) It is assumed that only 10 % of the white spirit evaporates.
2) It is assumed that 1 % of the product comes into contact with half of the surface of the hands (365 cm^2) /37/.
3) White spirit does not penetrate intact skin. Absorption through skin is set to 0 %.

Table 6.29. Drawn reference values for exposure to white spirit

Critical effect, see subsection 6.2.4	Symbol	Reference value
Irritation of mucous membranes, eyes	-	600 $mg \cdot m^{-3}$
Systemic effect, short-term exposure	RV_{acute}	10.0 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$
Systemic effect, repeated exposure	$RV_{chronic}$	4.0 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$

Skin irritation

The estimated dermal load with white spirit is 0.082 $mg \cdot cm^{-2}$. No quantitative data were found, which would have enabled an assessment of possible skin irritation. White spirit may degrease and dry out the skin and thus cause skin irritation. Gloves should be worn during use of the product.

Exposure of the mucous membranes

The concentration of air of white spirit is calculated to 150 $mg \cdot m^{-3}$ for a room size of 2 m^3. This is approx. 4 times lower than the concentration that caused eye irritation in humans. The irritating effect of white spirit to the mucous membranes depends on the contents of naphthenic and aromatic hydrocarbons. If the used type of white spirit only contains small amounts of especially aromatic hydrocarbons, irritation of the mucous membranes will be considerably limited when using white spirit this way.

Systemic exposure

No quantitative data were found for the absorption through skin of white spirit, but it is assessed that the absorption is very limited through intact skin. The contribution to the systemic exposure has therefore been set to naught.

The contribution to the systemic exposure from inhalation of vapours of white spirit is calculated to 0.088 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$. When comparing the calculated exposure to the drawn reference value RV_{acute} of 10 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$, MOE = 113 is found. If the calculated exposure is compared to the drawn reference value $RV_{chronic}$ of 4 $mg \cdot kg_{bw}^{-1} \cdot d^{-1}$, MOE = 45 is found. It is assessed that there will be a risk of chronic effects when using white spirit for a long period of time.

6.4 Environmental assessment of selected substances

6.4.1 N-methyl-2-pyrrolidone

N-methyl-2-pyrrolidone is assessed to be completely biodegradable on the basis of results from various tests for biodegradability /12/. No data were found for the anaerobic biodegradability. N-methyl-2-pyrrolidone generally has low acute toxicity for aquatic organisms with EC/LC_{50}-values > 100 $mg \cdot L^{-1}$ in standard tests for acute toxicity with algae, crustacean and fish /12/. With an estimated log P_{OW}-value of -0.38, the substance is assessed not to be bioaccumulable. N-methyl-2-pyrrolidone is assessed to constitute no risk to the environment.

6.4.2 Dipropylen glycol monomethyl ether (DPGME)

DPGME is completely degraded in a 28 days standard test for ready biodegradability /12/. No data were found for the anaerobic biodegradability. Only a few data were found for the aquatic toxicity of DPGME. These data

indicate that DPGME has low acute toxicity for aquatic organisms with EC/LC_{50}-values > 100 $mg \cdot L^{-1}$ in tests with crustacean and fish /12/. With an estimated log P_{OW}-value < 0 the substance is assessed to be not bioaccumulable. On the basis of the above data, DPGME is assessed to constitute no risk to the environment.

6.4.3 Petroleum distillates

Petroleum distillates are not completely biodegradable in standard tests for ready biodegradability /12/. Petroleum distillates may be toxic to aquatic organisms with EC/LC_{50}-values for acute toxicity between 1 - 10 $mg \cdot L^{-1}$ in standard tests with algae, crustacean and fish /12, 13/. With estimated log P_{OW}-values between 3.3 and 8.7 petroleum distillates are potentially bioaccumulable. Petroleum distillates should thus be classified as Dangerous for the environment (N) with R51/53 (Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.). A more detailed assessment of the effect of petroleum distillates in the aquatic environment is given in Chapter 7.

6.4.4 White spirit

White spirit is assessed on the basis of data for petroleum distillates and naphtha (pertroleum), hydrogentreated, heavy /12/ to be not completely biodegradable and at the same time to be toxic to aquatic organisms with EC/LC_{50}-values between 1 and 10 $mg \cdot L^{-1}$. With estimated log P_{OW}-values between 2.1 and 6, white spirit is potentially bioaccumulable. A more detailed assessment of the effect of white spirit in the aquatic environment is given in Chapter 7.

7 Effects in the aquatic environment

7.1 Substances selected for assessment of their effects in the aquatic environment

Based on the environmental assessment in Chapter 6 of the four selected substances, petroleum distillates and white spirit, respectively, were selected for a more detailed assessment of effects in the aquatic environment as both groups of substances are considered to be toxic to aquatic organisms and to potentially cause adverse long-terms effects in the aquatic environment.

7.2 Fate of the chemical substances in household products

Chemical substances in cleaning agents used in households will primarily be discharged to the environment via treated waste water from municipal wastewater treatment plants (WWTP). The cleaning agents are flushed with the slops to the sewage system and led to the WWTP. In the WWTP, the chemical substances undergo several processes such as degradation under aerobic and anaerobic (deoxidized) conditions, sorption to sludge particles, volatilization, hydrolysis, etc. The part of the chemical substances discharged with the treated waste water thus depends on the fate of the substances in the WWTP. Also in the aquatic environment, various biological and abiotic elimination processes influence the concentration of the chemical substances. Furthermore, the concentration will depend on hydraulic parameters as e.g. mixing/dilution and water flow conditions.

7.3 Estimated total consumption of petroleum distillates and white spirit in the products

7.3.1 Petroleum distillates

The annual maximum concentration of petroleum distillates discharged as a result of the application of ceramic cooktop cleaners was estimated on the basis of the following assumptions:

- Maximum annual sale of products for ovens and ceramic cooktops: 600,000 products
- The products contained an average of 0.25 litres
- The density of the products was assumed to be 1 g/L
- Products for ceramic cooktops constituted 65 % of the total consumption
- 22 % of the products for ceramic cooktops contained petroleum
- The average concentration of petroleum in these products was 11 %

It was thus estimated that 2,360 kg petroleum are used in products for ceramic cooktops annually.

7.3.2 White spirit

The annual maximum concentration white spirit discharged as a result of the application of stainless steel care products was estimated on the basis of the following assumptions:

- Maximum annual sale of stainless steel care products: 100,000 products
- The products contained an average of 0.25 litres
- The density of the products was assumed to be 1 g L^{-1}
- Percentage of products containing white spirit: 75 %
- Average content of white spirit in the products: 25 %

It was thus estimated that 4,690 kg white spirit are used in products for stainless steel care annually.

7.4 Calculation of predicted environmental concentration (PEC) and predicted no effect concentration (PNEC)

For the estimation of the environmental risk of discharge of petroleum distillates and white spirit, the Predicted Environmental Concentration (PEC) was compared with the concentration of the substance, at which no effects are expected in the aquatic environment, the Predicted No Effect Concentration (PNEC). The concentration of substances in the discharge from WWTPs (PEC_{WWTP}) was calculated on the basis of the amounts (M) of substance consumed, the degree of removal in the WWTPs ($f_{removal}$) and the annual amount of discharged waste water in Denmark (Q):

$$PEC_{WWTP} = \frac{M \cdot (1 - f_{removal})}{Q}$$

Q = 611 mill. m^3/year /35/

$f_{removal}$ available in reference tables in the EU Technical Guidance Document (TGD) /14/

$f_{removal}$ is a function of the octanol-water partition coefficient (log P_{OW}), Henry's law constant (H) and the biodegradability of the substances

Table 7.1 shows the calculated PEC_{WWTP} values.

Table 7.1. Calculated PEC values

Substance	PEC_{stp}, (µg L^{-1})
Petroleum distillates	1.54
White spirit	4.99

The highest concentrations not expected to cause effects in the aquatic environment, PNEC, are calculated on the basis of data of the toxicity of the substances towards aquatic organisms using an assessment factor as described in the EU Technical Guidance Document /14/. Table 7.2 gives the calculated PNEC values for the selected substances, see also subsection 6.4.3.

Table 7.2. Calculated PNEC values

Substance	Lowest effect value ($mg\ L^{-1}$)	Assessment factor	PNEC ($\mu g\ L^{-1}$)
Petroleum distillates	0.5 (NOEC, algae) /12/	100	5.0
White spirit	2.6 (EC_{50}, crustacean) /12/	10,000	0.26

7.5 Calculation of risk quotients

The calculated risk quotients (RQ) for the selected substances are given in Table 7.3. RQ is calculated as PEC/PNEC.

Table 7.3. Calculated risk quotients

Substance	PEC_{stp} ($\mu g\ L^{-1}$)	PNEC ($\mu g\ L^{-1}$)	RQ (PEC/PNEC)
Petroleum distillates	1.54	5.0	0.3
White spirit	4.99	0.26	16.6

A risk quotient > 1 indicates probability of effects in the aquatic environment. A dilution factor of 10 after discharge of treated waste water was assumed. Risk quotients < 10 will thus indicate that there is not considered to be any risk of adverse effects in the aquatic environment. Table 7.3 shows that the risk quotient for petroleum distillates in the discharge from WWTPs is below 1 for which reason petroleum distillates are not expected to cause any effects. For white spirit, the RQ is > 10 and discharge of this substance must be expected to cause a risk of effects in the aquatic environment. In order to assess the effect in the aquatic environment, simulations were made of the dilution and the transformation of white spirit in the environment of a defined exposure scenario.

7.6 Exposure scenario: The Little Belt

For the estimation of the concentration (PEC) of the selected chemical substances, a fate model describing degradation (biodegradation, hydrolysis, photolysis), evaporation and sedimentation was applied. All processes were specified as first order expressions with regard to the substance concentration. The process specifications were entered into a template in the modelling tool ECOLAB developed by DHI. In order to describe the transport of the substances, the fate model was linked to a hydraulic model, which models water flows in a defined water body. In this example, the two-dimensional model MIKE 21 was applied (the vertical distribution was assumed to be uniformly distributed). Furthermore, the Little Belt was chosen as a representative exposure scenario describing coastal areas in Denmark. The area covered by the model was approx. 35 km × 50 km.

In order to ensure that the simulation attained some kind of equilibrium, a simulation period of 2 months was applied. The weather conditions observed in the first week of April 2004 were repeatedly applied (approx. 10 times) in the simulation.

Table 7.4 and Figure 7.1 show the characteristics and location, respectively, of the 5 WWTPs discharging the substances into the Little Belt.

Table 7.4. Characteristics of WWTPs discharging into the Little Belt

	Kolding	Middelfart	Fredericia	Vejle	Juelsminde
Waste water, (1,000 m^3 d^{-1})	26.4	11.5	30.2	33.1	3.2
Treatment *	MBNDC	MBNDC	MBNDC	MBNDC	MBNDC

* M: mechanical; B: biological; N: nitrification; D: denitrification; C: chemical precipitation

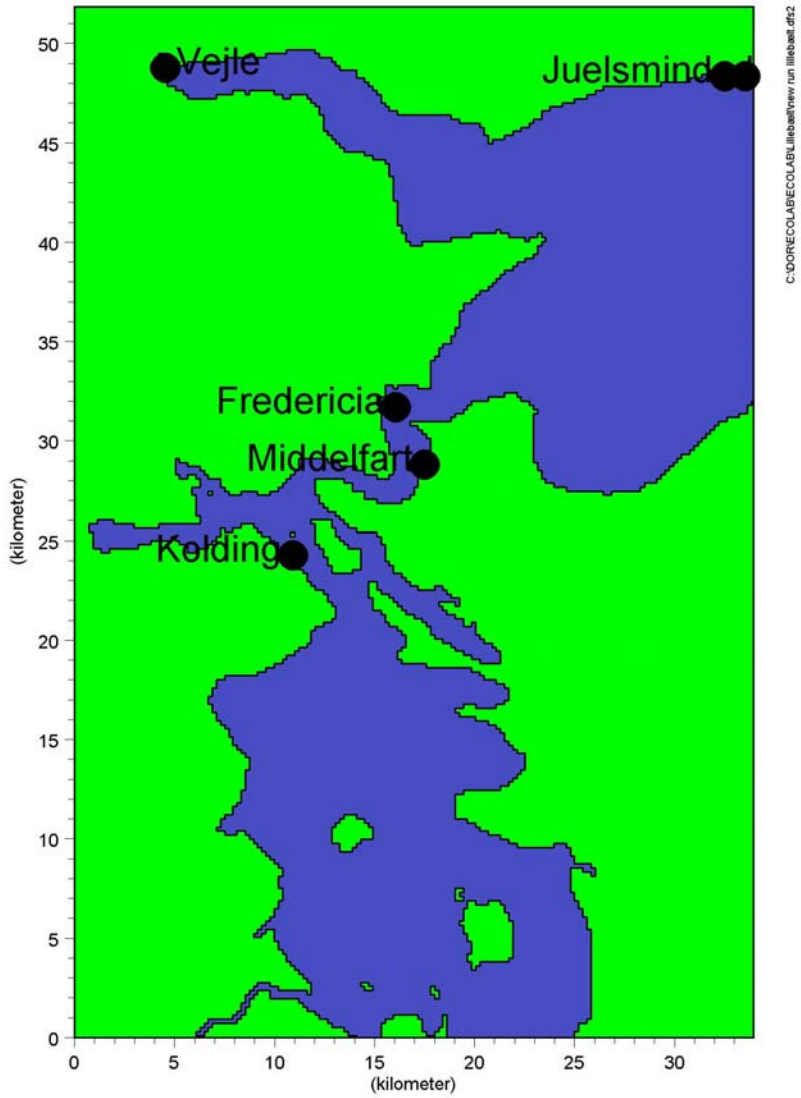


Figure 7.1. Location of discharges from WWTPs into the Little Belt

PEC (Predicted Environmental Concentration) for the selected chemical substances was thus estimated by linking the fate of the chemical substances in WWTP and the aquatic environment with the flow behaviour of the Little Belt. The PEC values were related to the PNEC (Predicted No Effect Concentration) of the substances, which is the highest concentration at which no adverse effects in the aquatic environment are expected, and a risk quotient (RQ = PEC/PNEC) was estimated for the substances after discharge into the aquatic environment.

During the simulation period, large variations in the concentrations of the chemical substances in the aquatic environment occur as a result of the natural variation in the flow behaviour. In order to assess potential chronic

effects, the average concentration of white spirit throughout the simulation period was estimated and compared with PNEC. For the assessment of potential acute effects, the maximum concentration of white spirit throughout the simulation period was estimated and compared with 10 × PNEC as it is generally assumed that PNEC for acute effects is a factor of 10 higher than PNEC for chronic effects.

The result of the simulations for white spirit was expressed graphically by specifying the risk quotients in the following intervals: RQ ≤ 0.1; RQ 0.1-1 and RQ ≥1 for the different areas of the Little Belt. The area of the Little Belt, in which there is a risk of acute effects, was found to be considerably smaller than the area, in which there is a risk of chronic effects. Figure 7.2 shows the estimated risk quotients (chronic effects) found as the ratio of the time-weighted average of the estimated concentration to PNEC.

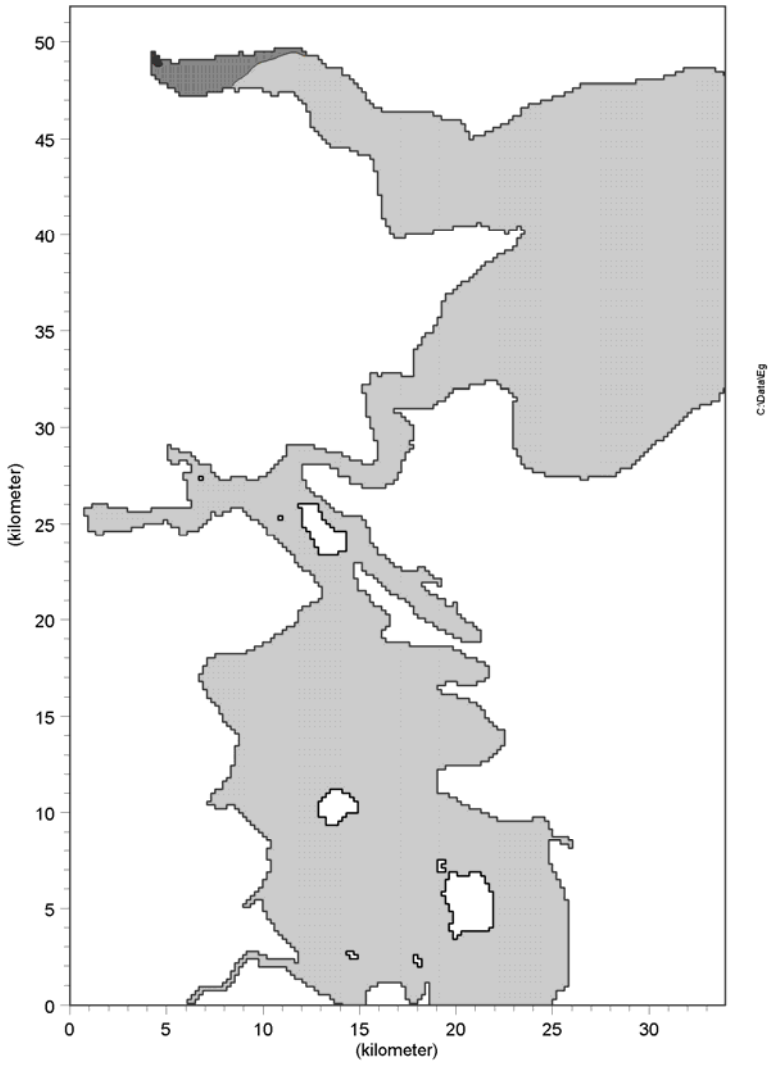


Figure 7.2. Risk quotients for chronic effects of white spirit in the Little Belt. Dark grey indicates RQ ≥ 1; Medium grey indicates RQ between 0.1-1; Light grey indicates RQ ≤ 0.1

The result of the simulation showed that, for white spirit, risk quotients > 1 were found for chronic effects in a limited near zone around the waste-water discharge from Vejle WWTP. In the other areas of the Little Belt scenario, no risk of adverse effects from white spirit was found. The inner part of Vejle Bay is characterised by a limited water exchange compared with the other wastewater discharges into the Little Belt. It was thus not surprising that the highest probability of effects occurred in exactly this area. The estimates express a worst-case situation with a high estimated consumption of stainless steel care products. Based on the simulations made for the Little Belt, it can be concluded that the discharge of white spirit may cause adverse long-term effects in the aquatic environment in a limited near zone around waste-water discharges when, at the same time, the area is characterised by a limited water exchange. No risk quotients > 1 were found for acute effects in the Little Belt (data not shown).

8 Overall product assessment

Based on the available data on the constituents in products for cleaning of ovens, cookers and ceramic cooktops, short characteristics of the individual product types are given below focussing on their contents of critical substances.

8.1 Oven cleaners

Spray oven cleaners may contain high concentrations of the solvent N-methyl-2-pyrrolidone, which is irritant (Xi, R36/38) and which, as mentioned, should be classified as reproduction toxic (T; R61 May cause harm to the unborn child). Exposure estimations for N-methyl-2-pyrrolidone showed, however, that the risk of effects on health and reproduction is estimated to be minimal. It is, however, recommended to avoid exposure to N-methyl-2-pyrrolidone during pregnancy. Oven cleaners containing the solvent dipropylene glycol monomethyl ether are not considered to cause any risk to the consumer.

Based on the available information, liquid oven cleaners are not considered to contain substances that are harmful to consumer health or the environment.

8.2 Products for ceramic cooktops

A few of the purchased products for ceramic cooktops contained the solvent petroleum, which may be hazardous to both health and the environment. Exposure estimations showed that the health risk from application of the products is estimated to be limited. The discharge of petroleum distillates into the aquatic environment as a result of the application of the products is not considered to cause any risk of adverse effects.

8.3 Stainless steel care products

Three of four purchased stainless steel care products are assessed to contain a form of white spirit, which is hazardous to both health and the environment. The concentration of this substance in the products is unknown but, based on information found in safety data sheets for similar substances, it was estimated to be 10 - ≥ 30 %. As two of the products are classified as health hazardous, the concentration of white spirit in these products probably exceeds 10 %, which is the lower concentration limit for classification for health hazards. Exposure calculations indicated that there may be a health risk in using products with a high content of white spirit if there is not adequate ventilation. Based on a simulation of the concentration of white spirit in waste water discharged into the Little Belt, this substance is estimated to potentially cause effects in a limited near zone around waste-water discharges in areas characterised by a limited water exchange. The products are thus considered to cause an inexpedient impact on consumer health and have a limited impact on the environment.

8.4 Products for cleaning of cooktops and microwave ovens

These products are not estimated to contain substances in concentrations harmful to consumer health or the environment.

9 Conclusion and recommendations

9.1 Main conclusions from the survey

The estimated sale of products for cleaning of ovens and ceramic cooktops (400,000 - 600,000 products per year) indicates that this is a considerable consumption (approx. 100,000 - 150,000 litres/year), which calls for an improved knowledge of the health and environmental properties of these products. The result of the survey gave an overview of the chemical substances that typically form part of the products.

Cleaners for oven, cooker and ceramic cooktops typically contain substances as surfactants (non-ionic and anionic surfactants, fatty acid soaps), solvents, acidity regulating agents (acids, bases), abrasives/polishers, preservatives, silicone compounds, thickening agents and fragrance. The compositions vary according to the application area and form. The knowledge of the specific composition of the products is still rather limited; in several cases it has not been possible to obtain detailed information on the chemistry of the products.

The result of the accomplished survey showed that a few of the examined products contained hazardous substances at high concentrations. The most essential conclusions regarding the health and environmental properties of the products are as follows:

- Oven spray cleaners generally contain high concentrations of organic solvents. Solvents may be harmful if inhaled.

- Two of four stainless steel care products are assessed to contain organic solvents (white spirit) in concentrations that may be harmful to health and the environment.

Exposure calculations have indicated that the application of products containing high concentrations of white spirit may involve a health risk, if there is not adequate ventilation. For the products containing N-methyl-2-pyrrolidone, petroleum distillates and dipropylene glycol monomethyl ether (DPGME), respectively, their application is assessed to involve only a low health risk. It seems, however, unnecessary to expose oneself to products with high concentrations of N-methyl-2-pyrrolidone and petroleum distillates as a consequence of their inherent health properties. A simulation of the concentration of white spirit in the aquatic environment showed that there may be a risk of adverse effects in a limited immediate zone around waste-water discharges in areas characterised by a limited water exchange.

The other substances identified in the products were not considered to differ markedly from those in other types of cleaning agents. It was not possible to collect information revealing the nature of the preservatives or fragrances that form part of the products. Several preservatives and fragrances are known allergenics, and many preservatives are very toxic to aquatic organisms.

9.2 Recommendations to consumers on cleaning of ovens, cookers and ceramic cooktops

Generally, it is recommended to reduce the quantity as well as the consumption of cleaning agents and other chemical products in the household and to choose ecolabelled cleaning products when possible. However, no ecolabelled products for cleaning of ovens, cookers and ceramic cooktops exist, as criteria for ecolabelling have not yet been developed for these product types. By limiting the total consumption of cleaning agents, the exposure of consumers and the environment to chemicals is reduced.

Some of the products contain substances that may have an impact on health or the environment. The products are generally more expensive than common cleaning products, and so there will be savings to gain by selecting common cleaning products as e.g. hand dishwashing agent or soft soap. It will often be sufficient to wipe up spillage immediately.

If special products are used for cleaning of the oven, avoid products labelled as harmful to health or the environment, and use gloves to avoid skin contact with possibly corrosive/irritating substances. Furthermore, the room should be ventilated well to avoid inhalation of vapours from products containing potentially harmful solvents.

10 Literature

/1/ Öko-test (2005). Test: Backofenreiniger. Schuss in den Often (in German). Öko-test Verlag GmbH, Frankfurt, Germany.

/2/ List of dangerous substances (2005). Danish Statutory Order No. 923 of 28/09/2005.

/3/ Statutory Order on classification, packaging, labelling, sale and marketing of chemical substances and products (2002). Danish Statutory Order No. 329 of 16/05/2002.

/4/ Statutory Order on detergents and cleaning agents [Bekendtgørelse om vaske- og rengøringsmidler] (2002). Danish Statutory Order No. 884 of 23/10/2002 (in Danish).

/5/ Statutory Order on the use of propellants and solvents in aerosol dispensers [Bekendtgørelse om anvendelse af driv- og opløsningsmidler i aerosolbeholdere] (1994). Danish Statutory Order No. 571 of 29/11/1994 (in Danish).

/6/ Regulation (EC) No. 648/2004 of the European Parliament and of the Council of 31 March 2004 on detergents.

/7/ Commission Recommendation of 13 September 1989 for the labelling of detergents and cleaning products (89/542/EEC).

/8/ Danish Environmental Protection Agency (2005). More environmental friendly alternatives to PFOS compounds and PFOS and PFOA. Environmental Project No. 1013, 2005. Ministry of Environment.

/9/ Danish Environmental Protection Agency (2000). The Danish Environmental Protection Agency's guidance on self classification of dangerous substances [Miljøstyrelsens vejledende liste til selvklassificering af farlige stoffer](in Danish).

/10/ Danish Environmental Protection Agency (2001). Environmental and Health Assessment of Substances in Household Detergents and Cosmetic Detergent Products. Environmental Project No. 615, 2001. Ministry of Environment and Energy.

/11/ Danish Environmental Protection Agency (2003). Mass flow analysis of glycol ethers [Massestrømsanalyse af glycolethere] (in Danish). Miljøprojekt nr. 768, 2003. Ministry of Environment.

/12/ IUCLID (International Uniform Chemical Information Database) version 4. Public data on high volume chemicals. Joint research centre, European Chemicals Bureau. Ispra, Italy. Year 2000 edition.

/13/ US Environmental Protection Agency (USEPA). ECOTOX Database.

/14/ European Chemicals Bureau (ECB). Technical Guidance Document on Risk Assessment in support of Commission Directive 93/67/EEC on Risk Assessment for new notified substances and Commission Regulation (EC) No. 1488/94 on Risk Assessment for existing substances and Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market. Ispra, Italy: ECB; 2000.

/15/ Environmental Review No. 15 2004. List of Undesirable Substances 2004. Danish Environmental Protection Agency.

/16/ Danish Working Environment Authority (2005). Limit values for substances and materials. WEA-guide C.0.1. Danish Working Environment Authority in Copenhagen.

/17/ Chemfinder Database and Internet searching. CambridgeSoft Coorporation 2004. www.chemfinder.com

/18/ Hazardous Substances Data Bank (2004). National Library of Medicine, Bethesda, Maryland. Greenwood Village, Colorado, USA: Thomson. 1-Methyl-2-Pyrrolidinone. http://toxnet.nlm.nih.gov.

/19/ EPISUITE v. 3.12 (Estimation software). U.S. Environmental Protection Agency, 2004.

/20/ Arbete och Hälsa (1994). Nordic Expert group for Criteria documentation of health risks from Chemicals. 1994:40. 115. N-Methyl-2-pyrrolidone (NMP) (in Swedish). Arbetsmiljöinstituttet.

/21/ The Dictionary of Substances and their Effects (DOSE) Royal Society of chemistry 1999. Cambridge.

/22/ RTECS. Registry of toxic Effects of Chemical Substances. National Institute for Occupational Safety and Health.United States.

/23/ OEHHA (2003). Office of Environmental Health Hazard Assessment Reproductive and cancer Hazard assessment Section. Proposition.

/24/ Chemicals and safety [Kemikalier og sikkerhed] (1989). Safety committee for the Danish chemical industry. N-methyl-2-pyrrolidon (in Danish).

/25/ Ursin C, Hansen CM,Van Dyk JW, Jensen PA, Christensen IJ, Ebbehøj J, (1995). Permeability of commercial solvents through living human skin. Am Ind Hyg Assoc J 56:651-660.

/26/ International Chemical Safety Cards. Distilates (Petroleum) hydrotreated light. NIOSH.

/27/ IARC.Monographs on the Evaluation of carcinogenic Risk of Chemicals to Humans (1989). Vol.47. International Agency for Research on Cancer. World Health Organization, Lyon, France.

/28/ Activity cards in case of chemical accidents. White spirit [Indsatskort for kemikalieuheld. Mineralsk terpentin] (in Danish). Danish Emergency Management Agency, 2006.

/29/ Arbete och Hälsa (1986). Nordiska expertgruppen för gränsvärdesdokumentation 1986:1- 64. Mineralsk terpentin/lacknafta, 1986 (in Swedish).

/30/ IPCS International Programme on chemical Safety (1996). White Spirit (Stoddard solvent). Health and safety guide No. 103. World Health Organization. Geneva, Switzerland.

/31/ IPCS (1996). International Programme on chemical safety Environmental Health criteria 187. White Spirit (Stoddard solvent). World health Organization. Geneva, Switzerland.

/32/ NIOSH. International chemical Safety Cards. Dipropylenglycol monomethylether. www.cdc.gov/niosh/

/33/ ECETOC (2005). Technical report No. 95. The Toxicology of Glycol ethers and its relevance to man. (Fourth Edition). Brussels, Belgium.

/34/ Arbete och Hälsa (1992). Scientific Basis for Swedish Occupational Standards Xll (in Swedish). Arbetsmiljöinstituttet. 1992:6, Page 21.

/35/ Danish Environmental Protection Agency (2005). Point sources - 2003 - revised edition [Punktkilder 2003 – revideret udgave]. Environmental Review no. 1 2005 [Orientering fra Miljøstyrelsen nr. 1 2005] (in Danish). Ministry of Environment.

/36/ HERA. Human and Environmental Risk Assessment on Ingredients of Household Cleaning Products. www.heraproject.com.

/37/ Prud'homme de Lodder LCH, Bremmer HJ, van Engelen JGM (2006). Cleaning products fact sheet: To assess the risks for the consumer. Bilthoven: RIVM; 2006. (RIVM report 320104003/2006).

/38/ European Chemicals Agency (ECHA. Consumer Exposure Estimation. Kap. R.15; version 1.1. In: Guidance on information requirements and chemical safety assessment. Helsinki: ECHA; May 2008.

/39/ IPCS/INCHEM. N-Methyl-2-pyrrolidone (2001). Geneva: WHO; 2001. (Concise International Chemical Assessment Document 35).

Chemical substances in products bought in retail shops according to their listings of ingredients

Table A.1
Contents of chemical substances in products bought in retail shops according to their listings of ingredients

Product No.	Listings of ingredients	Content in %	Labelling of product*	Comments
A	Non-ionic tensides	<5	Not labelled	Contains 8 percentage by weight of highly inflammable components
	Anionic tensides			
	Polycarboxylates			
	2-aminoethanol			
	Solvents			
	Propane (aerosol propellant)			
	Isobutane (aerosol propellant)			
B	Non-ionic tensides	<5	Not labelled	pH in application solution of approx. 4
	Anionic tensides			
	Preservatives			
	Aluminium oxide (polishing agent)			
	Citric acid			
	Tri-sodium citrate			
	Polydimethyl siloxane (silicone)			
	Fragrance			
	Xanthane rubber			
C	Petroleum distillates		Not labelled	
	Polishing agents			
	Tensides			
	Silicone oil			
	Fragrance			
D	White oil	35	Not labelled	No listing of ingredients on outer package
	Graphite	13		
	Ozokerite wax	52		
E	Non-ionic tensides	<5	Not labelled	
	Anionic tensides			
F	Sodium hydroxide	1-5	Corrosive (C)	Contains 5 percentage by weight of highly inflammable components
	Anionic tensides	5-10	S-phrases: S1/2,S23, S26, S36/37/39, S45, S51	
	Non-ionic tensides			
G	Anionic tensides	<5	Irritant (Xi)	
	Non-ionic tensides			
	Preservatives		R-phrases: R36 S-phrases: S2, S26, S46	

Product No.	Listings of ingredients	Content in %	Labelling of product*	Comments
H	Anionic tensides	<5	Irritant (Xi) R-phrases: R36/38 S-phrases: S2, S26	Acidic (pH approx. 4)
	Non-ionic tensides			
	Preservatives			
	Organic acid			
	Silicone			
	Abrasive			
	Thickening agent			
	Fragrance			
I	Potassium carbonate		Not labelled	
	Abrasive			
	Organic acid			
	Solvent			
	Surface-active agent			
J	(No listing of ingredients)		Not labelled	
K	Anionic tensides	<5	Not labelled	Acidic (pH approx. 3.5 in application solution)
	Non-ionic tensides			
	Preservatives			
	Aluminium oxide			
	Glycolic acid			
	Butyl diglycol			
	IDS			
	Silicone			
	Xanthane rubber			
	Fragrance			
L	Fatty acid soaps		Not labelled	
	Tensides			
	Potassium carbonate			
M	(No listing of ingredients)		Not labelled	
N	(No listing of ingredients)		Not labelled	
O	Amphoteric tensides		Not labelled	
	Non-ionic tensides			
	Isopropanol			
	Fragrance			
P	Anionic tensides	<5		All tensides are vegetable and are readily biodegradable (OECD 301 D)
	Citric acid			
	Polishing agent			
	Alcohol			
	Polysaccharide			
	Fragrance			
Q	Abrasive		Not labelled	
	Alcohol			
	Silicone			
	Thickening agent			
	Synthetic detergents			
R	Naphtha (crude oil), hydrodesulphurized, heavy		Irritant (Xi) and Hazardous to the environment (N) R-phrases: R48/20, R65, R67, R51/53 S-phrases: S23, S29, S62	

Product No.	Listings of ingredients	Content in %	Labelling of product*	Comments
S	Vaseline oils		Extremely flammable (F+) R-phrases: R12, R66 S-phrases: S2, S16, S23, S24	
	Dimethyl ether			
	Denatured ethanol			
	Naphtha (crude oil), hydrodesulphurized, heavy			
T	Naphtha (crude oil), hydrodesulphurized, heavy		Harmful (Xn) R-phrases: R48/20 R65 R67 R51/53 S-phrases: S2, S23, S62, S29/56	
X	Non-ionic tensides	<5	Not labelled	Acidic (pH approx. 3.5)
	Anionic tensides			
	Preservative			
	Aluminium oxide			
	Citric acid			
	Sodium citrate			
	Silicone			
	Xanthane			

* Note: The wording of the labelling (R- and S-phrases) is stated on the products. To save space, the R- and S-phrases are given by their numbers in this table.