Danish Ministry of the Environment
Environmental Protection Agency

Chemical substances in car safety seats and other textile products for children

Survey of chemical substances in consumer products No. 135, 2015

Title:

Chemical substances in car safety seats and other textile products for children

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Published by:

The Danish Environmental Protection Agency
Strandgade 29
1401 Copenhagen K
Denmark
www.mst.dk/english

Year:

2015

ISBN no.

978-87-93352-07-0

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Sources must be acknowledged.

Contents

Foreword

This study is part of the Environmental Agency's programme for surveying chemicals in consumer products, which in 2014 had a special focus on chemical substances in products for children.

The objectives of the study are:
- To determine which chemicals that can be problematic to human health may be present in car safety seats and other textile products for children.
- To examine parts of the car safety seats and other selected product groups for substances that may potentially pose a risk to children.
- To provide health and environmental assessments of the substances identified in the survey.

The project was conducted from March to December 2014, in a collaboration between COWI (project management, mapping, health and environmental assessment) and the Danish Teknological Institute, TI (chemical analyses and migration tests). Jesper Kjølholt, COWI was the overall project manager while Inge Bondgaard Nielsen was project responsible at TI.

The project supervised by a steering committee consisting of the following:

- Shima Dobel, Danish Environmental Protection Agency (Chair)
- Lene Gede, Danish Environmental Protection Agency
- Jesper Kjølholt, COWI

Please note, that this English version of the original report (in Danish) contains seven appendices of which five are in Danish. However, with the exception of appendix 3, the appendices consist almost entirely of tables with chemical names and data and, hence, we believe that the majority of the contents should be possible to interpret.

Conclusion and Summary

Background and objectives
This study was undertaken as part of the Danish Environmental Protection Agency's programme for the identification of problematic chemicals in consumer products, which in 2014 had a special focus on chemical substances in products for children. The overall objective has been to examine and assess whether there are chemical substances in car safety seats and other textile products for children that may pose a risk, and to evaluate whether the regulations on the area are met.

Survey
Through a survey based on literature and interviews/questionnaire an overview is provided of which product types would be relevant to include in the practical investigations of this project, and a variety of chemical substances that can be expected to occur in the relevant product types were identified. The results of the survey have formed the basis for the subsequent project activities,where specific products were selected and purchased for chemical analysis.

The project deals with car safety seats and other textile products for children. The focus of the survey is on articles for babies and infants, i.e. children of 0-3 years of age, because this age group is considered particularly vulnerable to exposure to chemicals. The study includes product types with textile used specifically and solely for children, and which children will typically sit on or lie in. The main focus has been on car safety seats, but other relevant product types such as cradle seats, prams and strollers, baby slings, bunting bags, travel-/weekend beds and baby mattresses have also been included in the survey. Children's clothing, furnishing fabrics and furniture for children as well as toys are not covered by the study.

In the survey, a literature search for publications with information about the chemical substances in textiles and childcare articles was ucarried out. The main sources have been studies undertaken by environmental authorities and consumer organizations in the Nordic countries and Germany. Additionally, the market for these products has been identified through personal communication and questionnaires to a number of market players, including consumer organizations as well as retailers and producers of children's articles.

The product types studied are typically composed of different components, e.g. a car seat consists of both textiles (upholstery, belts/straps), foam (fill) and plastic parts (shell, buckles). The occurrence and possible release of chemicals depends to a large extent on the material in which the substances are used. Chemicals in the plastic parts are considered to be better immobilised in the material than chemical substances in textiles and foam for which reason the focus has been on the latter two materials.

Five out of the 11 contacted distributors of car safety seats and other children's articles have returned the questionnaire; two distributors have additionally attached analysis reports for their own products, and some companies have provided other additional information on chemical substances in car safety seats.

No production of car safety seats takes place in Denmark. It is estimated that 75 - 80% of car safety seats on the Danish market originate from countries outside the EU, and of these, the majority from China. The remaining 20-25% are produced in the EU, mostly in Germany but also in Italy. Car safety seats produced in the EU are typically more expensive than the Asian products. Regarding

the other children's articles, there is a major production of prams in Europe (roughly covering half of the market), while most other children's articles such as cradle seats, baby slings and buntings mostly originate from countries outside the EU (about 80%).

In general, it seems that distributors do not know whether hazardous chemicals are present in the products or if chemicals are added to meet certain technical or functional requirements such as water repellancy or fire retardant properties. One producer has, however, indicated that some functional requirements are made with respect to fire resistance and UV protection for car safety seats and certain other products. The occurrence of flame retardants can according to the producer be explained by strict requirements to fire safety in the UK, making the addition of flame retardants necessary in products that are (also) intended for the British market. Additionally, PAH compounds may be present as impurities in foam parts.

Previous surveys and studies show that a large number of chemicals are used in textiles. The Swedish Chemicals Inspectorate, for example, has compiled a list of 1,900 chemicals known to be used in textile production. The substances are not necessarily present in the final products.

Danish and German consumer organizations in collaboration have made a larger study of car safety seats, in which a number of new car safety seats on the market are analysed every year. The results from 2011 to 2013 are included in this survey together with the results of a survey of car safety seats made by the Swedish Chemicals Inspectorate. In these studies, phosphorus-based flame retardants were detected in a large number of samples in several studies, and in concentrations that indicate an intentional use of the substances in the products. Two other studies also showed a significant occurrence of phthalates and brominated flame retardants in a few seats. The concentrations of most of the other substances detected suggest that the substances primarily occur as impurities in the materials and that they do not have a technical function in the final products. This applies to e.g. PAH compounds, organotin compounds, perfluorinated substances and azo dyes.

In two studies, which analysed 15 baby slings for a number of substances, only phosphorus-based flame retardants and nonylphenol ethoxylates were found in significant concentrations.

The presence of chemicals in prams was previously investigated in two studies. The phthalate DEHP was found in a single pram in a very high concentration but apart from that only the phosphorus-based flame retardants were detected in measurable concentrations. Tin was found in some of the products but the content could not be related to the occurrence of selected organic tin compounds. Some prams contained bromine in relatively high concentrations in the fabric (two out of four samples), which could indicate the presence of brominated flame retardants.

In one of the consumer product surveys published by the Danish EPA with focus on products for babies, two nursing pillows and two baby mattresses were analysed. In one of the nursing pillows high concentrations of phthalates were found while tin was found in both nursing pillows and mattresses. The content of tin could, however, not be related to content of organotin compounds.

Selection of products and substances

Based on the results of the survey, a preliminary hazard assessment was carried out of the key substances/-groups that were identified in previous studies of relevant textile products as well as an initial screening level exposure assessment concerning textile products for children, with special emphasis on products for small children.

In the exposure assessment, parameters such as distribution of the product, frequency and duration of use, overall usage duration and exposure pathways were evaluated qualitatively. On the basis of this assessment car safety seats, baby slings and baby mattresses were identified as the three product groups which, overall, resulted in the highest exposure, especially of small children, and

they were therefore selected for further testing in the chemical analysis programme and a total of 30 products were purchased for the purpose.

Chemical analyses and migration test

Previous studies have shown a very large variation in the occurrence of chemical substances in textile products and it was therefore considered that there was a need for an initial screening analysis as a supplement to the results from the survey to support the decision on, which specific quantitative analyses should be performed on each product. A screening analysis by GC/MS of all 30 products was conducted. Sub-samples of several different materials were taken from many of the products and in total 59 sub-samples were screened. All samples were additionally analysed specifically for formaldehyde, which has previously been found in related textile products and which cannot be detected by GC/MS screening. Furthermore, the samples of car safety seats were screened by X-ray for content of the elements tin and bromine as indicators of organotin compounds and brominated flame retardants.

The results from the screening analyses showed several unidentifiable compounds in low concentrations, i.e. in concentrations indicating that the substances probably did not have an intended function in the textile product. Only a few substances were detected in concentrations, that were considered important in relation to health, and formaldehyde was not detected in any of the samples. The X-ray screening analysis did, however, show a significant content of bromine, which could indicate the presence of brominated flame retardants.

The specific substances selected for quantitative chemical analysis based on the results of the screening analyses and initial hazard/exposure assessment were phosphorus-based flame retardants, the phthalate DIDP, azo dyes (through certain aromatic amines as indicators), isocyanates and brominated flame retardants. The substances found in most samples in significant concentrations were the phosphorus-based flame retardants TCEP, TCPP and TDCP and two isomers of diisodecyl phthalate (DIDP), all of which were found in concentrations of 10,000 mg/kg material in one or more samples.

Previous studies of textile products have shown the presence of several substances with well-known health or environmentally hazardous properties in some products, but these substances (e.g. various phenols, formaldehyde, phthalates other than DIDP, PAHs, organic tin compounds) were found only in very low concentrations in the 30 products analysed as a part of this project.

Azo dyes, which can release one or more of the 22 aromatic amines listed in Appendix 8 to Annex XVII of the REACH Regulation, are not permitted to be used in textile or leather articles, which may come into prolonged direct dermal or oral contact with humans. For the aromatic amines a general limit value of 30 mg/kg (each) has been set. The compound 4-methyl-m-amino-phenylenediamine was detected at or above this threshold in two products, while 3 of the other 11 tested products contained low levels of the relevant amines. The violations have been reported to the Danish Chemicals Inspectorate.

Isocyanates were, despite indications of their presence in the samples at the preliminary screening, not found in concentrations above 1 mg/kg in any of the samples examined by the specific quantitative analysis. It is therefore concluded that the conventional GC/MS screening method is not suitable to indicate a possible content of isocyanates.

The X-ray screening analysis indicated that brominated flame-retardants could be present in two products. This could, however, not be verified by the quantitative analyses of selected brominated flame retardants where only a content up to about 1 mg/kg was found. It is assessed that the products may have been treated with polymeric brominated flame retardants, which are not

possible to detect by the analysis performed but are considered to be less harmful to human health than the traditional brominated flame retardants.

In another consumer product project for the Danish EPA, conducted concurrently with this project, textiles from eight car safety seats were analysed for 39 polyfluoroalkyl substances (PFAS). The concentrations of PFAS were below the detection limit in all of the eight samples.

From the results of the quantitative chemical analyses, it was concluded that testing of migration was only relevant to perform for the phosphorus-based flame retardants. The seven products having the highest content of one or more of these substances – 4 car safety seats, 2 baby slings and 1 baby mattress – were tested for migration to artificial sweat over a period of 3 hours. Migration was observed in all tests, varying from <1 % up to 30% of the material's content (by weight).

Health assessment

On the basis of the results of the quantitative chemical analysis an assessment of health risks was performed for the substances showing a significant migration out of the products, since this migration may result in exposure of children via the individual product types. The hazard assessment therefore focuses on the three phosphorus-based flame retardants (TCEP, TCPP and TDCP), while no risk assessment has been conducted for either diisodecyl phthalate (DIDP) or the aromatic amines from azo dyes.

Phosphorus-based flame retardants

TCEP is associated with a low to moderate acute toxicity. In rat studies, it appears that up to 90% of the substance is absorbed after oral intake. Lesions in the kidney after repeated exposure is assessed to be the most sensitive endpoint with a LOAEL of 12 mg/kg bw/d. The substance has not been shown to be mutagenic, but is classified as a carcinogen in category 2 (Carc 2), with a carcinogenic effect related to the effects on the kidneys. TCEP has also been shown to be toxic to reproduction in mice and rats (Repr. 1B), and a NOAEL of 175 mg/kg bw/d is established because of impairment of fertility in both sexes.

TCPP is considered to have a low acute toxicity. Up to 80% of the substance is rapidly absorbed after oral intake, and dermal absorption studies have shown that a dermal absorption of 40% can be used for TCPP. Based on analogy with TCEP, TCPP is also classified as Carc. 2, H451. In a 90 day study in rats, a LOAEL value of 52 mg/kg bw/day was determined based on effects on the liver and thyroid gland. *In vitro* studies also indicate some endocrine disruption potential.

TDCP is also assessed to have low acute toxicity. Animal studies indicate absorption of 100%, 100% and 30% for oral intake, inhalation and dermal absorption, respectively. Neurotoxic effects were observed in studies with repeated exposure but a dose-response factor has not been established. TDCP is mutagenic *in vitro* but not *in vivo*, and it is classified Carc 2. on the basis of effects on the kidneys with a LOAEL of 5 mg/kg bw/d.

Health risk assessment

Based on the results of the chemical analyses and the worst-case exposure scenarios for the use of car safety seats, baby slings and baby mattresses, the health risk associated with the above substances has been estimated. This was done based on the procedures in the ECHA guidance document and on DNELs identified in the literature or calculated. The results, which were based on very conservative assumptions, indicated that there may be a risk associated with the exposure of children to particuarly TCEP in car safety seats and baby slings, and TDCP in car safety seats, baby slings and baby mattresses, if the children are exposed as described in the worst-case scenarios. The scenarios were therefore adjusted in order to make the assumptions more realistic. The assumptions were adjusted with regard to the skin surface area in contact with the products, the migration from the products and the absorption of the substances through the skin.

The results of the more realistic calculations also indicated an undesireable risk associated with a single car seat, a baby sling and a baby mattress.

With regard to baby mattresses it should be stressed that they are usually expected to be protected with a cover and in addition with a sheet during use and these two layers of textile are expected to act as a barrier to migration. This is supported by the results from the initial quantitative analyses, which showed that the content of TDCP in the mattress cover was approximately 1000 times lower than the content in the foam. It is therefore assumed that the textile cover is an effective barrier which can provide considerable protection of the children using the mattres. However, based on the results, it cannot be excluded that there may be a risk associated with the use, if the children, are in direct contact with the mattress without cover.

The test samples from the car seat and the baby sling have been taken from areas expected to be in direct contact with the face. Samples include both textile / felt and foam and as the results are obtained from the samples immersed in the sweat simulant, it will not be reflected if the textile part may be a barrier to the migration of the substances in the foam.

The risk assessment carried out does not account for exposure from other sources of TCEP, TCPP and TDCP. The assessment by the Scientific Committee, SCHER, of TCEP in toys indicates that there is exposure to TCEP from dermal contact with furniture and dust, inhalation and drinking water, which may also be possible for the other substances. In addition, it is also possible that children are exposed to substances from car safety seats, baby slings and mattresses within the same period of time.

Environmental assessment

Following the initial exposure assessment, which indicated a limited environmental load with chemicals from the selected product groups, it was decided to limit the environmental risk assessment to a conservative screening assessment of environmental impact. This was based on an arbitrary substance, "Substance X", in an arbitrary product at a concentration of 10,000 mg/kg and 100% release to wastewater within a period of one year. Assuming that all children in the age group 0-3 years use such textiles, the resulting concentrations (PEC) in sewage effluent and sludge, respectively, were estimated under worst case conditions and compared to the lowest Predicted No-Effect Level (PNEC) reported for any of the relevant, quantified substances – i.e. TCEP, TCPP, TDCP, DIDP and azo dyes (aromatic amines).

It was from this conservative screening assessment concluded that the risk of environmental effects in aquatic or soil environments due to release of the assessed substances from washing of childrens' textiles was insignificant and therefore it was not considered necessary to perform a more detailed assessment. Similarly, an environmental impact from emission of the substances to air was estimated to be insignificant.

1. Introduction

1.1 Background

The use of chemicals in the production of textile fibres, finished fabrics and textile products is intensive. This applies to all phases of the life cycle. Many of the chemicals used are potentially hazardous to human health and/or the environment. Most of the fabrics that can be found in articles are manufactured in countries outside the EU (KemI, 2013). While some of the substances used react chemically or are removed from the textiles during the production, and therefore not found in significant amounts in the finished products, other chemicals continue to exist in their original form and may be released later from the finished product thus resulting in exposure of consumers and the environment. Exposure of consumers can take place directly during use or, for certain substances, indirectly via the environment (release during washing and waste management).

In this project, the focus has been on products with textiles aimed for use by children. Products with textiles are found anywhere in the children's immediate environment, both as clothing and home textiles or as components of products developed specifically for children. The main focus of this project is on car safety seats as it is a product type that is used on a daily basis by a large fraction of Danish children from birth until approximately 12 years of age. The regulatory rules state that children under 135 cm in height must sit in an approved car safety seat when being transported in a car. Moreover, it is a product group, which in previous studies has been found to contain problematic chemicals.

1.2 Objectives

The objectives of the study are:

- To determine which chemicals that can be problematic to human health may be present in car safety seats and other textile products for children.
- To examine parts of the car safety seats and other selected product groups for substances that may potentially pose a risk to children.
- To provide health and environmental assessments of the substances identified in the survey.

2. Survey of products and chemicals

2.1 Surveying method

2.1.1 Literature search

A literature search was performed partly by a search on the internet with relevant search terms and partly by searching on the web sites of specific agencies and organizations, including:

• Danish Environmental Protection Agency
• Chemicals Inspectorate (KemI, Sweden)
• Environment Directorate (formerly SFT and Klif, Norway)
• Umweltbundesamt (Germany)
• Federal Institute for Risikobewertung (BfR, Germany)

For the internet search, search words such as "textiles", "car safety seats", "chemicals", "surveys", combined with "children" in Danish, English and German.

2.1.2 Information from market players

The following organizations and companies were contacted by telephone and/or by mail and requested to provide information on chemicals in car safety seats and other textile products, among others by completing a questionnaire, which can be found in Appendix I:

Organizations:
• Danish Consumer Council
• FDM (Federation of Danish Motorists), the interest organization of Danish car owners
• Stiftung Warentest, the German testing organization
• ADAC, the German association for car owners
• Ecology Center, USA/American environmental and consumer NGO

Importers, distributors and vendors:
• BabySam
• T. Hansen
• Ønskebørn
• COOP Denmark
• Britax Roemer
• IKEA A / S
• Dansk Supermarked
• Børnebiksen
• Jysk
• Fætter BR
• Silvan

2.2 Identification of relevant products

2.2.1 Delimitation of the product groups covered in this project

This project deals with car safety seats and other products with textiles for children. The survey focused on product types with textile used specifically by children, and that they typically sit or lie in, while children's clothing, home textiles, furniture and toys are not included. The main focus has been on car safety seats but other relevant product types such as cradle seats, prams and strollers, baby slings, buntings and baby mattresses have also been included in the survey.

Although car safety seats and/or booster seats can be used by children up to 12 years of age (for children under 135 cm), the investigation focused on articles for young children from 0-3 years of age. This age group represents the primary users of the mentioned product types, and children in this group of age are considered particularly vulnerable because they often lick/suck on or put objects in the mouth.

The product types mentioned are typically composed of a number of components. E.g. a car seat typically consists of textiles (upholstery, belts), foam (buffer) and plastic parts (shell, buckles). Chemical substances in the plastic parts are considered less prone to be released from the material than chemical substances in textiles, i.e. they are less prone to be released during use and, hence, significant skin contact with these product parts is not expected. Therefore, within the framework of the investigation, it has not been a priority to carry out a comprehensive survey of the plastic parts and no chemical analyses of these product components were performed. However, to the extent that previous studies have included analyses of chemical substances in parts other than textiles in relevant products, these results are reported.

2.2.2 Child car safety seats and booster seats

Product description

In Denmark, it is a legal requirement that children under 135 cm must be secured in safety equipment that is suitable considering both height and weight. Babies (up to approx. 1 year) are typically fixed in rear-facing infant seats, toddlers (1-4 years) in forward as well as rear-facing seats, while children from 4-5 years of age should use booster seats with or without backrest (Road Safety Council , 2014).

FIGURE 1
EXAMPLES OF HIGHCHAIRS / BELT PADS TO: A - BABIES (CA. 0- 1 YEAR); B - YOUNG CHILDREN (1-4 YEARS), AND C - LARGER CHILDREN (APPROX 4-12 YEARS) (PICTURES FROM WWW.BABYSAM.DK).

A car seat is a complex product composed of several different parts and materials (Tønning et al., 2008 and own observations):

- Frame made of metal or hard plastic.
- Shell, buckles and possible armrests made of hard plastic.
- Foam materials for fillings and upholstery of the chair itself and possible support cushions, for example polyurethane foam, polystyrene foam or polyester fiber. Cotton wool may occur.
- Textile cover for chair and support pads. The cover is typically made of cotton, polyester, or a mixture of these.
- Potentially, some buckles or labels consisting of soft plastic or rubber.
- Straps or belts consisting of textile.

The market for car safety seats

In the trade statistics from Statistics Denmark there is no specific product code for car safety seats. There is no production of car safety seats in Denmark. According to FDM (personal communication, 2014) around 75-80% of car safety seats on the Danish market originate from non-EU countries, and of these the majority are imported from China. The remaining 20-25% are produced in the EU, mostly in Germany but also in Italy. Typically, car safety seats produced in the EU are more expensive than the Asian products, and therefore the vast majority of car safety seats found in discount stores, DIY centres and supermarket chains typically come from countries outside the EU. Many brands are marketed as being European, although the actual production takes place outside the EU.

Several businesses are reported to be contract manufacturers, i.e. they first commence a production when a retail company has commissioned a certain number of seats. By this the products are sent directly sent from the factory to the customer, which reduces the need for preservatives and biocides for storage (FDM, 2014).

FDM (2014) estimates that about 100,000 to 500,000 seats per year are sold in Denmark, but the actual number is probably in the low end of the range. Over the past seven years, on average 61,000 children per year were born in Denmark (Statistics Denmark, 2013). Assuming that each child needs approximately 3 car safety seats through its childhood, that the lifetime of a car seat is 5 - 10 years and that a chair is re-used 1-2 times (the models often become obsolete before they are worn out), the number of sold seats roughly equals the birth rate and therefore believed rather to be in the order of 60,000-100,000 seats per year than the above estimate by FDM.

A very large number of different car safety seats are on the market. Danish and German consumer organisatiotions (Danish Consumer Council, FDM, Stiftung Warentest and ADAC) have teamed up to finance a larger study of child car safety seats. In total, 131 different car safety seats from a large number of producers have been tested as part of the study (Danish Consumer Council, 2014c). There is no information indicating that the market is dominated by only a few actors, and in many Internet shops seats from many different producers are sold. Child car safety seats can be purchased e.g. in a variety of Internet shops, baby and children's equipment shops and department stores, at FDM and in certain DIY centres, car accessories stores and supermarkets.

There is a widespread re-use of car safety seats, e.g. they are used by younger siblings or given to family and friends, and there is also widespread private sale through Internet sites such as the Den Blå Avis.

Reply from market players on chemicals in car safety seats

Five out of the 11 contacted distributors/vendors of car safety seats and other children's articles have responded to the questionnaire. Two respondents have additionally attached analysis reports for their own products, and some have provided additional information by e-mail or telephone.

In general, it seems that the distributors/vendors have no information about possible presence of harmful chemicals in car safety seats or information about chemicals are added to meet certain technical or functional requirements such as water-resistance or flame-retardant properties.

One company with a significant market share in Denmark has indicated that there are functional requirements with respect to fire resistance and UV protection for car safety seats. However, flame retardants are added only to the foam parts and not to the textiles, while it is not known whether chemicals are added to achieve UV protection. Additionally, it is indicated that PAH (polycyclic aromatic hydrocarbons) may be present in the foam, although this chemical is not intentionally added to achieve a specific function. The occurrence of flame retardants can be explained by the stricter fire safety requirements to car safety seats in the UK, making the addition of flame retardants necessary in products intended for the British market.

2.2.3 Other textile articles for children

In addition to car safety seats the distributors/vendors were also asked for information regarding import, production and possible use of chemical additives used in the following products:

- Nursing pads, -cushions and -pillows
- Prams and strollers
- Buntings, carrier- and sleeping bags
- Baby slings
- Cradle seats and the like
- Travel- and weekend beds

Baby mattresses were only later selected as an independent product type (representing the, from an exposure point of view, most relevant parts of prams, carry cots, travel-/weekend beds etc.) for possible purchase and subsequent and chemical analysis, and therefore information on this product type has only indirectly been answered by the respondents to the questionnaire.

Product descriptions

The above products are typically composed of a variety of materials which will result in different extent of exposure of the child. Prams and strollers, cradle seats, travel-/weekend beds are expected to be made of the same materials as car safety seats, while nursing pillows, mattresses and buntings only contain the textile parts and foam/fillers.

Some of these products were previously tested in a consumer product project by the Danish EPA on products for babies (Tønning et al., 2008). The following information on materials in such products (except travel-/weekend beds) is extracted from this study. The breakdown into product groups in the investigation by Tønning et al. (2008) is not completely identical with the breakdown of products here. Significant changes in the composition of the materials are not expected for the products since the compilation of data in the previous survey.

Nursing pads / cushions / pillows - Cover of plastic film or textile (cotton or cotton/polyester) with a coating of plastic or similar, and also covers of nylon fabric occur. The plastic may be PVC, polyurethane (PU), acrylic plastic or other. Covers are often decorated with prints. Fill material of foam (polyurethane foam, PU) or polyester.

Carrycots / pram upholsteries – Cover/exterior fabrics made of textile often with a plastic coating either on the outside or inside, or with a water-repellent impregnation. The textile material is often polyester but can also be cotton or cotton/polyester. The coating may be polyurethane (PU), which is of type FR (= containing a flame retardant product). Upholstery/fill of polyurethane foam is (PU) and/or polyester.

Cot bumpers and head protection in prams - Outer fabric of cotton or cotton/polyester. Filling of polyester fibre, or possibly PU foam.

Bunting bags / sleeping bags – Cover/exterior of polyester, cotton or polyester/cotton. Inside textile of cotton, polyester/cotton or polyester fleece (furry fabric). Fill/interior of polyester, wooly fibres or down/feathers.

Baby slings - Outer fabric of cotton, cotton/polyester or polyester. Fill/upholstery of polyester fiber or polyurethane (PU).

Baby chairs and loose chair linings / -cushions, cradle seats, sedan chairs, bouncy chairs - Exterior of cotton or cotton/polyester. Filling of polyester fiber.

Baby mattresses and mattress pads - Cover of cotton and cotton/polyester. Fill of polyurethane (PU), polyester, latex foam, PU foam with flame retardant, felt of flax.

Travel- and weekend beds - These products are not described by Tønning et al. (2008). The materials for the mattresses in these types of beds are supposed to be identical to the materials described for baby mattresses and mattress pads.

The market for the products
While there also is a major production of prams in Europe (approximately 50%), it is stated that other children's articles such as cradle seats, baby slings and buntings mostly come from countries outside the EU (approximately 80%). As with car safety seats, many of the manufacturers have their headquarters in Europe while the production takes place outside the EU. For most of the products it is estimated that one unit of the product is bought for each child. Since there is a certain re-use of the products, the market for each product is estimated to be less than the number of newborn children, which in Denmark is about 60,000 a year. The number of new products sold are on this background estimated to be in the range of 25,000-50,000 pcs./year.

The consumer product project on baby products by Tønning et al. (2008) estimated that the number of prams sold in Denmark were 25,000 to 40,000 pcs./year while the number of each of the other products was estimated at 40,000 to 60,000 pcs./year. In the current study it is assessed to be unlikely that the number of products sold corresponds to the number of babies (60,000 newborns per year), since all products will be recycled within the families to a certain degree of.

Products are sold in many of the same places as car safety seats, however, probably a larger share of the market covered by baby and children equipment stores and internet stores specialised in baby and children's equipment.

Response from distributors/vendors on chemical substances in other products
As with car safety seats it does not seem that distributors/vendors have any knowledge on the presence of harmful chemicals in these children's products, or if chemicals are added to achieve specific technical or functional properties such as water-repellancy or flame-retarding properties. A single producer stated that UV filters are used in hoods for prams, that flame retardants are used in the foam materials, and that PAHs can be present as impurities in the foam parts.

2.3 Chemical substances in textiles

2.3.1 Problematic chemical substances occurring in textiles

Table 2-1 gives an overview of substances or groups of substances that can potentially be found in textiles. The list is based on previous consumer product projects prepared for the Environmental Protection Agency (Poulsen et al., 2011; Rasmussen et al. 2013, Andersen et al., 2014) and a publication on chemicals in textiles from the Swedish Chemicals Agency (KemI, 2013a).

Some of the listed substance groups comprise many individual substances, of which only a few examples of the most wellknown individual substances are mentioned. It is emphasized that the list is not complete, but it gives a good overview of substances that potentially can be found in textile products. The substances are added either to achieve specific functional properties or are present as residues from the use of various process chemicals in the production of textiles.

TABLE 2-1
OVERVIEW OF CHEMICAL SUBSTANCES THAT POTENTIALLY CAN BE FOUND IN TEXTILES (SE CLARIFICATION IN TEXT).

Substance function	Substance groups or substances	Example of a substance from the substance group	CAS no.	Restrictions on the use of the substance in relation to textiles according to REACH Annex XVII
Biocides, including preservatives, disinfectants and insecticides	Phenols, such as: Pentachlorophenol (PCP) Tetrachlorophenol (TeCP), trichlorophenol (TrCP), o-phenylphenol (OPP)	Pentachlorophenol	87-86-5	Shall not be placed on the market, or used, —as a substance, —as a constituent in other substances, or in mixtures, in a concentration equal to or greater than 0,1 % by weight
		Trichlorophenol	88-06-2	-
		Ortho-phenylphenol	90-43-7	-
	Organic tin compounds	Tributyltin	688-73-3	Tri-substituted organostannic compounds such as tributyltin (TBT) compounds and triphenyltin (TPT) compounds shall not be used after 1 July 2010 in articles where the concentration in the article, or part thereof, is greater than the equivalent of 0,1 % by weight of tin. Dibutyltin (DBT) compounds shall not be used after 1 January 2012 in mixtures and articles for supply to the general public where the concentration in the mixture or the article, or part thereof, is greater than the equivalent of 0,1 % by weight of tin. Dioctyltin (DOT) compounds shall not be used after 1 January 2012 in the following articles for supply to, or use by, the general public, where the concentration in the article, or part thereof, is greater than the equivalent of 0,1 % by weight of tin: – textile articles intended to come into contact with the skin, – gloves, – footwear or part of footwear intended to come into contact with the skin,
		Triphenyltin		
		Dioctyltin		

Substance function	Substance groups or substances	Example of a substance from the substance group	CAS no.	Restrictions on the use of the substance in relation to textiles according to REACH Annex XVII
				– wall and floor coverings, – childcare articles, – female hygiene products, – nappies, – two-component room temperature vulcanisation moulding kits (RTV-2 moulding kits)
	Dimethylfumarate (DMFu)		624-49-7	Shall not be used in articles or any parts thereof in concentrations greater than 0,1 mg/kg. Articles or any parts thereof containing DMF in concentrations greater than 0,1 mg/kg shall not be placed on the market.
	Formaldehyde		50-00-0	-
	Triclosan			-
	Silver compounds	Silver	7440-22-4	-
		Silver nitrate	7761-88-8	-
Flame retardants	Polybromo biphenyls (PBB)		59536-65-1	1. Shall not be used in textile articles, such as garments, undergarments and linen, intended to come into contact with the skin 2. Articles not complying with paragraph 1 shall not be placed on the market.
	Polybrominated	Octabromodiphenyl	32536-52-0	1. Shall not be placed on the market, or used:

Substance function	Substance groups or substances	Example of a substance from the substance group	CAS no.	Restrictions on the use of the substance in relation to textiles according to REACH Annex XVII
	diphenyl ethers (PBDE)	ether		– as a substance, – as a constituent of other substances, or in mixtures, in concentrations greater than 0,1 % by weight. 2. Articles shall not be placed on the market if they, or flame-retardant parts thereof, contain this substance in concentrations greater than 0,1 % by weight.
	Phosphorus-based flame retardants	Tris (1,3-dichloro-2-propyl) phosphate (TDCP)	13674-87-8	-
		Tris (1-chloro-2-propyl) phosphate (TCPP)	13674-84-5	-
		Tris (2-chloroethyl) phosphate (TCEP)	115-96-8	-
UV absorbers and stabilizers.	Benzophenones	2-Hydroxybenzo-phenone	117-99-7	-
		2,4-Dihydroxybenzo-phenone	131-56-6	-
		2,2'-Dihydroxy-4,4'-dimethoxybenzophenone	131-54-4	-
	Triazoles	2-Hydroxyphenyl-benzotriazoles		-
		Bumetrizole	3896-11-5	-

Substance function	Substance groups or substances	Example of a substance from the substance group	CAS no.	Restrictions on the use of the substance in relation to textiles according to REACH Annex XVII
	Triazines	2-Hydroxyphenyl-s-triazines		-
Plasticizers	Phthalates	Bis (2-ethylhexyl) phthalate (DEHP)	117-81-7	1. Shall not be used as substances or in mixtures, in concentrations greater than 0,1 % by weight of the plasticised material, in toys and childcare articles. 2. Toys and childcare articles containing these phthalates in a concentration greater than 0,1 % by weight of the plasticised material shall not be placed on the market. 3. The Commission shall re-evaluate, by 16 January 2010, the measures provided for in relation to this entry in the light of new scientific information on such substances and their substitutes, and if justified, these measures shall be modified accordingly. 4. For the purpose of this entry 'childcare article' shall mean any product intended to facilitate sleep, relaxation, hygiene, the feeding of children or sucking on the part of children.
		Dibutyl phthalate (DBP)	84-74-2	
		Benzyl butyl phthalate (BBP)	85-68-7	
		Di-isononyl-phthalate (DINP)	28553-12-0	1. Shall not be used as substances or in mixtures, in concentrations greater than 0,1 % by weight of the plasticised material, in toys and childcare articles which can be placed in the mouth by children. 2. Such toys and childcare articles containing these phthalates in a concentration greater than 0,1 % by weight of the plasticised material shall not be placed on the market. 3. The Commission shall re-evaluate, by 16 January 2010, the measures provided for in relation to this entry in the light of new scientific information on such substances and their substitutes,
		Di-isodecyl- phthalate (DIDP)	26761-40-0	
		Di-n-octyl phthalate (DNOP)	117-84-0	

Substance function	Substance groups or substances	Example of a substance from the substance group	CAS no.	Restrictions on the use of the substance in relation to textiles according to REACH Annex XVII
				and if justified, these measures shall be modified accordingly. 4. For the purpose of this entry 'childcare article' shall mean any product intended to facilitate sleep, relaxation, hygiene, the feeding of children or sucking on the part of children.
Dyes and dyeing ancillary materials	Azo dyes			1. Azodyes which, by reductive cleavage of one or more azo groups, may release one or more of the aromatic amines listed in Appendix 8, in detectable concentrations, i.e. above 30 mg/kg (0,003 % by weight) in the articles or in the dyed parts thereof, according to the testing methods listed in Appendix 10, shall not be used, in textile and leather articles which may come into direct and prolonged contact with the human skin or oral cavity, such as: – clothing, bedding, towels, hairpieces, wigs, hats, nappies and other sanitary items, sleeping bags, – footwear, gloves, wristwatch straps, handbags, purses/wallets, briefcases, chair covers, purses worn round the neck, – textile or leather toys and toys which include textile or leather garments, – yarn and fabrics intended for use by the final consumer. • 2. Furthermore, the textile and leather articles referred to in paragraph 1 shall not be placed on the market unless they conform to the requirements set out in that paragraph. 3. Azodyes, which are contained in Appendix 9, 'List of azodyes' shall not be placed on the market, or used, as substances, or in mixtures in concentrations greater than 0,1 % by weight, where the
	Aniline		62-53-3	
	Benzidine and/or its derivatives		92-87-5	

Substance function	Substance groups or substances	Example of a substance from the substance group	CAS no.	Restrictions on the use of the substance in relation to textiles according to REACH Annex XVII
				substance or the mixture is intended for colouring textile and leather articles.
Surfactants and wetting agents	Alkylphenols and alkylphenol ethoxylates	Nonylphenol	25154-52-3	Shall not be placed on the market, or used, as substances or in mixtures in concentrations equal to or greater than 0,1 % by weight for the following purposes: ... 3) textiles and leather processing except – processing with no release into waste water, – systems with special treatment where the process water is pre-treated to remove the organic fraction completely prior to biological waste water treatment (degreasing of sheepskin);
		Nonylphenol ethoxylater	-	
		Octylphenol		-
		Octylphenol Ethoxylates		-
Solvents	N-Methyl-2-pyrrolidone (NMP)		872-50-4	(Listed in Appendix 6 – Toxic to reproduction) Shall not be placed on the market as: – substances – as constitues of other substamces or – in mixtures • for supply to the general public when the individual concentration in the substance or mixture is equal to or greater than: – either the relevant specific concentration limit specified in Part 3 of Annex VI to Regulation (EC) No 1272/2008, or, the relevant concentration specified in Directive 1999/45/EC

Substance function	Substance groups or substances	Example of a substance from the substance group	CAS no.	Restrictions on the use of the substance in relation to textiles according to REACH Annex XVII
				where no specific concentration limit is set out in Part 3 of Annex VI to Regulation (EC) No 1272/2008.
	N,N-Dimethylacetamide (DMAc)		127-19-5	(Listed in Appendix 6 – Toxic to reproduction) Shall not be placed on the market as: – substances – as constitues of other substamces or – in mixtures • for supply to the general public when the individual concentration in the substance or mixture is equal to or greater than: – either the relevant specific concentration limit specified in Part 3 of Annex VI to Regulation (EC) No 1272/2008, or, the relevant concentration specified in Directive 1999/45/EC where no specific concentration limit is set out in Part 3 of Annex VI to Regulation (EC) No 1272/2008.
	N,N-dimethylformamide; dimethyl formamide (DMF)		68-12-2	Shall not be used in articles or any parts thereof in concentrations greater than 0,1 mg/kg. Articles or any parts thereof containing DMF in concentrations greater than 0,1 mg/kg shall not be placed on the market.
Impregnation agents	Fluorotelomer alcohols	6:2 FTOH		-
		8:2 FTOH		-
	Fluorotelomer	6:2 FTA		-

Substance function	Substance groups or substances	Example of a substance from the substance group	CAS no.	Restrictions on the use of the substance in relation to textiles according to REACH Annex XVII
	acrylates	8:2 FTA		-
	Perfluorinated alkyl sulfonates	Perfluorooctan sulfonic acid (PFOS)		(Listed in Appendix 6 – Toxic to reproduction) Shall not be placed on the marked as: – substances – as constitues of other substamces or – in mixtures • for supply to the general public when the individual concentration in the substance or mixture is equal to or greater than: – either the relevant specific concentration limit specified in Part 3 of Annex VI to Regulation (EC) No 1272/2008, or, – the relevant concentration specified in Directive 1999/45/EC where no specific concentration limit is set out in Part 3 of Annex VI to Regulation (EC) No 1272/2008.
		Perfluorohexane sulfonic acid		-
	Perfluoroalkyl carboxylic acids	Perfluorohexane acid		-
		Perfluorooctanoic acid (PFOA)		-
	Perfluoroalkyl sulfonamides	Perfluorooctanesulfonamide (PFOSA)		-
		Perfluorooctanesulfonamidoethanol (N-Me-		-

Substance function	Substance groups or substances	Example of a substance from the substance group	CAS no.	Restrictions on the use of the substance in relation to textiles according to REACH Annex XVII
		FOSE)		
Pigments for printing and dyeing	Heavy metals	Chromium		A number of chromium compounds and salts (both Chromium (III), - (IV) and (VI) are listed in Appendix 1 and 2, entry 28 – Carcinogens and in Appendix 4, Entry 29 – Mutagens: 1. Shall not be placed on the marked as: – substances – as constitues of other substamces or – in mixtures • for supply to the general public when the individual concentration in the substance or mixture is equal to or greater than: – either the relevant specific concentration limit specified in Part 3 of Annex VI to Regulation (EC) No 1272/2008, or, – the relevant concentration specified in Directive 1999/45/EC where no specific concentration limit is set out in Part 3 of Annex VI to Regulation (EC) No 1272/2008. Without prejudice to the implementation of other Community provisions relating to the classification, packaging and labelling of substances and mixtures, suppliers shall ensure before the placing on the market that the packaging of such substances and mixtures is marked visibly, legibly and indelibly as follows: 'Restricted to professional users'.
		Nickel		Shall not be used: ...

Substance function	Substance groups or substances	Example of a substance from the substance group	CAS no.	Restrictions on the use of the substance in relation to textiles according to REACH Annex XVII
				b) in articles intended to come into direct and prolonged contact with the skin such as: … – rivet buttons, tighteners, rivets, zippers and metal marks, when these are used in garments if the rate of nickel release from the parts of these articles coming into direct and prolonged contact with the skin is greater than 0,5 µg/cm²/week.
		Copper		-
		Cobalt		A number of cobalt compounds and salts are listed in Appendix 1 and 2, entry 28 – Carcinogens and in Appendix 6, Entry 30 – Toxic to reproduction: 1. Shall not be placed on the marked as: – substances – as constitues of other substamces or – in mixtures • for supply to the general public when the individual concentration in the substance or mixture is equal to or greater than: – either the relevant specific concentration limit specified in Part 3 of Annex VI to Regulation (EC) No 1272/2008, or, – the relevant concentration specified in Directive 1999/45/EC where no specific concentration limit is set out in Part 3 of Annex VI to Regulation (EC) No 1272/2008. Without prejudice to the implementation of other Community

Substance function	Substance groups or substances	Example of a substance from the substance group	CAS no.	Restrictions on the use of the substance in relation to textiles according to REACH Annex XVII
				provisions relating to the classification, packaging and labelling of substances and mixtures, suppliers shall ensure before the placing on the market that the packaging of such substances and mixtures is marked visibly, legibly and indelibly as follows: 'Restricted to professional users'.
Other substances with no particular function, but may be present as impurities or of unknown origin	Polycyclic aromatic hydrocarbons (PAHs)	Benzo[a]pyrene (BaP)	50-32-8	Cf. Regulation 1272/2013 the five named PAHs should each occur only at concentrations lower than 0.5 mg / kg (weight percent) in toys and childcare articles that are marketed for the first time on and after 27 December 2015 and which contains rubber parts or plastic components that come into direct as well as prolonged or short-term repetitive contact with the human skin or the oral cavity under normal or reasonably foreseeable conditions of use.
		Benzo[e]pyrene	192-97-2	
		Benzo[a]anthracene	56-55-3	
		Chrysene	218-01-9	
		Benzo[b]fluoranthene	205-99-2	

The Swedish Chemicals Agency (KemI, 2013) has compiled a list of 1,900 chemicals that are known to be used in textile production. From this list 165 substances were identified as harmful based on their classification as either carcinogenic, endocrine-disrupting, mutagenic, toxic to reproduction, skin sensitizating and/or harmful to the environment. A few of the substances or substance groups in the above table, such as PAHs or triclosan, are not listed in Chemical Agency's list but have been included here.

2.3.2 Previous studies of chemicals in car safety seats

A number of studies on chemicals in car safety seats have been conducted in Denmark, Sweden, Germany and the United States. The survey results are summarized in the following paragraphs and in Table 2-2.

Danish and German Consumer Organisations (Danish Consumer Council, FDM, Stiftung Warentest and ADAC) have teamed up to be able to carry out a larger study of child car safety seats. The Danish Consumer Council has kindly made last year's results available for this survey (Danish Consumer Council, 2011; 2012; 2013).

The following parts of car safety seats were analysed:
• Cover (textile)
• Straps/belts
• The textile from the pads placed on the straps/belts (to improve comfort).

The plastic parts and the fill material was not included in the analysis programme, which comprised the following substances: 18 PAHs, 11 phthalates, 7 phosphorus-based flame retardants, 3 phenols (phenol, nonylphenol, bisphenol A), 6 organotin compounds, 57 azo dye indicators(aromatic amines), 8 metals, 6 brominated flame retardants and formaldehyde . A full list of the analysed substances can be found in Appendix 2. However, some of the materials were not analysed for all substances.

Table 2-2 only shows results for substances that actually were present in the respective materials in 2013. Phosphorus-based flame retardants were the only substances which were found in a large number of samples (eg. TCPP was found in the cover of the 14 seats) and in concentrations that suggests an intended functionality. A single car seat had a high concentration of the phthalate DEHP in the cover. The concentrations of most other substances, which were detected in only a few seats, were so low that they were considered residues or impurities in the materials. This applies to e.g. PAHs, organotin compounds and formaldehyde.

Overall in the 2013 analysis programme, 34 chemicals were found in the various materials (from 40 seats), while in 2012, 22 chemicals were identified (from 31 seats), and in 2011, there were 50 findings (from 38 seats). In the studies from 2011 and 2012, it was the phosphorus-based flame retardants that occurred in the greatest number of samples and in the highest concentrations (up to 143,600 mg TDCP/kg and up to 24,060 mg TCPP/kg). In 2011, also phthalates were found in significant concentrations in 6 out of 38 seats (up to 14,025 mg/kg) and brominated flame retardants in 4 out of 38 seats (up to 7,750 mg/kg). In 2012, no phthalates were detected, while brominated flame retardants were found in the cover of 3 out of 31 seats in concentrations up to 6,300 mg/kg.

In 2011, the US consumer organization Ecology Center (HealthyStuff, n.n.) studied 150 seats including many brands, which are also sold in Europe and Denmark. According to the summary of the study there were harmful chemicals in 60% of car safety seats. However, it has not been possible to identify which substances were included or how the car safety seats were tested.

The Swedish Chemicals Inspectorate (KemI) has in 2013 analysed 12 car safety seats and additionally two other childrens' chair covers for brominated flame retardants, dyes, perfluorinated compounds (PFOS/PFOA), phthalates, lead, formaldehyde and organic tin compounds (KemI, 2013b; unpublished).

The samples were taken from different parts of car safety seats:
• Textiles
• Fill and foam
• Hard and soft plastics.

The substances were found in a few samples, while the vast majority of the samples did not contain any of the mentioned substances. Formaldehyde was an exception, which was detectable in approximately one third of the fill and foam samples, but not the textile parts (KemI, 2013b).

TABLE 2-2
OVERVIEW OF SUBSTANCES FOUND IN PREVIOUS STUDIES ON CAR SAFETY SEATS. ONLY SUBSTANCES ACTUALLY DETECTED IN ONE OR MORE SAMPLES ARE INCLUDED IN THE TABLE. ADDITIONAL SUBSTANCES, WHICH WERE EXAMINED, ARE MENTIONED IN THE BODY TEXT. IN IF THE INVESTIGATION NOT COVERED ANALYSES OF EACH SUBSTANCE IN CERTAIN MATERIALS IS THIS SET.

Substance or substance group	Material	Detected substances, concentration range, comments (if any)	No. detect./ No. of samples	Source
Brominated flame retardants	Textile (cover)	Decabromodiphenyl ether 19 mg/kg	1/50	KemI, 2013b
	Plastic, fill and foam	These materials were not analysed for brominated flame retardants	-	KemI, 2013b
	Textile (pads)	Decabromodiphenyl ether 500 mg/kg	1/40	Danish Consumer Council, 2013
Azo dye indicators	Textile (cover)	Diaminodiphenylmethane 6 mg/kg, 1,4-Phenylenediamine 96 mg/kg, Aniline 157 mg/kg	2/50	KemI, 2013b
	Textile (pads)	Disperse orange 97 mg/kg	1/40	Danish Consumer Council, 2013
Phthalates	Plastic	DEHP 130 mg/kg – 113,000 mg/kg	2/18	KemI, 2013b
	Textile (cover)	DEHP 33,000 mg/kg	1/40	Danish Consumer Council, 2013

Substance or substance group	Material	Detected substances, concentration range, comments (if any)	No. detect./ No. of samples	Source
	Textile (pads)	DINP 175 mg/kg DIDP 3,175 mg/kg	1/40	Danish Consumer Council, 2013
Lead	Textile	7.5 mg/kg	1/50	KemI, 2013b
Formaldehyde	Fill and foam	< LoD - 28 mg/kg	9/24	KemI, 2013b
	Textile (cover)	15 -45 mg/kg	3/40	Danish Consumer Council, 2013
	Textile (pads)	27 mg/kg	1/40	Danish Consumer Council, 2013
Organic tin compounds	Fill and foam	DBT 0.012 mg/kg	1/24	KemI, 2013b
	Textile (cover)	MOT 0.31 – 2.15 mg/kg DOT 0.41 – 35 mg/kg DBT 0.08 – 0.9 mg/kg MBT 0.13 mg/kg	3/40 4/40 2/40 1/40	Danish Consumer Council, 2013
	Textile (pads)	MOT 0.15 – 1.7 mg/kg DOT 0.41 – 35 mg/kg DBT 0.068 mg/kg	4/40 4/40 1/40	Danish Consumer Council, 2013
PAH	Textile (cover)	Naphthalene 3 mg/kg Phenanthrene 0.54 mg/kg Pyrene 0.38 (all detected in the same seat)	1/40	Danish Consumer Council, 2013

Substance or substance group	Material	Detected substances, concentration range, comments (if any)	No. detect./ No. of samples	Source
	Textile (pads)	Phenanthrene 0,2 – 0,47 mg/kg Fluoranthene 0,68 mg/kg Pyrene 0,39 – 1,5 mg/kg BaP 0,34 mg/kg Chrysene 3,7 mg/kg Benzo[a]anthracene 0,45 mg/kg	3/40	Danish Consumer Council, 2013
Phosphorus-based flame retardants	Textile (cover)	TCEP 173 mg/kg TCPP 5.6 – 19,000 mg/kg TDCP 20 – 148,000 mg/kg Triphenylphosphate 8.3 – 250 mg/kg	1/40 14/40 6/40 6/40	Danish Consumer Council, 2013
	Textile (pads)	TCEP 255 mg/kg TCPP 5.7 – 12,000 mg/kg TDCP 26 – 56,900 mg/kg Triphenylphosphat 5.1 - 750 mg/kg	1/40 11/40 6/40 3/40	Danish Consumer Council, 2013
Phenols	Textile (cover)	Phenol 27 – 255 mg/kg Bisphenol A < LoD	6/40	Danish Consumer Council, 2013
	Textile (pads)	Phenol 23 – 460 mg/kg Nonylphenol 160 mg/kg	1/40 1/40	Danish Consumer Council, 2013

2.3.3 Previous studies of chemical substances in other textile products for children

Baby slings

The Danish Consumers' Council published in early 2014 a study on baby carriers, in which 13 products were analysed for a variety of substances. In the analysis programme the following substances were included: PAHs, phthalates, phosphorus-based flame retardants, formaldehyde and nonylphenol (Danish Consumer Council, 2014a). In contrast to other studies, the various components of the products (belts, plastic parts, textiles and possible fill materials) were mixed to produce composite samples. Excluded from this approach were the analyses for formaldehyde and nonylphenol, which were only applied to the textile parts. Only phosphorus-based flame retardants and nonylphenol ethoxylates were found to a significant degree in the baby slings as can be seen from Table 2-3.

In a previous consumer product project on baby products (Tønning et al., 2008) the textile parts of two baby slings were analysed. The following substances (-groups) were included in the specific

analysis program: azo dyes, chlorinated benzenes and toluene, chlorinated phenols, phthalates, formaldehyde, bromine, chlorine, tin, antimony, organic tin compounds and selected phosphorus-based flame retardants. Not all substances were analysed in all products or in all parts of the individual products. For example the baby slings were not analysed for phosphorus-based flame retardants. In the baby slings, chlorine, tin and phthalates were detected in all samples tested, as shown in Table 2-3. The occurrence of tin could, however, not be related to the presence of selected organic tin compounds.

TABLE 2-3
OVERVIEW OF SUBSTANCES FOUND IN PREVIOUS STUDIES OF BABY SLINGS.

Substance or substance group	Material	Detected substances, concentration range, comments (if any)	No. detect./ No. of samples	Source
PAH	Composite	Phenanthrene 0.36 mg/kg No ther PAH's were found	1/13	Danish Consumer Council, 2014a
Phosphorus-based flame retardants	Composite	TCEP 18 mg/kg TCPP 14 – 5,500 mg/kg TDCP 4,400 mg/kg	1/13 3/13 1/13	Danish Consumer Council, 2014a
Nonylphenol-ethoxylates	Textile	> 300 mg/kg	1/13	Danish Consumer Council, 2014a
Chlorine	Fill and foam	49 – 110 mg/kg	2/2	Tønning al., 2008
Tin	Fill and foam	381 – 468 mg/kg	2/2	Tønning al., 2008
Phthalates	Plastic parts	DEP 60-350 mg/kg DIBP 25 – 760 mg/kg	1/1	Tønning al., 2008

Prams

In another study by the Danish Consumer Council the presence of chemicals in 7 prams was investigated (results available for 6 products, Danish Consumer Council, 2014b). Composite samples consisting of parts from the liner/lining of, apron and hood were analysed for phthalates and phosphorus-based flame retardants. Samples from the apron alone was additionally analysed for polyfluorinated alkyl compounds (PFAS). The phthalate DEHP was found in a single pram at a very high concentration but apart from that only phosphorus-based flame retardants occurred in measurable concentrations (Table 2-4).

The aforementioned consumer product project on baby products (Tønning et al., 2008) also included analyses of upholstery, foam and plastic parts from two pram aprons. Tin was found in both foam and fabric, but the presence of tin could not be related to the presence of selected organic tin compounds. The prams also contained bromine in relatively high concentrations in the textile (2 out of 4 samples), which could indicate the presence of brominated flame retardants. Some samples also contained phthalates, phosphorus and polyfluorinated compound 6:2 FTOH, however only in very low concentrations.

The study of pram aprons included a number of volatile organic compounds, which were analysed by a semi-quantitative screening. Some substances were found in relatively low concentrations but could not be detected in the majority of samples. The results from the screening are not presented here.

TABLE 2-4
OVERVIEW OF SUBSTANCES FOUND IN PREVIOUS SURVEYS OF PRAMS

Substance or substance group	Material	Concentration range, comments (if any)	No. detect./ No. of samples	Source
Bromine	Textile	1220 – 1320 mg/kg	2/4	Tønning al., 2008
	Foam	< LoD	0/4	Tønning al., 2008
Chlorine	Textile	513 -1.600 mg/kg	2/2	Tønning al., 2008
	Foam	22 – 106 mg/kg	3/3	Tønning al., 2008
Fosfor	Textile	64 mg/kg	1/2	Tønning et al., 2008
	Foam	< LoD	0/4	Tønning et al., 2008
Tin	Textile	41 mg/kg	1/2	Tønning et al., 2008
	Foam	258 – 658 mg/kg	3/4	Tønning et al., 2008
Phthalates	Textile	DEHP 40 mg/kg	1/4	Tønning et al., 2008
	Composite	DEHP 74.000 mg/kg	1/6	Danish Consumer Council, 2014b
	Hood	DEHP 211,000 mg/kg The analysis was repeated on the hood due to the high conc. found in the composite sample	1/6	Danish Consumer Council, 2014b
Phosphorus-based flame retardants	Textile	TCEP < LoD Tributyl phosphate 2 mg/kg Triphenyl phosphate 0.4 mg/kg	1/3	Tønning et al., 2008
	Foam	TCEP < LoD Triphenyl phosphate 5 mg/kg	1/4	Tønning et al., 2008

Substance or substance group	Material	Concentration range, comments (if any)	No. detect./ No. of samples	Source
	Composite	TCEP 320 mg/kg TCPP 6.9 – 23 mg/kg TDCP 3300 – 44 mg/kg Triphenyl phosphate 5.1 – 30 mg/kg	1/6 4/6 2/6 3/6	Danish Consumer Council, 2014b
Polyfluorinated alkyl substances (PFAS)	Textile*	6:2 FTOH 6 mg/kg	1/1	Tønning et al., 2008
	Textile	PFOA 0.023 – 0.026 mg/kg	2/6	Danish Consumer Council, 2014b

* From the screening analysis (Tønning et al., 2008), not the specific analysis.

Nursing cushions

In the consumer product project on baby products by Tønning et al. (2008) also two nursing cushions were analysed. In one of them, high concentrations of phthalates (144,000 to 220,000 mg/kg) were detected. Tin was found in both cushions but could not be related to the presence of selected organic tin compounds.

Baby mattresses

The same project on baby products (Tønning et al., 2008) also included chemical analyses of two baby mattresses, which were analysed for a few substances (formaldehyde, bromine, phosphorus, chlorine, tin, antimony, and selected organic tin and phosphorus compounds). Only tin and chlorine was detected in foam samples from both mattresses, but the content of tin could not be related to the presence of selected organic tin compounds.

2.4 Ecolabel and criteria

There are a number of eco-labels that have established requirements to the content of certain chemical substances in textiles. The requirements are briefly reviewed below as they can give an indication of the problematic substances that may occur in textiles, which are not eco-labeled.

Oeko-Tex

The concept of the Oeko-Tex ® Standard 100 is to achieve uniform standards for the use of chemicals in textile production and to set up environmental criteria for potentially hazardous substances in textiles.

The Oeko-Tex tests and criteria are divided into different classes of products depending on the intensity of skin contact:

- Product Class I: Textiles and toys for babies and small children up to 3 years of age, e.g. underwear, rompers, bedding, soft toys etc.
- Product Class II: Textiles with a large part of their surface in direct contact with the skin, such as underwear and linen.

- Product Class III: Textiles with no or only a small part of their surface in direct contact with the skin, e.g. jackets.

- Product Class IV: Home textiles such as table cloths, curtains and carpets.

In many cases the limit values for products in Product Class 1 are lower than in the other product classes, which is because the products in this class are intended for children under 3 years of age. Table 2-5 shows the substances that are banned or restricted in relation Oeko-Tex 100 standard for Product Class 1.

TABLE 2-5
LIST OF SUBSTANCES WITH OEKO-TEX CRITERIA

Substance or substance group	Examples	Product Class I criteria (mg/kg)[1]
Formaldehyde	-	<LoD
Extractable metals	Sb (Antimony)	30.0
	As (Arsenic)	0.2
	Pb (Lead)	0.2
	Cd (Cadmium)	0.1
	Cr (Chromium) / Cr(VI)	1.0 / <LoD
	Co (Cobalt)	1.0
	Cu (Copper)	25.0
	Ni (Nickel)	1.0
	Hg (Mercury)	0.02
Dissolved heavy metals	Pb (Lead)	90.0
	Cd (Cadmium)	50.0
Pesticides	Sum (up to 60 pesticides)[2]	0.5
Chlorophenols	Pentachlorophenol (PCP)	0.05
	Tetrachlorophenols (TeCP), Sum	0.05
	Trichlorophenols (TrCP), Sum	0.2
Phthalates	DINP, DNOP, DEHP, DIDP, BBP, DBP, DIBP, DIHP, DHNUP, DHP, DMEP, DPP, Sum	0.1 w-%
Organic tin compounds [mg/kg]	TBT	0.5

Substance or substance group	Examples	Product Class I criteria (mg/kg)[1]
	TPhT	0.5
	DBT	1,0
	DOT	1,0
Other chemical residues	OPP (o-Phenylphenol)	50
	Aryl amines [2]	No limit value
	SCCP [w-%]	0.1 w-%
	TCEP [w-%]	0.1 w-%
	DMFu	0.1
Dyes	Cleavable aryl amines [2]	Not used
	Carcinogens [2]	Not used
	Allergens [2]	Not used
	Others [2]	Not used
Chlorobenzenes and Toluenes	Sum	1.0
Polycyclic aromatic hydrocarbons	Benzo[a]pyrene	0.5
	Benzo[e]pyrene	0.5
	Benzo[a]anthracene	0.5
	Chrysene	0.5
	Benzo[b]fluoranthene	0.5
	Benzo[j]fluoranthene	0.5
	Benzo[k]fluoranthene	0.5
	Dibenzo[a,h]anthracene	0.5
	Sum PAH [2]	5.0
Biologically active products	-	None
Flame retardants	General	None
	PBB, TRIS, TEPA, pentaBDE, octaBDE, DecaBDE, HBCDD , SCCP, TCEP [2]	Not used

Substance or substance group	Examples	Product Class I criteria (mg/kg)[1]
Solvents	NMP [3]	0.1
	DMAc	0.1
	DMF	0.1
Detergents, moisturizers and residues hereof	OP, NP, Sum	10.0
	OP, NP, OP(EO)1-20, NP(EO)1-20 Sum	250.0
Polyfluorinated substances	PFOS	1.0 µg/m²
	PFOA	0.05
	PFUdA	0.05
	PFDoA	0.05
	PFTrDA	0.05
	PFTeDA	0.05
Emissions of volatile substances	Formaldehyde	0.1 mg/m³
	Toluene	0.1 mg/m³
	Styrene	0.005 mg/m³
	Vinyl cyclohexene	0.002 mg/m³
	4-Phenylcyclohexene	0.03 mg/m³
	Butadiene	0.002 mg/m³
	Vinyl chloride	0.002 mg/m³
	Aromatic hydrocarbons	0.3 mg/m³
	Volatile organic substances	0.5 mg/m³

1 In some cases other concentration units are used.
2 The full list of substances is available at https://www.oeko-tex.com/en/manufacturers/test_criteria/limit_values/limit_values.html.
3 With the exception of spun dyed fibres used for PPE (polyphenyl ethers): 3,0%

The EU Flower and the Swan

An updated criteria document establishing the ecological criteria for the award of the EU Ecolabel to textile products was published in July 2014 (European Commission, 2014). The Criteria Document sets limit values for a wide range of chemicals, divided into categories according to the production stages of the supply chain for textile products.

The criteria for the EU Flower are largely the same as the Oeko-Tex criteria. E.g. the threshold values for heavy metals and phosphorus-based flame retardants are the same. A detailed list of the restrictions on chemicals can be found in Appendix 1 of the criteria document (European Commission, 2014).

The Nordic Ecolabel (the Swan) has also developed a criteria document for eco-labeling of textiles, skin and leather (Nordic Ecolabelling, 2013). The Swan generally follows the EU Flower criteria but it should be noted that the Nordic criteria have not yet been updated.

2.5 Mapping of waste streams

No information on the specific product groups in relation to waste disposal and recycling etc. has been identified. Thus, there is no identified data on volumes of the various product types in the waste streams.

As for car safety seats, it is known that some reception stations/recycling centres prescribe delivery of car safety seats in the fraction "hard plastic", presumably for reuse/recycling of this part of the seat. The other components of car safety seats, mainly the textile and foam parts, are assumed just to be dropped off in the "small combustibles" fraction and thus go to waste incineration and subsequent end disposal (including use of slag for different (construction/fill) purposes).

Mattresses (other than spring mattresses, which are not relevant in this context) are generally considered to be "small combustibles" and should thus also prevailingly be disposed of by incineration. There were no specific regulations for baby slings, however these are also likely to be part of the faction "small combustibles" just like the textile-based parts of the other textile product types in the survey.

Metal frames of prams, strollers and weekend beds etc. are disposed of as "metal", but this is not a relevant waste fraction in relation to this project.

3. Preliminary hazard and exposure assessment

A premilinary hazard screening was carried out with emphasis on the health hazard aspects related to the substances/substance groups that, according to the studies identified in the literature- and questionnaire based survey, previously have been found in safety car safety seats and other textile products for children. The purpose of this screening was primarily to identify the substances that from a purely hazard point of view (based primarily on the substances' classification) would be most relevant to include in the chemical analysis programme making up the next phase of the project. As the survey included a significant number of product types, the screening hazard assessment was supplemented by an initial exposure assessment to be able to set priorities and focus the analysis phase as deemed necessary in light of the limitations in the overall framework of the project.

The initial assessments have provided the basis for the more detailed descriptions and assessments in phase 3 of the project i.e. the actual human health and environmental assessment based on the quantitative results obtained in phase 2 (chemical analysis phase). To avoid unnecessary repetition, the majority of the descriptions and –assessments made in the screening have been moved and are elaborated further in Chapter 6 (health assessment) and Chapter 7 (environmental assessment), respectively. Please see these two chapters for details.

The initial review of the health and environmental classifications for a number of substances or substance groups identified in the survey, which may occur in textiles for children (but not necessarily in the specific products purchased) can be found in Annex 3.

3.1 Preliminary health hazard screening

3.1.1 Health effects

The substances/groups of substances that on basis of the performed survey were included in the preliminary hazard assessment are the following:

- Chlorophenols and alkylphenols (and their ethoxylates)
- Organic tin compounds
- Dimethylfumarate (DMFu)
- Formaldehyde
- Triclosan
- Silver and silver compounds
- Brominated flame retardants
- Phosphorus-based flame retardants
- UV absorbers and stabilizers.
- Phthalates
- Azo dyes
- N-methyl-2-pyrrolidone (NMP)
- N, N-dimethylacetamide (DMAc)
- N, N-dimethylformamide (DMF)
- Fluoroalkylated substances (PFAS)
- Heavy metals
- Polycyclic aromatic hydrocarbons (PAH)

Below is a brief description of the health properties of the above, potentially occurring substances, primarily from their classifications, but also a few other data sources (see Annex 3):

Some of the **chlorinated phenols** are suspected of being carcinogenic, while nearly all of them are known irritatants when in contact with skin. 2,4-dichlorophenol is on the EU list of substances suspected of being endocrine disrupters (Cat. 2).

Alkylphenol ethoxylates are degraded to **alkylphenols** among which nonylphenol is the best studied. Nonylphenol may impair fertility and the unborn child during pregnancy. Furthermore, the substance is suspected of causing allergy and is considered to be an endocrine disruptor. Five alkylphenols are on the EU list of suspected endocrine disruptors. Of these, nonylphenol and 4-tert-octylphenol are classified in Cat. 1 while 4-tert-butylphenol is classified in Cat. 2.

For the group of **tributyltin compounds (TBT)** and for **triphenyltin hydroxide** a harmonised classification has been adopted, while for other substances from this substance group no such classification exist. TBT can cause moderate to severe skin and eye irritation, and there are indications of irritation of the respiratory tract after inhalation. The biggest concern with respect to organotin compounds is however the environmental effects, since some substances from the group have been shown to be endocrine disrupting in the environment and affect the immune system in the long term.

Dimethyl fumarate (DMFu) has no harmonized classification. Harmful when in contact with skin, skin irritant, may cause allergic skin reaction, and eye irritant are the most frequent effects mentioned in the self-classifications of the substance. In the EU thousands of cases of allergy to DMFu have been reported, and the substance is therefore now regulated under REACH and is not permitted to occur in articles in concentrations higher than 0.1 mg/kg.

Formaldehyde can cause cancer in humans. Furthermore, the substance is classified as toxic by ingestion, inhalation or skin contact and can cause allergic skin reaction and irritate the skin and eyes.

Triclosan is suspected of being an endocrine disruptor and, in addition, suspected to increase the risk of developing allergies in children to other substances because of triclosan's effect on bacteria and thereby the immune system (forbrugerkemi.dk). The substance has recently been banned as a biocide in textiles and is also regulated in cosmetic products.

Silver or silver compounds can, like triclosan, be added to textiles as an antibacterial agent. Nano-sized silver has been found in clothes, especially sportswear, where its function is to prevent bad odours. The health effects of nano-silver are not well documented, while the high toxicity in the aquatic environment is assessed primarily to be due to dissolved silver (silver ions).

Some of the **brominated flame retardants** are suspected of being harmful to fetuses, to induce cancer, disrupt the hormone balance and reduce fertility. The group of polybrominated biphenyls and four of the brominated diphenyl ethers are on the EU list of endocrine disrupting substances (Cat. 1 and 2, respectively).

The most common **phosphorus-based flame retardants** in textile products are TCPP, TDCP and TCEP. The substances are used only in the foam and fill material, not in the fabric itself. Two of the substances are classified as carcinogenic (TDCP and TCEP), while TCEP is also classified as toxic to reproduction.

There are three main groups of **UV protective substances** in textiles: Benzophenones, triazoles and triazines. Some benzophenones are suspected of being carcinogenic, endocrine disrupting

and/or harmful to the unborn child, while others are not considered to be problematic to the same degree. None of the identified substances have a harmonized classification.

The **phthalates** include several substanceso of which six (DEHP, DBP, BBP, DINP, DIDP, DNOP) are regulated under REACH. Several of the phthalates affect fertility and/or are harmful to the unborn child. Additionally, many are suspected of being endocrine disruptors, while some phthalates are considered to be largely unproblematic.

Azo dyes may give rise to the formation of a series of aromatic amines in textiles such as biphenyl-4-amine, or benzidine. Many of the aromatic amines can cause cancer and a number of the substances are classified as skin allergens or toxic to reproduction.

The health effects of **N-methyl-2-pyrrolidone (NMP)** include irritation of the mucous membranes of the eyes and respiratory tract in humans, drowsiness and irregular breathing, and effects on fetus development. Additionally, NMP penetrates easily through the skin and may thus increase skin penetration of other substances.

N, N-**Dimethyl acetamide** is classified as toxic to reproduction (may harm the unborn child) and as hazardous by inhalation and skin contact. The chronic effects include possible "chronic liver and kidney damage." The substance may produce systemic injuries when inhaled or absorbed through skin over an extended period.

Dimethyl formamide is classified as hazardous by skin contact and inhalation, as well as eye irritating and toxic to reproduction (may harm the unborn child). Although animal studies failed to demonstrate that the substance is mutagenic or carcinogenic, several tests of persons who have been exposed to dimethyl formamide indicate that the substance may contribute to the development of testicular cancer.

Polyfluorinated alkyl substnaces, PFAS, can be divided into a large number of sub-groups in which the substances' health properties seem to be more closely linked to the length of the perfluoroalkyl (C_nF_{2n+1} or $F(CF_2)_n$) than to the functional group of the molecule. Substances with a perfluoroalkyl chain of 6-8 carbon atoms appear to be the most harmful. Only the C_8 compounds PFOS and its derivatives have a harmonized classification under CLP. According to the classification the substances are carcinogenic as well as toxic to reproduction.

Among the **heavy metals,** which occur mainly in the textile part, either due to their use for dyeing or printing, or simply as an impurity, are chromium, nickel, copper and cobalt.

Chromium (VI) compounds are highly toxic and can cause allergy by skin contact. Following long-term exposure to chromium (VI) various forms of gastrointestinal discomfort and increased incidence of lung cancer have been observed.

Nickel can cause skin allergy and sensitization to nickel can lead to contact dermatitis. In addition, exposure via inhalation in the work environment has led to increased risk of lung cancer.

Long-term oral exposure to copper can lead to liver damage. Copper and copper salts can produce allergic reactions by skin contact in sensitive individuals.

Cobalt is sensitizing and has the classification "may cause an allergic skin reaction" and "may cause allergy or asthmatic symptoms or breathing difficulties if inhaled."

PAH (polycyclic aromatic hydrocarbons) is a group of substances comprising more than 100 individual substances, which are composed of two or more fused benzene rings. Benzo[a]pyrene

(BaP) is often used as an indicator of the occurrence and health effects of PAHs and is also the most studied substance from the group. BaP and certain other PAHs have been shown to be toxic by inhalation, ingestion, or skin absorption. Some are carcinogenic, mutagenic and toxic to reproduction.

3.1.2 Health exposure assessment

Exposure to chemicals in children's articles

The project focuses on product types with textile parts specially developed for (small) children that the child will lie or sit in and thereby give rise to significant skin contact or that children can be expected to lick/suck on or put in the mouth. Clothes and toys are not inclucluded in this survey.

Children's possible exposure via the different product types have been evaluated qualitatively by the project team by considering the different routes of exposure (dermal, oral and inhalation exposure), the length of the use period and the distribution of the different product types in Denmark. The exposure scenarios are summarized in Table 3-1.

It can be seen from the table that car safety seats generally are considered to have a high exposure score, owing both to a long period of use, the frequent use, possibility of relatively high skin contact and oral exposure and the ubiquity of such seats among Danish families. Baby mattresses (as a separate product or as a component part of carrycots, pushchairs, weekend beds etc.) were also assessed to result in high exposure.

TABLE 3-1
OVERALL INITIAL EXPOSURE ASSESSMENT OF TEXTILE PRODUCTS FOR CHILDREN.

Product	Exposure pathway	Typical age group and period of use	Typical duration of exposure	Distribution in the population	Overall exposure assessment
Car safety seats (incl. booster seats)	Both dermal, oral and inhalation. Dermal exposure will occur especially in the summer when kids are sitting in the car seat in short-sleeved clothes/short pants and also sweats. Oral exposure will occur to a lesser extent with certain parts of the seat, for example belts and buckles or the side of the headrest. Inhalation exposure will especially occur in the first period of the useful life and in the summer where high temperatures cause greater evaporation of possible volatile substances. Car safety seats are furthermore used inside a car where the air exchange typically is limited.	0 – up to 12 years of age, thus used for almost the entire childhood.	Daily / several times a week with a useful life of 0.5 - 1 hours/event.	Very common	High
Baby mattresses	Found in beds, carrycots and prams. Both dermal, oral and inhalation. There will be limited skin contact as beddings or similar is typically used in the pram and kids will typically also be wearing clothes. Dermal exposure will therefore primarily be the hands and feet. Oral exposure can occur, especially from the textile cover of the mattress, but not from the foam part. Inhalation exposure will occur especially in the first period of their useful life. Bed mattresses are used indoors, where there is generally poor air exchange, while the carrycot and lift mattresses are used both indoors and outdoors.	Pram/carrycot mattresses: 0 - 2 years, daily Bed matresses: from 0 years, daily	Pram/carrycot mattresses: 3 hours/event Bed matressess: 12 hours/daily	Very common	High
Baby sling	Both dermal, oral and inhalation. Dermal exposure will occur especially in the summer when kids are wearing short-sleeved clothes/shorts and also sweats.	0-1 year, daily – several times per week	1 hour/event	Common	Medium

Product	Exposure pathway	Typical age group and period of use	Typical duration of exposure	Distribution in the population	Overall exposure assessment
	Oral exposure will occur to a lesser extent with certain parts of the seat, for example belts and buckles or the side of the headrest. Inhalation exposure will especially occur in the first period of the useful life.				
Cradle seat	Both dermal, oral and inhalation. Dermal exposure will occur especially in summer when the kids are sitting in the cradle seat in short-sleeved clothes/short pants and also sweats. Oral exposure will occur to a lesser extent with certain parts of the seat, for example belts and buckles or the side of the headrest. Inhalation exposure will especially occur in the first period of the useful life.	Babies of less than 6 months for approx. 3 months	1 – 2 times daily, about 15 min/event	Very common	Medium
Prams	Both dermal, oral and inhalation. There will be limited skin contact as beddings or similar is typically used in the pram and kids will typically also be wearing clothes. Dermal exposure will therefore primarily be the hands and feet expsosed to the sides of the pram. Oral exposure can occur, especially from the textile cover of the mattress, but not from the foam part. Inhalation exposure will especially occur in the first period of the useful life and in the summer where high temperatures cause greater evaporation of possible volatile substances. Prams are however typically used outside where the air exchange is good.	0 - 2 years, daily	3 hours/event	Very common	Medium
Strollers	Both dermal, oral and inhalation. Dermal exposure will occur especially in summer when the kids are	0.5 - 3 years, daily	3 hours/event	Very common	Medium

Product	Exposure pathway	Typical age group and period of use	Typical duration of exposure	Distribution in the population	Overall exposure assessment
	sitting in the stroller in short-sleeved clothes/short pants and also sweats. Oral exposure will occur to a lesser extent with certain parts of the seat, for example belts and buckles or the side of the headrest. Inhalation exposure will especially occur in the first period of the useful life and in the summer where high temperatures cause greater evaporation of possible volatile substances. Strollers are however typically used outside where the air exchange is good.				
Bunting bags	Both dermal, oral and inhalation. Dermal exposure will be limited as the children typically will be wearing long-sleeved shirts and pants in those seasons where the bunting bags are used the most. Children will primarily touch the bunting bag with their hands/arms, but will otherwise be dressed. Loose parts such as straps and the sides of the head piece can be placed in the mouth and may result in an oral exposure. Inhalation exposure will especially occur in the first period of the useful life, but will be limited as the product is typically used outdoors in the colder seasons.	Up to 2 years of age, approx. half of the year	Daily/several times per week, about 2 hours/event on the average	Very common or common	Medium / low
Travel and weekend beds	Both dermal, oral and inhalation. There will be limited skin contact as bed linen and night clothes are typically used. Dermal exposure will therefore primarily be the hands and feet expsosed to the sides of the pram. Oral exposure will occur to a lesser extent with certain parts of the bed, for example the sides. Inhalation exposure may occur especially in the first part of the period of	2 years, approx. every 2nd week	10 hours/event	Very common	Low

Product	Exposure pathway	Typical age group and period of use	Typical duration of exposure	Distribution in the population	Overall exposure assessment
	use				
Baby joggers	Similar to the pathways of the stroller	0.5 - 3 years, several times per week	1 hour/event	Less common	Low
Carriers	Both dermal, oral and inhalation. Dermal exposure will occur especially in the summer when the kids are wearing short-sleeved clothes/shorts and are also sweating. Oral exposure will occur to a lesser extent with certain parts of the carrier, for example belts and buckles or the side of the headrest. Inhalation exposure will especially occur in the first period of the useful life. Carriers are primarily used outdoor.	From 1 - 2 years, approx. every 2nd week	1 hour/event	Common	Low

Selection of product groups for further investigation (chemical analysis)
Based on the initial exposure assessment, car safety seats, baby slings, prams/strollers/carrycots and cradle seats appear to be the product types that overall give rise to the largest exposures. Prams, strollers and carrycots, however mainly because of the baby mattresses being part of the products. The Environmental Protection Agency has presently a special focus on phosphorus-based (chlorinated) flame retardants, which leads to focusing also on products with foam materials, where these substances are considered likely to occur.

Moreover, in consultation with the Danish EPA it was decided to limit the number of product types to be included in the specific studies (chemical analysis), to three in order to be able to obtain a satisfactory coverage of the individual product types within the project's economic framework. Due to these considerations in combination with previous findings of chemical substances in products as well as a desire to focus particularly on products for babies/infants, it was decided that the analysis and test programme should include the following product types:

- Car safety seats
- Baby slings
- Baby mattresses (incl. mattresses in prams, baby lifts, etc.)

The calculation of the exposure, which children may be exposed to, is made on the basis of realistic worst-case scenarios to illustrate the potential dermal, oral and inhalatory exposure of children primarily aged 0-3 years. The exposure scenarios follow the REACH guidance, "Guidance on Information Requirements and Chemical Safety Assessment. Chapter R.15 - Consumer exposure estimation", Version 2.1 from April 2012 (ECHA, 2012b).

The concrete method for calculation and assessment of oral, dermal and inhalatory exposure of children to chemicals in the mentioned products is described in detail in Chapter 6.

3.2 Initial environmental hazard screening

An environmental hazard screening has been performed for the same substances/groups of substances that have been identified for the health screening in section 3.1. The environmental screening is also based mainly on the the official CLP-classification of the substances.

3.2.1 Environmental Effects

Table 3-2 below gives an overview of the substances/groups of substances listed under the health screening (and discussed in detail in Annex 3), which also have a harmonized classification that includes environmental characteristics.

It appears from the table that a significant number of substances are classified for chronic toxicity to aquatic organisms, which is considered to be the appropriate ecotoxicity classification to focus on since, in the current context, it seems unlikely that exposure should occur at levels where acute effects are relevant to consider. Many of the substances are classified as Aquatic Chronic 1, which implies that the chronic No-Observed-Effect Concentration (NOEC) in fish, crustaceans and/or algae is ≤ 0.1 mg/L.

TABLE 3-2
HARMONISED ENVIRONMENTAL CLASSIFICATION OF SUBSTANCES (CLP REGULATION 1272/2008).

Index No.	Substance	CAS No.	Environmental Classification	
			Hazard category	Hazard statement codes
604-002-00-8	Pentachlorophenol	87-86-5	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
604-013-00-8	2,3,4,6-tetrachlorophenol	58-90-2	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
604-018-00-5	2,4,6-trichlorophenol	88-06-2	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
604-020-00-6	2-Phenylphenol	90-43-7	Aquatic Acute 1	H400
-	Tributyltin compounds	-	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
050-004-00-1	Triphenyltin hydroxide	76-87-9	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
604-070-00-9	Triclosan	3380-34-5	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
047-001-00-2	Silver nitrate	7761-88-8	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
015-102-00-0	Tris(2-chloroethyl)-phosphate (TCEP)	115-96-8	Aquatic Chronic 2	H411
015-188-00-X	(1-methylethylidene)di-4,1-phenylenetetraphenyl diphosphate	5945-33-5	Aquatic Chronic 4	H413
607-318-00-4	Dibutylphthalate (DBP)	84-74-2	Aquatic Acute 1	H400
612-042-00-2	Benzidine	92-87-5	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
612-008-00-7	Aniline	62-53-3	Aquatic Acute 1	H400
601-053-00-8	Nonylphenol	25154-52-3	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
607-624-00-8	Perfluorooctan sulfonic acid (PFOS); and its potassium-, diethanol-amine-, ammonium- and lithium salts	1763-23-1 2795-39-3 70225-14-8 29081-56-9 29457-72-5	Aquatic Chronic 2	H411
024-017-00-8	Chromium (VI) compounds	-	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
028-002-01-4	Nickel (powder)	7440-02-0	Aquatic Chronic 3	H412
601-032-00-3	Benzo[a]pyrene	50-32-8	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
601-049-00-6	Benzo[e]pyrene	192-97-2	Aquatic Acute 1 Aquatic Chronic 1	H400 H410

Index No.	Substance	CAS No.	Environmental Classification	
			Hazard category	Hazard statement codes
601-033-00-9	Benz[a]anthracene	56-55-3	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
601-048-00-0	Chrysene	218-01-9	Aquatic Acute 1 Aquatic Chronic 1	H400 H410
601-034-00-4	Benz[e]acephenan-thrylene	205-99-2	Aquatic Acute 1 Aquatic Chronic 1	H400 H410

The table includes only those substances for which there is a harmonized classification. It is considered likely that an additional number of substances would be classified as chronically toxic in the aquatic environment, if a classification had been available.

3.2.2 Environmental exposure

The primary way in which a substance in one of the textile products in this project could be released to the aquatic environment is by discharge to the sewage system following washing of the product. Many of the mentioned substances will mainly end up in the sludge phase at the sewage treatment plants but some of the more water-soluble substances will probably remain in the water phase and finally enter a surface water body with the treated effluent. This exposure pathway to the water environment, and to the environment as such, is possibly the most important, even though the textile products in this project undoubtedly are washed significantly less frequent than clothing.

As regards the release of the chemical substances to air it will typically be very slow and be mediated by migration to and evaporation from the textile surface. For substances with very low vapor pressure the release will be minimal.

Environmental exposure in the waste phase of the relevant products is assessed to be low as the textile part of the products are expected to be disposed of ultimately in a waste incineration plant where an efficient high temperature combustion in combination with flue gas cleaning will ensure that only negligible amounts are emitted to the atmosphere. It cannot be ruled out that very low amounts could occur in the slag or in residuals from the flue gas cleaning.

The exposure of the aquatic environment via sewage

It is proposed to calculate the environmental exposure resulting from the release of substances into urban wastewater from the washing of the textile products as follows:

By textile washing among consumers the spent washwater will predominantly be relased to the public sewage system, through which it is transported to a sewage treatment plant, in which partly a transformation and partly a distribution of the substance between the water phase and the solid phase (sewage sludge) will take place. The treated effluent is discharged to a receiving surface water body, typically a river or the sea near the coast, while the sludge is either incinerated, converted into other products or applied to soil (mostly farmland).

The daily release of a chemical substance from a standard household/family to the sewage system can be calculated by the following formula:

Daily discharge of Substance-X from textile washing per household = Number of machine wash/day * Amount (w) of textile/wash * Proportion (%) of textile containing Substance-X * Proportion (%) of Substance-X in the textile * Proportion (%) of Substance-X released/wash.

Exposure of the soil environment via sewage

As a realistic worst-case exposure of the soil by application of sewage sludge it is assumed that the entire amount of substance-X from the washing of textiles ending up in a sewage treatment plant will be distributed to the sludge phase, after which the produced sludge is applied to farmland in the maximum allowable amount. In need of a more refined assessment, estimates of degradation during the treatment process and a more realistic distribution between sludge and water phase will be applied.

Exposure via the air

Emissions to the air are assessed in the health part of the project and the estimates from that assessment, if deemed relevant, will be used as worst case for environmental loads via air.

4. Selection of products and substances for analysis

4.1 Products and product parts

In consultation with the EPA, chemical analyses were to be performed only on three selected product groups to ensure a sufficient coverage for a given product type within the project's economic framework. The criteria for selection/prioritization were given partly by the initial exposure assessment for the identified product types, partly from the expected presence of substances in specific products or product parts. Finally, the focus has particularly been on products intended for babies/infants as these groups are considered the most sensitive to the effects of chemical substances.

In light of the considerations in the previous chapter, the following product groups were selected for procurement of products for subsequent chemical analysis:

- Car safety seats
- Baby slings
- Baby mattresses (incl. mattresses for carrycots and prams).

With regard to **Car safety seats**, 10 products in the price range from about 600 to about 1500 kr. each were purchased in both physical stores and Internet stores. Preferably, brands and models were selected that have not been analysed before and brands in the low end of the price scale as these are usually produced outside the EU where less control of the use of chemicals in such products can be expected. In addition, the focus was on car safety seats intended for the youngest age group, i.e. 0-13 kg. An overview of the purchased car safety seats is given below in Table 4-1.

TABLE 4-1
OVERVIEW OF PURCHASED CAR SAFETY SEATS.

Product no.	Size	Origin	Place of purchase (type)
A1	0 - 13 kg	China	Specialty store for car accessories
A2	9 - 36 kg	China	Specialty store for car accessories
A3	9 - 36 kg	Italy	Specialty store for car accessories
A4	0 - 13 kg	France	Supermarket
A5	0 - 18 kg	France	Supermarket
A6	0 - 4 years	China	Specialty store for car accessories
A7	0 – 13 kg	Probably China	Specialty store for baby/infant articles
A8	0 - 13 kg	Probably Asia	Specialty store for baby/infant articles
A29	0 - 13 kg	No information	Internetshop (baby/infant articles)
A30	0 - 13 kg	Probably Asia	Internetshop (baby/infant articles)

Baby slings (10 items) were purchased partly in physical stores and partly via Danish websites, which have a greater variety of brands (Table 4-2). Particularly, brands and models were purchased that were not analysed in previous studies and/or models where the babies can sit in different positions. The latter type is particularly interesting because the largest oral exposure is expected when the baby sits on the wearer's stomach, and hence can suck on the edge of the carrier belt, or sits on the wearer's back with the possibility of oral contact with the shoulder straps. The price of the baby slings were in the range from about 300 to about DKK 1,300.

TABLE 4-2
OVERVIEW OF PURCHASED BABY SLINGS

Product no.	Size	Origin	Place of purchase (type)
B9	0 - 3 år	China	Specialty store for baby/infant articles
B10	3 – 24 months	Latvia	Specialty store for baby/infant articles
B11	3,5 -15 kg	Romania	Internetshop (baby/infant articles)
B12	3,5 - 6 kg	China	Internetshop (baby/infant articles)
B13	4 – 48 months	India	Internetshop (baby/infant articles)
B14	3.5 – 9 kg	No information	Internetshop (baby/infant articles)
B15	3,5-15 kg	Probably China	Internetshop (baby/infant articles)
B16	3,5 – 18 kg	No information	Internetshop (baby/infant articles)
B17	6 months – 12 kg	Probably Asia	Internetshop (baby/infant articles)
B18	3,6 - 18,2 kg	China	Internetshop (baby/infant articles)

The final product group was **baby mattresses**, including both separate mattresses intended for carrycots/prams, and mattresses already being part of such products (Table 4-3). The 10 products purchased lie in the price range from about 80 to about 80 DKK 1,300. and they represent a wide range of the baby mattresses available on the Danish market. Most brands offer mattresses in different sizes, so that there are models suitable for carrycots, prams and baby beds, respectively. The materials appear to be identical in the different size groups. Although linen is typically used, which reduces the dermal exposure, exposure by inhalation could still be relevant due to the total time the babies lie on mattresses (in either carrycot, pram or bed).

TABLE 4-3
OVERVIEW OF PURCHASED MATERESSES AND CACRYCOTS.

Product no.	Product type	Origin	Place of purchase (type)
M19	Carrycot mattress	Netherlands	Specialty store for baby/infant articles
M20	Carrycot mattress	Poland	Specialty store for baby/infant articles
M21	Carrycot	Sweden/Poland	Specialty store for baby/infant articles
M22	Carrycot	Poland	Specialty store for baby/infant articles
M23	Soft carrycot	China	Specialty store for baby/infant articles
M24	Carrycot	No information	Specialty store for baby/infant articles
M25	Carrycot mattress	No information	Specialty store for baby/infant articles
M26	Carrycot mattress	No information	Specialty store for baby/infant articles

Product no.	Product type	Origin	Place of purchase (type)
M27	Carrycot mattress	No information	Specialty store for baby/infant articles
M28	Carrycot mattress	No information	Specialty store for baby/infant articles

4.2 Chemical susbstances

Previous studies of articles for babies/infants suggest that primarily the phosphorus-based flame retardants (in particular TCPP and TDCP), brominated flame retardants, formaldehyde and phthalates can occur in such high concentrations that a health risk can not be excluded.

Additionally, some substances classified due to health effects have either not been studied or have only been studied in very few products or materials, e.g. chlorophenols and PFAS.

However, the available studies are not considered to provide a basis that with sufficient certainty is able to identify the most relevant substances for quantitative analysis in the analysis part of the project. Therefore, an initial semi-quantitative screening analysis by GC-MS on the selected products was conducted to provide the necessary data basis for the selection of substances for quantitative analysis and possibly subsequent migration testing.

The GC-MS screening analysis was supplemented with a specific analysis of formaldehyde as this substance has been previously demonstrated to occur in several textile products, while it is undetectable by GC-MS screening.

5. Chemical analysis and test programme

5.1 Introduction

Based on the results of the literature survey and the preliminary assessment of the potentially occurring substances and the possible exposure of children in the studied product types (see Chapter 4), the following three product types were selected for the chemical analysis programme: Car safety seats, baby slings and baby mattresses. A total of 30 products were purchased; 10 products within each of the three selected groups of products.

As the results of the survey could not clarify which substances would be the most relevant to analyse quantitatively (as discussed in the previous chapter), screening analyses by gas chromatography-mass spectrometry (GC/MS) and by X-ray diffraction (XRD) were performed initially. The screening analysis by GC/MS was performed to identify the possible content of volatile and semi-volatile organic substances in the products while the screening analyses by XRD were performed to elucidate the possible content of elements in the products that could indicate a content of inorganic compounds and metal-containing organic compounds, e.g. organotin compounds.

From most of the products several sub-samples have been for analysis and they have as far as possible (and relevant) been taken from the parts of the product where children will have the most direct contact to reflect a worst-case exposure scenario. Most often this will be the zones near of the baby's face, where the child can suck on the textiles. The products selected for analysis typically consists of a number of different types of materials, for example textiles and foam, which is another reason to take more subsamples from many of the products. Sub-samples consisting of several different materials have been taken as well as sub-samples consisting of only one material.

An overview of the sub-samples within each product type is given in the tables below (by product type). In the sample numbering, the first letter refers to the type of product, i.e. "A" for "autostol" (car seat), "B" for "bæresele" (baby sling) and "M" for "madras" (mattress). The subsequent figure is simply the sample serial number, while a possible final letter (A, B and, if necessary, C) denotes different sub-samples of the same main sample.

TABLE 5-1
CAR SAFETY SEATS – OVERVIEW OF SUB-SAMPLES FOR GC/MS SCREENING ANALYSIS.

Product number	Sub-sample for GC/MS screening
A1	Black textile and foam
A2A	Grey textile and foam
A2B	Black plastic
A3A	Black textile and foam + backside
A3B	Grey textile and foam + backside
A4	Blue textile and foam + backside

Product number	Sub-sample for GC/MS screening
A5A	Red tekstile and foam + ribbon
A5B	Black backside made of rubber
A6A	Grey textile with foam
A6B	Backside
A7A	Black textile and foam
A7B	Textile with print
A8A	Black textile and foam
A8B	Red textile and foam
A29	Black textile and foam + "a heart"
A30	Grey textile and foam

TABLE 5-2
BABY SLINGS – OVERVIEW OF SUB-SAMPLES FOR GC/MS SCREENING ANALYSIS.

Product number	Description
B9A	Bright textile with foam
B9B	Foam "mat" between inner and outer textile
B9C	Small strap with grey plastic and bright textile
B10A	Foam from red and grey bib
B10B	Red textile with felt, grey textile and bib
B10C	White foam mat in the bib
B11	Grey textile and foam
B12A	Foam from belt strap, foam and felt
B12B	Grey, black and white textile from bib
B12C	Plastic "panel" on bib
B13A	Foam from belt strap with plastic and felt in the bib
B13B	Perforated textile from belt strap with fibres, black textile from belt strap and black textile from inner side of bib
B14A	Foam in the bib
B14B	White textile from backside of the bib + grey and black textile on the strap
B15A	Foam with felt on the bib
B15B	Black strap and dark blue textile
B16A	Foam in the strap
B16B	Black and grey textile from the inside of the sling
B17A	Foam in the bib and in the sling itself

Product number	Description
B17B	White and black textile from the bib
B18A	Foam from strap and felt from bib
B18B	Grey textile from strap and black textile from ribbon
B18C	White "net" textile in the sling and white textile on the bib

TABLE 5-3
BABY MATTRESSES – OVERVIEW OF SUB-SAMPLES FOR GC/MS SCREENING ANALYSIS.

Product number	Description
M19A	Textile from separate mattress for carrycots
M19B	Foam from separate mattress for carrycots
M20A	Textile from separate mattress for carrycots
M20B	Foam from separate mattress for carrycots
M21A	Textile from carrycot
M21B	Foam from carrycot
M22A	Textile from carrycot
M22B	Textile from carrycot
M23A	Textile from soft carrycot
M23B	Textile from soft carrycot
M24A	Textile from carrycot
M24B	Textile from carrycot
M25A	Textile from separate mattress for carrycots
M25B	Foam from separate mattress for carrycots
M26A	Textile from separate mattress for carrycots
M26B	Foam from separate mattress for carrycots
M27A	Textile from separate mattress for carrycots
M27B	Foam from separate mattress for carrycots
M28A	Textile from separate mattress for carrycots
M28B	Foam from separate mattress for carrycots

Based on the results from the screening analyses the decision was made on quantitative analyses of relevant substances by specific methods. The results of the quantitatively determined content were subsequently compared with the exposure scenarios as a basis for decision on the possible conduct of a migration test. This means that migration was only tested for the substances detected in significant concentrations, and where migration was considered to be a relevant route of exposure.

5.2 Screening analyses

Screening analyses for organic compounds by GC/MS have been carried out on all subsamples mentioned in the above summary tables.

The screening analyses by X-ray analysis (XRD) were performed with the primary objective to identify the possible presence of organotin compounds, and these analyses were limited to car safety seats as such substances were considered primarily to occur within this product group, if at all. Only the textile part of the seats were analysed as it was assumed that it would primarily be these sub-samples that could contain organotin compounds (or brominated flame retardants).

5.2.1 Screening analysis by GC/MS

The screening analyses cover a large number of volatile and semi-volatile organic compounds, but the method is not equally suitable for all substances. E.g. volatile aldehydes (including formaldehyde, which in previous studies has been found in some textiles) are not detected by the method. Isocyanates, which may occur as a residual monomer in foam, also require a specific method of analysis, and the same applies to aromatic amines derived from azo dyes.

As, by the GC/MS screening, the contents of all substances are quantified based on the same internal standard, the results can only be regarded as semi-quantitative. The response factor for some of the substances in the analysis is close to the response factor of the internal standard, while the response factor for others may deviate significantly and therefore will result in a more uncertain determination of the concentration in the sample.

Analytical method - volatile and semi-volatile organic compounds by GC/MS

A known sub-amount of the product of between 0.5 and 2 grams is weighed, extracted with solvent, and then analysed by gas chromatography combined with mass-selective detection (GC/MS). Internal standards of deuterium-labeled naphthalene and phenanthrene were used. The individual compounds detected were identified by comparing the actual mass spectra with mass spectra from the NIST MS library[1]. The NIST library is a database of spectra for more than 500,000 chemical substances.

All volatile and semi-volatile organic substances detected by the GC/MS screening are semi-quantified using the response factor for naphthalene.

The limits of detection vary between 1 and 50 mg/kg, depending on the matrix and the specific response of the substances. The contents of all substances found above the detection limit are reported in mg/kg of the sample.

Results of the screening analysis by GC/MS

The detailed results of the screening analyses can be found in Appendix 4. Many different volatile and semi-volatile components have been found in the samples, and the results vary considerably between samples and, hence, it has been difficult to find any clear pattern in the results.

In a few samples no volatile or semi-volatile substances were detected and in other samples only very few, while in other samples more than 15 different components were detected. If one should point at some substances occurring in many of the samples, particularly the phosphorus-based flame retardants are noteworthy. In addition, it various hydrocarbons (primarily aliphatic hydrocarbons), (aromatic) amines and individual phthalates and certain isocyanates are present in a number of samples.

[1] National Institute of Standards and Technology (NIST), USA.

A significant number of substances were detected by the screening that could not be identified. The substances are not included in the NIST library, and therefore considered not to be commonly known substances.

The results of the screening analysis by GC/MS has formed the basis for the selection of substances to be quantified by specific analytical methods, see section 5.3.

5.2.2 Screening analysis by X-ray

By X-ray screening analysis all elements can in principle be detected, however not elements with low molecular weights such as hydrogen, oxygen, carbon and nitrogen. In this project, however, the focus of the elemental screening has been on the metal tin, as the use of organotin compounds in certain textile products previously has been reported, and as these substances only have a poor recovery by the GC/MS screening method. In addition, samples can be simultaneously analysed for content of bromine (as an indicator of content of brominated flame retardants.

Analytical method - screening analysis by X-ray

The samples were analysed for their content of tin and bromine by wavelength-dispersive (WD) X-ray analysis; Philips PW2400 / UNIQUANT ver. 5.49.

The detection limit of the method is 20 mg/kg and the variability is estimated to be 5-15 % RSD.

Results of the screening analysis by X-ray

In Table 5-4 the results of the screening analyses performed by X-ray are shown. Only car seat samples were screened by X-ray analysis.

TABLE 5-4
RESULTS OF X-RAY SCREENING ANALYSES OF CAR SAFETY SEATS.

Sample no.	Sample type	Tin mg/kg	Bromine mg/kg
A1	Textile	< 20	5,700
A2A	Textile	< 20	220
A3A	Textile	< 20	170
A3B	Textile	65	410
A4	Textile	< 20	450
A5A	Textile	< 20	< 20
A6A	Textile	< 20	430
A6B	Textile	< 20	< 20
A7A	Textile	< 20	< 20
A8A	Textile	< 20	< 20
A8B	Textile	< 20	290
A29	Textile	< 20	27,000
A30	Textile	< 20	90

< Less than the stated limit of detection.

As the table shows, tin was not found in significant quantities in any of the samples. Therefore, it was considered unnecessary to carry out specific analyses for organotin compounds.

However, bromine was detected in 9 out of the 13 samples of textiles from car safety seats. A high content of bromine may indicate the use of brominated flame retardants and therefore it was decided to carry out quantitative analyses for those brominated flame retardants that are most often used in textiles in samples with the highest content found by the screening: 1, 3B, 4, 6A and 29.

5.3 Quantitative analyses

Based on the results from the screening analyses by GC/MS and X-ray, quantitative analyses for selected, specific organic substances were performed. No quantitative determinations of inorganic substances were performed as it was considered that the relevant element identified (bromine) would most likely occur in the form of organic compounds.

Some of the substances listed in the survey (chapter 2) were deselected for the chemical analysis programme due to the following considerations:

- The substance or indications of the presence of the substance was not detected in any of the screening analyses cionducted;
- the substance was only detected at low (i.e. not relevant) concentrations;
- the substance was not found to be of toxicological concern in the initial risk screening;
- the substance was considered to be already sufficiently documented in other studies.

This applies, for example to substances such as chlorophenols, aliphatic hydrocarbons, carboxylic acids, aldehydes, ketones, alcohols and amines, triazoles/triazines, certain solvents, perfluorinated alkyl compounds (covered by a separate project under consumer product program in 2014[2]), a series of biocides, PAHs, and various phthalates.

Based on screening results the following substances were selected for specific analysis:

- Phosphorus-based flame retardants, based on detection of significant content in many of the products, i.e. content in amounts estimated to be due to intentional use and not just residues from previous process stages or contamination by migration from other materials.

- Azo dyes, due to detection of aromatic amines, and because the specific aromatic amines derived from azo dyes cannot be detected by the GC/MS screening method. Additionally, in other studies these substances have been shown to be present in some textile products. Azo dyes are measured analytically by the derived aromatic amines.

- Phthalates, based on the detection of significant (i.e. intentional) contents in a single sample.

- Isocyanates, only in foam sub-samples, as these substances have been found in other studies and because indications of content of TDI were found by the screening analysis.

- Formaldehyde, as the substance cannot be detected by the screening method and the substance has previously been found in other studies of textile, including car safety seats.

- Brominated flame retardants as the X-ray screening indicated high bromine content in several of the screened samples.

[2] Lassen *et. al.* (in press). "Perfluoralkyl substances (PFAS) in textiles for children". In this project, 8 car safety seats, among many other textile products, were analysed for their content of PFAS but no such substances were detected in any of the seats.

The specific analyses of the above substances/-groups were carried out on sub-samples of products within the three selected product types as presented in Table 5-5, Table 5-6 and Table 5-7 below.

TABLE 5-5
OVERVIEW OF QUANTITATIVE ANALYSES OF CAR SAFETY SEATS BY SPECIFIC METHODS.

Product	P-based flame retardants	Formaldehyde	Isocyanates	Phthalates	Azo dyes	Brominated flame retardants
A1	Black textile and foam	Black textile	-	-	Black textile	Black textile
A2A	Grey textile and foam	Grey textile	-	-	Grey textile	-
A2B	Black plastic	-	-	-	-	-
A3A	Sort betræk inklusiv skum	Black textile	Foam from chair	-	-	-
A3B	Black textile and foam	Black textile	-	-	-	Black textile
A4	Blue textile, foam and backside	Blue textile	-	-	-	Blue textile
A5A	Red textile, foam and ribbon	Red textile	Foam from chair	-	-	-
A5B	Black rubber backside	Black rubber backside	-	-	-	-
A6A	-	Grey textile	Foam from chair	-	-	Grey textile
A6B	-	Black textile from back of belt	-	Black textile from back of belt	Black textile from back of belt	-
A7A	-	Black textile	Foam from chair	-	Black textile	-
A7B	-	Printed textile	-	-	-	-
A8A	Black textile and foam	Black textile	Foam from chair	-	Black textile fom belt	-
A8B	Red textile and foam	Red textile	-	-	Red textile	-
A29	Black textile, foam and "heart"	Black textile	-	-	Black textile (two types)	Black textile
A30	Grey textile and foam	Grey textile	-	-	-	-

- : The analysis was not carried out on this sample.

TABLE 5-6
OVERVIEW OF QUANTITATIVE ANALYSES OF BABY SLINGS BY SPECIFIC METHODS.

Product	P-based flame retardants	Formaldehyde	Isocyanates	Phthalates	Azo dyes	Brominated flame retardants
B9A	-	Bright textile		-	-	-
B9B	Foam "mat" between textile layers	-	Foam "mat" between textile layers	-	-	-
B9C	Small plastic "panel"	Bright textile	-	-	-	-
B10A	-	-	-	-	-	-
B10B	Red textile with felt, gery textile and bib	Red textile with felt, grey textile and bib	-	-	-	-
B10C	-	-	-	-	-	-
B11	-	Grey textile	-	-	-	-
B12A	Foam from strap, foam and felt	White textile	-	-	-	-
B12B	Grey, black and white textile from bib	Grey and black textile	-	-	Black textile	-
B12C	Plastic "panel" in bib	-	-	-	-	-
B13A	-	Perforated textile from strap	-	-	-	-
B13B	-	Black textile from strap and inner side of bib	-	-	Perforated textile and black textile	-
B14A	-	-	-	-	-	-
B14B	-	White textile from bib + grey and black textile from strap	-	-	-	-
B15A	-	-	-	-	-	-
B15B	-	Black strap and dark blue textile	-	-	Black strap and dark blue textile	-
B16A	Foam from belt	-	-	-	-	-
B16B	-	Black and grey textile from inside of strap	-	-	Black and grey textile from inside of strap	-

Product	P-based flame retardants	Formaldehyde	Isocyanates	Phthalates	Azo dyes	Brominated flame retardants
B17A	-	-	-	-	-	-
B17B	White and black textile from strap	White and black textile from strap	-	-	Black textile from bib	-
B18A	Foam from belt and felt from bib	-	-	-	-	-
B18B	Grey textile from strap and black textile from ribbon	Grey textile from strap and black textile from ribbon	-	-	Grey textile from strap and black textile from ribbon	-
B18C	White "net" textile in strap and white textile from bib	White "net" textile in strap and white textile from bib	-	-	-	-

- : The analysis was not carried out on this sample.

TABLE 5-7
OVERVIEW OF QUANTITATIVE ANALYSES OF BABY MATTRESSES BY SPECIFIC METHODS.

Product	P-based flame retardants	Formaldehyde	Isocyanates	Phthalates	Azo dyes	Brominated flame retardants
M19A	-	Textile cover	-	-	-	-
M19B	-	-	Foam	-	-	-
M20A	-	Textile cover	-	-	-	-
M20B	-	-	Foam	-	-	-
M21A	-	Textile cover	-	-	-	-
M21B	-	-	-	-	-	-
M22A	-	Textile cover	-	-	-	-
M22B	-	-	Foam	-	-	-
M23A	-	Textile cover	-	-	-	-
M23B	-	-	-	-	-	-
M24A	Textile cover	Textile cover	-	-	-	-
M24B	Foam	-	Foam	-	-	-
M25A	-	Textile cover		-	-	-
M25B	-	-	Foam	-	-	-
M26A	-	Textile cover	-	-	-	-
M26B	-	-	Foam	-	-	-

Product	P-based flame retardants	Formaldehyde	Isocyanates	Phthalates	Azo dyes	Brominated flame retardants
M27A	-	Textile cover	-	-	-	-
M27B	-	-	Foam	-	-	-
M28A	-	Textile cover	-	-	-	-
M28B	-	-	Foam	-	-	-

- : The analysis was not carried out on this sample.

5.3.1 Phosphorus-based flame retardants

Based on the GC/MS screening results, 25 samples or subsamples of the parts of the products that may come into direct contact with the child were selected for phosphorus-based flame retardant analysis (primarily the chlorinated ones). The subsamples were completely similar to the corresponding sub-samples analysed by GC/MS.

All samples and subsamples were analysed for the content of the following phosphorus-based flame retardants:

TCEP: Tris (2-chloroethyl) phosphate, CAS no. 115-96-8
TCPP: Tris (1-chloro-2-propyl) phosphate, CAS no. 13674-84-5
TDCP: Tris (1,3-dichloro-2-propyl) phosphate, CAS no. 13674-87-8
TPP: Triphenyl phosphate, CAS no. 115-86-6

Analytical method for phosphorus-based flame retardants

Known aliquots were weighed and extracted with solvent, and the extracts subsequently analysed by gas chromatography combined with mass selective detection (GC/MS). The internal standards used were deuterium-labeled naphthalene and phenanthrene. All substances were determined quantitatively against an external calibration standard for each flame retardant. True duplicate determinations were made. The results are expressed as the mean of the duplicate determinations.

The detection limits ranged from 1 to 50 mg/kg depending on the matrix and the specific response of the substance. The relative standard deviations ranged from 5-20% (RSD), however, with a single outlier sample (5B) having a RSD of 73%.

Results of analyses for phosphorus-based flame retardants

The following Table 5-8 present the results of the analyses for phosphorus-based flame retardants in sub-samples from the three product groups: car safety seats, baby slings and baby mattresses.

TABLE 5-8
RESULTS OF ANALYSES FOR P-BASED FLAME RETARDANTS IN CAR SAFETY SEATS, BABY SLINGS AND BABY MATTRESSES (MEAN OF DUPLICATE DETERMINATIONS).

	P-based flame retardants, result in mg/kg			
	TCEP	TCPP	TDCP	TPP
Car safety seats				
A1, textile + foam	-	720	2,700	44
A2A, textile + foam	- / -	810	3,700	-
A2B, black plastic	-	30	14	-

	P-based flame retardants, result in mg/kg			
	TCEP	TCPP	TDCP	TPP
A3A, textile + foam	-	2,200	20,300	34
A3B, textile + foam	-	4,800	21,100	65
A4, textile + foam	-	56	42,600	84
A5A, textile + foam	-	46	31,500	54
A5B, black rubber	-	-	23	-
A8A, textile + foam	840	18,100	5,100	28
A8B, textile + foam	41	2,490	6,700	30
A29, textile + foam	-	-	-	330
A30, textile + foam	-	-	-	28
Baby slings				
B9B, foam mat	-	21	-	18
B9C, textile and plastic	-	17	-	-
B10B, textile	-	-	-	14
B12A, foam	75	11,200	160	43
B12B, textile	20	720	23	14
B12C, plastic	-	340	-	-
B16A, foam	-	-	-	86
B17B, textile	-	-	-	14
B18A, foam and felt	4,700	16,300	13,000	-
B18B, textile	57	140	45	-
B18C, textile	44	41	48	-
Baby mattresses				
M24A, textile	-	-	92	-
M24B, foam	-	-	89,700	74

- :Below the stated limit of detection: 5-20 mg/kg

TCEP: Tris(2-chloroethyl)phosphate, CAS nr. 115-96-8

TCPP: Tris(1-chloro-2-propyl)phosphate, CAS nr. 13674-84-5

TDCP: Tris(1,3-dichloro-2-propyl)phosphate, CAS nr. 13674-87-8

TPP: Triphenyl phosphate, CAS nr. 115-86-6

High levels of flame retardants were detected in seven of the samples, i.e. a content of more than 1% (> 10,000 mg/kg) indicating an intended addition for a functional purpose.

Seven samples with concentrations greater than 10,000 mg/kg were selected for additional testing for migration (migration to sweat) for all four flame retardants: TCEP, TCPP, TDCP and TPP. However, only one subsample was selected per product (the sub-sample with the highest content). Samples of all three product types were selected, however most car seat samples.

See the results of the migration tests in section 5.4.

5.3.2 Formaldehyde

Formaldehyde cannot be determined by the screening method by GC/MS Therefore, sub-samples from all products were selected for the quantitative analysis of formaldehyde as previous studies have shown that formaldehyde can be found in textile products, including car safety seats. Only subsamples made of textile were examined for the content of formaldehyde.

Analytical method for formaldehyde

Sub-samples of the textiles were taken in the areas of the samples, which may come into direct contact with the child. The sub-samples were cut into smaller pieces and a known aliquot was weighed. The sample was extracted with purified water for one hour in a water bath at 40 °C and shaking at regular intervals. Acetylacetone reagent was added to an aliquot of the samples solution and subsequently spectrophotometric analysis was performed at a wavelength in the range 412-415 nm. The analysis was performed according to accreditation under Japanese law no. 112: 1972 without any modifications.

Limit of detection: 2 - 5 mg/kg. True duplicate determinations were made.

Results of analyses for formaldehyde

No content of formaldehyde was found in any of the 37 textile samples analysed with a detection limit of 2-5 mg/kg. See detailed table in Appendix 5.

5.3.3 Isocyanates

Quantitative determination of isocyanates were made on 14 samples selected based on the results of the screening analyses. The screening analyses had indicated content of isocyanates in the pure foam samples as well as in sub-samples containing both textile and foam. Since it is assessed that isocyanates do not occur in textiles, and the content in the composite samples therefore must be due to the foam part, only sub-samples of pure foam were analysed specifically for isocyanates.

The samples were analysed for content of the isocyanates 2,4- and 2,6-toluene diisocyanate (2,4- and 2,6-TDI, CAS no. 584-84-9 and 91-08-7) as these are the only ones of the identified isocyanates that are (semi)volatile and therefore can be emitted from the foam. In addition, the analysis included 4,4'-diphenylmethane diisocyanate (MDI, CAS no. 101-68-8).

Analytical method for isocyanates

Sub-samples with known weight were extracted with dichloromethane with an internal standard added and subsequent derivatization. The substances 2,4- and 2,6-TDI and MDI were analysed for. The analysis was performed by HPLC with fluorescence fluorescence detector.

True triplicate dterminations were made since isocyanates can be randomly distributed within the foam system. The results are reported as the mean of the triplicate determinations.

Results of analyses for isocyanates

As described previously, the screening analyses indicated that in several samples there could be a content of isocyanates, probably caused by the release of unreacted monomer from the foam materials. Since TDI and MDI has problematic health properties such as sensitization, the 14 most relevant samples were selected for specific analysis for isocyanates. The results of this analysis are shown in Table 5-9.

TABLE 5-9
RESULTS OF SPECIFIC ANALYSES FOR ISOCYANATES (MEAN OF TRIPLICATE DETERMINATIONS).

		Concentration (mg/kg)		
Sample no.	Sub-sample	2,4-TDI	2,6-TDI	MDI
Car safety seats				
A3A	Foam from chair	0,17	0,43	< 0,1
A5A	Foam from chair	< 0,1	< 0,1	< 0,1
A6A	Foam from chair	< 0,1	< 0,1	< 0,1
A7A	Foam from chair	< 0,1	< 0,1	< 0,1
A8A	Foam from strap	< 0,1	< 0,1	< 0,1
Baby slings				
B9B	Foam mat between textiles	< 0,1	< 0,1	< 0,1
Baby mattresses				
M19B	Foam	0,14	< 0,1	< 0,1
M20B	Foam	< 0,1	< 0,1	< 0,1
M22B	Foam	< 0,1	< 0,1	< 0,1
M24B	Foam	0,91	0,64	< 0,1
M25B	Foam	< 0,1	< 0,1	< 0,1
M26B	Foam	< 0,1	< 0,1	< 0,1
M27B	Foam	0,23	0,17	< 0,1
M28B	Foam	< 0,1	< 0,1	< 0,1

< Content below the stated limit of detection.

While the screening analysis by GC/MS had indicated contents of the isocyanates 2,4- and 2,6-TDI in the 14 samples at concentrations between 10 and 940 mg/kg, the specific quantitative analyses could not confirm these high concentrations. Thus, isocyanates (2,4- and 2,6-TDI) were only detected in the samples 3A, 19B, 24B and 27B with 0.64 mg/kg as the highest concentration.

The results of the specific analysis thus clearly show that the screening method by GC/MS cannot be used for the determination of isocyanates. It was expected that the method would be able to give an indication of the isocyanate content, but this is apparently not the case.

5.3.4 Phthalates

In the screening by GC/MS only one single sample of a car seat (sample A6B) was found, which had a high content of phthalates, namely isomeric di-decylphthalates (DIDP). The concentration of the isomeric di-decylphthalate was considered to be outside the screening range, and therefore the concentration was probably underestimated by the screening analysis. In the specific analysis, the sample was diluted to an appropriate level in order to determine the exact concentration.

Analytical method for isomeric di-isodecyl phthalate (DIDP)
The sub-sample (about 0.5 g, accurately weighed) was extracted with dichloromethane by ultrasound for 1 h and mechanical shaking for 1 hour. Deuterium-labelled internal standards of dibutyl phthalate-d4 and di- (2-ethylhexyl)-phthalate-d4 had been added to the solvent prior to the extraction. The extract was analysed by capillary gas chromatography with mass spectrometric detection (GC/MS).

The analysis was carried out by an accredited method for phthalates; however, the isomeric di-isodecyl phthalates, CAS. 26761-40-0 and 68515-49-1, are not covered by the accreditation. Ttrue duplicate determinatiosn were performed. The results are reported as the average of the duplicate determinations.

Results of analyses for isomeric di-isodecyl phthalate
By the GC/MS screening analysis only very low concentrations of phthalates were found, if at all, and only in one sample the content was high enough (functional level) to justify a specific analysis. The result of this is shown in Table 5-10.

TABLE 5-10
RESULTS OF SPECIFIC ANALYSES FOR PHTHALATES IN CAR SEAT SAMPLE A6B (MEAN OF DUPLICATE DETERMINATIONS).

Sample No.	Material	Phthalate concentration (mg/kg)	
		Di-isodecyl-phthalate isomer 1	Di-isodecyl-phthalate isomer 2
A6B	Textile	41,000	350,000

The screening analysis by GC/MS indicated a content of di-isodecyl phthalates reported as >12,100 mg/kg and >3320 mg/kg, respectively, for the two isomers. These concentrations were considered, as mentioned above, not to be correct as the MS detector was probably overloaded with the isomeric di-decylphthalates at the screening, and the true concentrations therefore way out of the linear calibration range. In the specific quantitative measurements the extracts were diluted so that the concentration was quantifiable and the total content of DIDP was then found to be about 390,000 mg/kg (39% w/w), which is a exceedance of the provisions regarding certain phthalates in childcare articles in REACH. The Environmental Protection Agency has therefore reported this finding of DIDP to the Danish Chemicals Inspectorate.

5.3.5 Azo dyes
Determination of azo dyes (determined as the derived aromatic amines) requires a specific method of analysis for all the relevant amines, and, hence, the GC/MS screening method cannot be used to select the samples for quantitative determination of azo dyes. Therefore, 13 samples of textiles from car safety seats and baby sling were selected, which had the darkest colors as it was assessed most likely that azo dyes, if at all, would occur in dark colored textile samples. No samples of textiles from the baby mattresses were selected, as they all were made of relatively bright fabrics.

Analytical method for aromatic amines derived from azo dyes
The analyses were performed according to DS/EN 14362-1 by gas chromatography combined with mass spectrometric detection (GC/MS) as indicated in REACH Annex XVII, Section 43, which comprise 23 substances (all aromatic amines) and sets a limit for the content of each of the substances of 30 mg/kg. In addition, 4 addtional amines were determined by the analysis, including aniline and p-phenylenediamine, which, when they both are present in significant concentrations, indicate that the samples contain 4-aminoazobenzene. Duplicate determinations were made.

The aromatic amines derived from azo dyes and aniline and p-phenylenediamine, were quantified by comparison with calibration standards of all named substances. 2,6-Dichloro-p-phenylene-diamine and 4,5-dichloro-o-phenylenediamine was identified by comparing the current mass spectra with mass spectra in the NIST library. The amounts stated for these two substances were calculated from the response of the internal deuterium-labeled standard naphthalene-d8 (semi-quantitative determination).

The standard method EN 14362-3: 2012 deals with specific analysis of 4-aminoazobenzene, which is only performed if the presence of aniline and 4-phenylenediamine in significant quantities, i.e. more than 5 mg/kg for both substances. Therefore, this analysis was not performed as the indicator substances were not detected in significant quantities.

Results of analyses for amines derived from azo dyes and other amines

The results of the analyses for azo dyes as represented by the derived aromatic amines are shown in Table 5-11 below. The results are reported as the mean of the performed duplicate determinations. Only substances found above the limit of detection are reported. See the list of all examined specific substances in Annex 6.

TABLE 5-11
RESULTS OF QUANTITATIVE ANALYSES FOR AZO DYE-DERIVED AMINES AND OTHER AROMATIC AMINES IN CAR SAFETY SEATS AND BABY SLINGS (MEAN OF DUPLICATE DETERMINATIONS).

Component	CAS-no.	Concentration, mg/kg												
		Car safety seats							Baby slings					
		A1	A2A	A6B	A7a	A8A	A8B	A29	B12B	B13B	B15B	B16B	B17B	B18B
4-Methyl-m-phenylene diamine (2,4-TDA)	95-80-7	50	-	-	-	30	6,7	-	11	-	-	-	-	-
Benzidine	92-87-5	-	-	-	-	-	-	-	-	-	-	7,5	-	-
3,3'- Dimethoxy-benzidine	119-90-4	-	-	-	-	-	-	-	-	-	-	6,4	-	-
Other aromatic amines		-	-	-	-	-	-	-	-	-	-	-	-	-
Aniline	62-53-3	0,57	-	-	-	-	-	-	-	0,95	-	8,2	-	0,96
p-Phenylene diamine		20	-	-	-	-	-	-	-	-	-	-	-	-
2,6-Dichloro-*p*-phenylene diamine 4,5-Dichloro-*o*-phenylene diamine	609-20-1/ 5348-42-5	280	90	-	-	130	-	24	200	-	38	98	230	-

"-" Concentration below the LoD: 2 – 5 mg/kg.

Generally, only very low amounts of amines as defined in REACH Annex XVII, paragraph 43 were detected, and all samples except one thus comply with the limit of 30 mg/kg for the aromatic amines set out in REACH Annex XVII. The sample exceeding the limit of 30 mg/kg is sample made

of black textile from car seat A1, in which was detected 50 mg of 4-methyl-m-phenylene diamine/kg textile. This result has been reported to the Danish Chemicals Inspectorate.

5.3.6 Brominated flame retardants

The screening analysis by X-ray showed high levels of bromine in five of the textile samples, and these textiles were therefore selected for quantitative analysis for brominated flame retardants. The analysis include the following brominated flame retardants, which historically have been used in textiles, i.e.:

- Polybrominated diphenyl ethers (PBDEs)
- Hexabromocyclododecane-dodecane (HBCD)

and

- polybrominated biphenyls (PBB) and
- tetrabromobisphenol-A (TBBPA).

The polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDEs) include a variety of individual components, all of which were determined by the analysis. Of these, decaBDE is the substance most commonly used in textiles.

Analytical method for brominated flame retardants

Sub-samples in known quantities were extracted by Soxhlet, ASE or liquid/liquid extraction with addition of deuterium-labeled standards. The extracts were purified on columns, and analysis was performed by capillary gas chromatography with mass spectrometric detection (GC/MS) or HPLC/MS-MS, depending on the substance. Tetrabromobisphenol-A (TBBPA) was derivatized with BSTFA prior to analysis.

The detection limits ranged between 0.00002 and 0.01 mg/kg depending on the matrix and the response of the substances. The relative standard deviations (RSD) ranged from 5 to 25%. True duplicate determinations were performed.

Results of analyses for brominated flame retardants

The results of the specific analyses for brominated flame retardants in Table 5-12 are reported as the average of the performed duplicate determinations. See the complete list of individual substances in Annex 7.

TABLE 5-12
RESULTS OF THE QUANTITATIVE ANALYSES FOR BROMINATED FLAME RETARDANTS IN TEXTILES FROM CAR SAFETY SEATS (AVERAGE OF DUPLICATE DETERMINATIONS).

Substance	Concentration in mg/kg				
	A1	A3B	A4	A6A	A29
Polybrominated biphenyls (PBB), individual substances	-	-	-	-	-
Sum of polybrominated biphenyls (PBB)	< 0,03	< 0,04	< 0,02	< 0,02	< 0,02
2,4,4'-TriBDE (BDE-28)	0,00088	0,00037	0,00094	0,14	0,047
Sum of other polybrominated diphenyl ethers (PBDE)	< 0,07	< 0,08	< 0,05	< 0,05	< 0,05

Substance	Concentration in mg/kg				
	A1	A3B	A4	A6A	A29
Tetrabromobisphenol-A (TBBPA)	< 0,03	< 0,04	< 0,02	< 0,02	< 0,01
Hexabromocyclo dodecane (HBCD) (alpha, beta, gamma)	< 0,002	1,2*	0,031	< 0,001	0,042

- Means content below the stated limit of detection.

* The content was only found in one of the duplicate determinations.

A few brominated flame retardants were detected in low concentrations:

- 2,4,4-TriBDE (BDE-28) was found in 3 samples with 0.047 mg/kg as the highest concentration. BDE-28 is present in low concentrations in pentaBDE, but if this was the source, the sum of PBDE should be much higher.

- Hexabromocyclododecane (HBCD) was detected in 3 samples with 1.2 mg/kg as the highest concentration.

Thus, the findings of relatively high concentrations of bromine by X-ray analysis cannot be explained by presence of the investigated brominated flame retardants.

In recent years, however, a number of alternative brominated flame retardants have been introduced on the market including some polymeric brominated flame retardants, which are considered to be less harmful than traditional brominated flame retardants. Since it is not possible to point at other sources to the bromine found in the textile samples, it is considered the most likely explanation that polymeric brominated flame retardants have been used, which could not be determined by the analytical method applied.

5.4 Migration testing

The results of the quantitative analyses in combination with the exposure scenarios led to the selection of phosphorus-based flame retardants for migration testing. Seven sub-samples were tested for migration to sweat (as this migration type was assessed to be the main pathway of exposure). In practice, the seven sub-samples with the highest content of P-based flame retardants were selected, however max. one sub-sample per product and in a way so that all three product types were represented. Migration tests were not performed with any of the other substances because the concentration levels were assessed to be too low for migration of health concern to take place. The aromatic amine 4-methyl-*m*-phenylene diamine is automatically considered to pose a risk when the limit value is exceeded. Hence, in this context it was found unnecessary to test it for migration.

5.4.1 Migration test method

A migration test fluid of artificial sweat was prepared according to ISO 105-E04: 2008 in accordance with Oeko-Tex®, wherein the simulator comprises 1-histidine monohydrochloride 1-hydrate, sodium chloride, sodium dihydrogen phosphate and sodium hydroxide, and a pH adjusted to 5.5. The artificial sweat was heated to 37 °C to mimic body temperature. The amount of test sample relative to migration fluid was approximately 2.5 grams textile to 50 ml simulant.

A sub-sample of known weight was taken of each of the 7 samples. The sub-samples were placed in a known volume of the sweat simulant in a heating cabinet at 37 °C, and static contact with the simulant for 3 hours. After 3 hours of migration to the artificial sweat, the sub-samples were removed from the migration liquid, and the liquid was immediately extracted with dichloromethane and stored refrigerated until assayed for the specific substances. The migration test was performed in duplicate.

5.4.2 Analytical method - phosphorus-based flame retardants in migration liquid

A known alilquot of the migration fluid sample was weighed and extracted with dichloromethane after which the extract was analysed by gas chromatography combined with mass selective detection (GC/MS). Internal standards of deuterium-labeled naphthalene and phenanthrene were used. The substances found were quantified by comparison to calibration standards. All analyses were performed as true duplicate determinations.

Quantitative determinations were made against calibration standards for each of the four P-based flame retardants:

TCEP: Tris (2-chloroethyl) phosphate, CAS no. 115-96-8
TCPP: tris (1-chloro-2-propyl) phosphate, CAS no. 13674-84-5
TDCP: Tris (1,3-dichloro-2-propyl) phosphate, CAS no. 13674-87-8
TPP: Triphenyl phosphate, CAS no. 115-86-6

The detection limits ranged between 1 -5 mg/kg, while the relative standard deviations (RSD) varied from 10 to 15 % for the determination in mg/kg. The RSD for the determination in mg/m² was higher due to uncertainty in the measurements of the surface areas of the subsamples.

5.4.3 Results of the migration tests with phosphorus-based flame retardants

The results of the quantitative analyses of the content of phosphorus-based flame retardants in the product samples are reported in Table 5-8.

Table 5-13 presents the results of tests for migration of the four flame retardants to artificial sweat performed on selected samples (four car safety seats, two baby slings and one baby mattress). It should be noted that TPP was not detected in significant concentrations in any of the textile samples, yet it was included in the migration test for completeness. The results are reported as the mean of duplicate determinations on the basis of weight and surface area, respectively (mg/kg and mg/m², respectively).

TABLE 5-13
RESULTS OF THE TESTS/ANALYSES FOR PHOSPHORUS-BASED FLAME RETARDANTS IN ARTIFICIAL SWEAT MIGRATION LIQUID FOR CAR SAFETY SEATS, BABY SLINGS AND BABY MATTRESSES, RESPECTIVELY.

	Extracted amount after 3 hours, weight basis (mg/kg)			
	TCEP	TCPP	TDCP	TPP
Car safety seats				
A3B, textile with foam	< 1	140	95	< 1
A4, textile with foam	< 1	11	460	< 1
A5A, textile with foam	< 1	12	560	< 1
A8A, textile with foam	840	1700	130	< 1
Baby slings				

	Extracted amount after 3 hours, weight basis (mg/kg)			
	TCEP	TCPP	TDCP	TPP
B12A, foam	19	1200	< 1	< 1
B18A, foam and felt	1400	2400	150	< 1
Baby mattresses				
M24B, foam	< 1	< 5	500	< 1

	Amount migrated after 3 hours, surface area basis (mg/m²)			
	TCEP	TCPP	TDCP	TPP
Car safety seats				
A3B, textile with foam	< 0.5	63	42	< 0.5
A4, textile with foam	< 0.1	1.1	47	< 0.1
A5A, textile with foam	< 0.3	3.2	150	< 0.3
A8A, textile with foam	130	260	20	< 0.2
Baby slings				
B12A, foam	11	710	< 0.6	< 0.6
B18A, foam and felt	620	1100	66	< 0.5
Baby mattresses				
M24B, foam	< 0.5	< 3	210	< 0.5

< : Means content below the stated limit of detection.
TCEP: Tris(2-chloroethyl) phosphate, CAS nr. 115-96-8
TCPP: Tris(1-chloro-2-propyl) phosphate, CAS nr. 13674-84-5
TDCP: Tris(1,3-dichloro-2-propyl) phosphate, CAS nr. 13674-87-8
TPP: Triphenyl phosphate, CAS nr. 115-86-6

Three of the four tested phosphorus-based flame retardants (TCEP, TCPP and TDCP) were found in artificial sweat following migration testing for 3 hours. TPP, which was present only in low concentrations in the textile samples, was not detected. The relationship between the content in the migration fluid and the content determined in the products vary both between the individual flame retardants and between individual samples. The former difference may be explained by differences in the polarity and boiling point of the substances, while the latter difference is believed to be due to differences in the physical and chemical availability of the flame retardants among the different products.

6. Health assessment

6.1 Introduction

The health assessment in this chapter includes a hazard assessment of three phosphorus-based flame retardants that have been shown to migrate out of the analysed products to a significant extent. Based on the results of the migration tests and on the established esposure scenarios a risk assessment has been performed.

The chemical analyses also showed presence of the phthalate DIDP in a single sample and an aromatic amine derived from azo dyes in two samples, in levels, which are at or above the applicable respective threshold limit. No health assessment has been conducted for these substances.

The quantitative chemical analysis also included substances such as formaldehyde, certain isocyanatses and brominated flame retardants, but none of these substances/substance groups occurred in concentrations, which are believed to give rise to health concerns. These substances/substance groups are therefore also omitted from the health assessment.

The hazard assessment was conducted only for those substances that were found in relevant concentrations in the quantitative analyses, since this occurrence can indicate exposure via the individual product types. The hazard assessment focuses on the above mentioned substances.

The exposure assessment was performed for relevant routes of exposure based on the REACH guidance, "Guidance on Information Requirements and Chemical Safety Assessment. Chapter R.15 - Consumer exposure estimation" (ECHA, 2012b). It was assumed in the exposure assessment that the children were 1-12 months of age. For the phosphorus-based flame retardants the exposure calculation was carried out on the basis of the migration found in the tests performed.

The risk assessment was carried out by comparing the estimated exposure with DNEL/DMEL values calculated for the substances.

6.2 Hazard assessment

In the following sections, the phosphorus-based flame retardants TCEP, TCPP and TCDP are described in terms of their harmonized classification according to the CLP Regulation, their health effects and the DNEL (Derived No Effect Level) values identified in the literature or calculated from the NOAEL/LOAEL values. TPP is not included in the assessment since no migration was detected in concentrations above the quatification limit in any of the samples analysed.

6.2.1 Method for calculation of DNEL

DNEL indicates the exposure level at which, according to available knowledge, health effects due to exposure to a given substance are not expected to occur. If no DNELs were identified in the literature, DNEL values have been calculated using the ECHA guideline "Guidance on information krav and chemical safety assessment. Chapter R.8: Characterisation of dose [concentration] - response for human health "(ECHA, 2012a).

DNEL values for effects with a threshold value were calculated based on an adjusted NOAEL (no observed adverse effect level) or LOAEL (lowest observed effect level) and the appropriate

uncertainty factors (AF: Assessment Factors), selected based on the study, which forms the basis of the NOAEL or LOAEL value. DNEL values can be set for all relevant exposure pathways and situations, or the most sensitive effect can be used as basis for setting the DNEL, taking into account whether the DNEL reflects external or internal exposure. For substances without a threshold, a DMEL (Derived minimal-effect-level) may in some cases be derived, e.g. if a carcinogenicity study is available.

Table 6-1 shows the uncertainty factors used to calculate DNELs.

TABLE 6-1
OVERVIEW OF THE UNCERTAINTY FACTORS USED FOR THE DERIVATION OF DNEL.

Uncertainty	Uncertainty factor
Extrapolation between species (inter-species): allometric scaling (correction for differences in body weight and metabolism between animals and humans)	4 for rats 7 for mice 1.4 for dogs
Extrapolation between species (inter-species): other differences between animals and humans	2.5
Difference between individuals of the same species (intra-species variation)	10
Extrapolation from LOAEL to NOAEL	3 – 10 (depending on the effect)
Duration of exposure in the study	2 – sub-chronic to chronic

6.2.2 Phosphorus-based flame retardants

The following phosphorus-based flame retardants have been included in the quantitative analyses:
- TCEP: Tris (2-chloroethyl) phosphate, CAS no. 115-96-8
- TCPP: Tris (1-chloro-2-propyl) phosphate, CAS no. 13674-84-5
- TDCP: Tris (1,3-dichloro-2-propyl) phosphate, CAS no. 13674-87-8
- TPP: Triphenylphosphate, CAS no. 115-86-6

All four compounds were found in the textile and foam parts, in some of the samples in high concentrations. However, as TPP was not identifiedabove the quantification limit in the migration analyses, no hazard evaluation is performed for TPP.

Harmonised classification
Two of the substances are classified in the category carcinogenic (TDCP and TCEP), and TCEP is also classified as toxic to reproduction (

Table 6-2). There is no harmonised classification of TCPP. The industry proposal for the classification of TCPP, which is available from the ECHA website, does not include the classification of carcinogenicity or reproductive toxicity effects. However, the EU risk assessment report (RAR), and the EU Scientific Committee on Health and Environmental Risks (SCHER) consider it possible to make assessments by anology in relation to cancer data for the substances TCEP and TDCP.

TABLE 6-2
HARMONISED CLASSIFICATION OF PHOSPHORUS-BASED FLAME RETARDANTS (CLP REGULATION 1272/2008)

Index No.	Substance	CAS No.	Classification	
			Hazard Class and Category Code(s)	Hazard statement Code(s)
015-199-00-X	tris[2-chloro-1-chloromethyl)ethyl] phosphate (TDCP)	13674-87-8	Carc. 2	H351
015-102-00-0	tris(2-chloroethyl)-phosphate (TCEP)	115-96-8	Acute Tox. 4 * Carc. 2 Repr. 1B Aquatic Chronic 2	H302 H351 H360F H411

* There are specific cut-off values for the substances with respect to the selected hazard class.

Health Effects

The health effects of TCEP, TCPP and TDCP are described in EU risk assessment reports (EU RAR, 2009; 2008a and 2008b). Effects of TCPP and TDCP are also summarised in a recent project on consumer products project from the Danish Environmental Protection Agency (Andersen et al., 2014) based on the EU risk assessment reports (EU RAR). The following sections are based on those sources.

TCEP

A study in rats has shown that TCEP to a large extent is absorbed following oral ingestion (about 90% of the dose) and is distributed in the body organs. In the EU risk assessment, absorption rates (oral, dermal and inhalation) of 100% are used (EU RAR, 2009).

Three studies in animals indicate low to moderate toxicity of TCEP. A rat study showed an LD50 in the range of 430-1230 mg/kg bw following oral exposure. The inhalation toxicity appears to be low based on results from tests with rats that survived the 8-hour exposure to aerosols saturated with TCEP. The acute dermal toxicity has also been shown to be low, with a dermal LD50 of > 2150 mg/kg bw in a rabbit study.

TCEP is not considered to be a skin and eye irritant, and is not corrosive.

With regard to repeated dose toxicity, 12 studies are identified in the EU RAR. Most NOAEL values were derived for non-neoplastic effects and ranged between 44-350 mg/kg bw/d. Based on one study in mice, a LOAEL of 12 mg/kg bw/d was established for renal lesions following oral exposure for 18 months. Effects on the kidneys were assessed to be the most sensitive endpoint why this LOAEL is used in the EU risk assessment.

The available mutagenicity data show that TCEP is not mutagenic.

A number of carcinogenicity studies in rats and mice have been conducted with TCEP in accordance with established guidelines. These studies show that TCEP is carcinogenic in rats and mice and form the basis for the classification of TCEP as Carc. 2. TCEP causes benign and malignant tumours in multiple organs in rats and mice. The carcinogenicity of TCEP is considered to be related to non-genotoxic mechanisms and effects on the kidneys (increased cell growth). A LOAEL of 12 mg/kg bw/d was established based a study showing tumour formation at higher concentrations.

The available studies in mice and rats show that TCEP is toxic to reproduction. Exposure of mice resulted in significant impairment of reproduction in both sexes and in a NOAEL of 175 mg/kg

bw/d. A NOAEL of 200 mg/kg bw/d was established in a study on developmental toxicity in rats and a NOAEL of 100 mg/kg bw/d was determined for maternal toxicity.

In light of the foregoing, injuries to the kidneys are assessed to be the critical effect with a LOAEL of 12 mg/kg bw/d, and this value is therefore used in the risk assessment in this report. Since the absorption of TCEP is high (about 90% of the dose by oral intake), the assessments in this report are based on 100% absorption at both oral and dermal exposure, and inhalation.

TCPP

Toxicokinetic properties and health effects of **TCPP** are described in Andersen et al. (2014):
"TCPP is absorbed rapidly and extensively (approximately 80% of the dose) following oral administration and is widely distributed in the organs of the body. TCPP is extensively metabolised in the body, and the metabolites are excreted via urine and faeces. Dermal absorption studies have shown that a dermal absorption of 40% can be used for TCPP (EU RAR, 2008a). The acute toxicity is low because most oral LD50 values are below[3] 2000 mg/kg body weight according to a classification as Acute Tox. 4, H302. .....

Based on an oral 28-day study in rats, a NOAEL of 100 mg/kg body weight/day (in terms of liver effects) was established, and in an oral 90-day study in rats, a LOAEL value of 52 mg/kg body weight/day was found, regarding effects on liver and thyroid. .....

There are no available cancer studies for TCPP. But the EU Risk Assessment Report and the EU Scientific Committee on Health and Environmental Risks consider it possible to make analogies in relation to cancer data on substances TCEP and TDCPP. On this background, TCPP should be classified as Carc. 2, H451, as this is the EU harmonised classification for the two analogy substances TCDP and TCEP.

In terms of effects on the foetus and fertility, a LOAEL value of 99 mg/kg body weight has been drived from a 2-generation reproduction toxicity study in rats, based on the effects on uterine weight seen in all dosed females in the F0 generation. A LOAEL value of 99 mg/kg body weight is derived for developmental toxicity in the offspring based on the increased number of dwarfism observed in all dose groups in the F0 generation (EU RAR, 2008a). Toxic effects in dams may play a role in these results, but the substance may need to be classified as Repr 2; H361.

TCPP's endocrine disrupting potential has also been studied in an in vitro study using a H295R cell line wheer the testosterone concentration was increased by TCPP concentrations of 1, 10 and 100 mg/L. Furthermore, data from the 2-generation reproduction study indicate endocrine disruption of TCPP due to findings of uterine weight and extension of the estrogenic cycle. These results indicate that TCPP may change the sex hormonal balance, which may support the classification as presented above. However, it remains to be determined whether increased testosterone levels will also occur in in vivo studies, and this may be associated with the decrease in uterine weight" (Andersen et al., 2014).

TCPP is not considered to be allergenic by skin contact, but in irritation tests a slight degree of skin and eye irritation was demonstrated. TCPP was not genotoxic or mutagenic neither in *in vitro* nor in *in vivo* animal studies (Andersen et al., 2014).

In view of the above, the effect on the liver is assessed to be the critical effect with a LOAEL value of 52 mg/kg bw/day, and this value is therefore used in the risk assessment in this report. The highest

[3] In the english version of Andersen et al. (2014) available from the Danish EPA it is stated that "The acute toxicity is low because most oral LD50 values are below 2000 mg/kg body". The authors of this report believe that the correct wording would be "... above 2000 mg/kg".

absorption occurs for oral exposure, where 80% of TCPP is absorbed why this value is used in the calculation of oral exposure. The dermal absorption is 40 % and this value is therefore used in the calculation of dermal exposure in this report.

TDCP
The absorption of **TDCP** based on animal studies is described in the EU RAR (EU RAR, 2008b) to be 100%, 100% and 30% for oral intake, inhalation and dermal absorption, respectively (the latter for handling of foam containing TDCP). These values are used in the exposure calculations. TDCP is extensively metabolised in the body and the metabolites are excreted primarily via the urine, but also via faeces and exhaled air.

A number of animal studies to elucidate the acute toxicity, skin, eye and respiratory tract irritation and sensitization are described in the EU RAR and it is concluded that TDCP has a low acute toxicity (LD50 values > 2000 mg/kg) and no significant potential for either irritation or sensitization.

With regard to repeated dose toxicity, a 2-year cancer study in rats has been conducted, in which groups of 60 male and female rats received diets containing TDCP at doses of 0, 5, 20 and 80 mg/kg bw/day. Significantly higher mortality was observed in the high dose group of males. This study resulted in a LOAEL of 5 mg/kg bw/day for effects on kidneys and testicles. The effects on the kidney (hyperplasia) can be interpreted as a pre-neoplastic lesion, which may lead to tumour formation. Therefore, the established LOAEL of 5 mg/kg bw/day is also considered to be the effect concentration for carcinogenic effects. Several studies of mutagenicity suggest that TDCP is mutagenic *in vitro* but not *in vivo*. The classification of TDCP as Cat. 2 Carc. is based on the rat study and the mutagenicity studies.

In another animal study with repeated dosing, neurotoxic effects were studied but dose-related effects could not be demonstrated. One epidemiological study from a company producing TDCP showed no adverse health effects associated with exposure to TDCP.

A NOAEL value derived on the basis of a reproduction toxicity study in rats exposed to 0, 25, 100 and 400 mg/kg/d on days 6-15 of gestation was used for risk assessment. A NOAEL of 100 mg/kg bw/d was determined based on a statistically significant increased bone resorption, reduced fetal viability and maternal toxicity.

Based on the foregoing, the effect on kidneys and potentially subsequent tumour formation is assessed to be the critical effect with a LOAEL of 5 mg/kg bw/d and this value is therefore used in the risk assessment. The highest absorption occurs by oral exposure, which results in 100% absorption (in animal studies), whereas dermal exposure results in 30% absorption. These values are used in the exposure calculations in this report.

Determination of Derived-no-effect-levels (DNEL)
The determination of DNEL values for the phosphorus-based flame-retardants is described below and the values are listed in **Fejl! Henvisningskilde ikke fundet.**.

The DNEL value for **TCEP** is calculated based on a LOAEL for kidney damage of 12 mg/kg bw/d from a 18-month oral carcinogenicity study in mice (EU RAR, 2009). As the scientific committe SCHER has already evaluated TCEP in toys (SCHER, 2012), the same uncertainty factors as used by SCHER are used in the present assessment, i.e. 10 for interspecies variation, 10 for intraspecies variability and3 for extrapolation from LOAEL to NOAEL. An additional factor of 3 to account for the uncertainty about the importance of TCEP with regard to formation of tumours in humans was also introduced. The latter takes into account that there is a lack of knowledge about the mode-of-action of the substance as well as indications of a threshold for tumour formation. This gives a total

uncertainty factor of 900. As the mice are exposed orally and 100% absorption of TCEP is assumed, the DNEL value for systemic effects becomes 0.013 mg/kg bw/d. For comparison, use of default uncertainty factors recommended by ECHA and shown in Table 6-1 would result in a factor of 17.5 for interspecies variation contrary to the factor of 10 used by SCHER.

The DNEL value of 0.007 mg/kg bw/d for **TCPP** is based on a LOAEL of 52 mg/kg bw/day determined in an oral 90-day rat study corresponds to an internal dose of 41.6 mg/kg bw/day when taking 80% uptake of TCPP by oral exposure into account. The following uncertainty factors are used: interspecies variation (10 (allometric scaling (4), other differences (2.5)), intraspecies variation (10), extrapolation from LOAEL to NOAEL (3) and for the duration of the study (2), i.e. a total uncertainty factor of 600 (Andersen et al., 2014). The DNEL value of 0.07 mg/kg bw/d is within the interval indicated by SCHER for the TDI of 0.057-0.17 mg/kg bw/d.

The DNEL value of 0.005 mg/kg bw/d for **TDCP** is based on an oral LOAEL of 5 mg/kg bw/day determined in the 2-year cancer study. The calculations are based on 100% oral uptake of TDCP and therefore the internal dose is equal to the values found. The total uncertainty factor of 1000 is composed of the following: interspecies varitation (10 (allometric scaling (4), other differences (2.5)), intraspecies varitation (10) and extrapolation from LOAEL to NOAEL (10). The uncertainty factor for extrapolation from LOAEL to NOAEL is in this case set to 10, since hyperplasia in the kidney is considered a serious effect (Andersen et al., 2014). The DNEL value of 0.005 mg/kg bw/d is within the interval indicated by SCHER for the TDI of 0.005-0.016 mg/kg bw/d.

For the above-mentioned susbstances, the Commission Directive 2014/79/EC of 20 June 2014 on toy safety sets a limit content of 5 mg/kg for TCEP, TCPP and TDCP in toys intended for children under 36 months and toys intended to be put in the mouth, applicable to each of the three substances.

TABLE 6-3
DNEL VALUES FOR PHOSPHORUS-BASED FLAME RETARDANTS.

Substance	Cas no.	Systemic DNEL	Source
TCEP	115-96-8	0.013 mg/kg bw/d	Determined from a LOAEL of 12 mg/kg bw/d and a total AF of 900 as suggested by SCHER.
TCPP	13674-84-5	0.07 mg/kg bw/dag	Andersen et al., 2014
TDCP	13674-87-8	0.005 mg/kg bw/dag	Andersen et al., 2014

6.3 Assessment of human exposure

Based on the results of the survey and the assessment of the potential for exposure, three product types (car safety seats, baby slings and baby mattresses) are selected for further exposure and risk assessment. The exposure assessment is based on the results of the migration tests from samples taken from car safety seats, baby slings, and mattresses, supplemented with data from the literature.

6.3.1 Method for calculation of human exposure

Calculations of the potential exposure of children using the products from the survey will be based on worst-case scenarios to illustrate the potential dermal and oral exposure of children, mainly aged 1-12 months. If the assumptions used in the worst-case scenarios indicate a risk, the scenarios will be refined using more realistic assumptions. If the worst-case scenarios do not indicate a risk, no further calculations will be carried out.

Dermal exposure

Dermal exposure is assumed to be the most common route of exposure regarding car safety seats, baby slings and baby mattresses. Exposure calculation will as a starting point assume that children only wear diapers/pants, but otherwise are undressed so that direct exposure to chemical substances migrating from the analysed materials is possible on the remaining part of the body.

Development of scenarios follow the principles in the REACH guidance, "Guidance on Information Requirements and Chemical Safety Assessment. Chapter R.15 - Consumer exposure estimation", version 2.1 of October 2012 (ECHA, 2012b). Parameters used in the exposure calculation are shown in Table 6-4.

TABLE 6-4
PARAMETERS USED IN THE EXPOSURE SCENARIOS FOR DERMAL ABSORPTION (FROM ECHA, 2012A).

Parameter	Description	Unit
Migr.	Amount of substance migrating to artificial sweat per surface area of the product per unit time	mg/cm²/hour
$T_{contact}$	Contact duration between article and skin per event	hour/event
n	Mean number of events per day	/d
A_{skin}	Area of contact between product and skin	cm²
bw	Body weight	kg
F_{abs} *	Dermal absorption	%
Resulting parameter	**Description**	**Unit**
L_{der}	Dermal load on the skin that is expected due to migration	mg/cm²
$D_{der, external}$	Dermal dose per day and body weight	mg/kg bw/d
$D_{der, internal}$	Dermal absorbed dose per day and body weight	mg/kg bw/d

* For a Tier 1 estimate a dermal absorption of 100 % is usually applied.

The dermal load can, based on measurements of migration to artificial sweat, be calculated in accordance with the following formula:

$$L_{der} = Migr \cdot T_{contact}$$

The external dermal dose is calculated according to the following formula:

$$D_{der,ekstern} = \frac{L_{der} \cdot A_{skin} \cdot n}{BW}$$

If the dermal absorption is included in the formula, the internal dermal dose (the quantity that can be absorbed and transferred to the bloodstream) can be calculated as follows:

$$D_{der,intern} = \frac{L_{der} \cdot A_{skin} \cdot F_{abs} \cdot n}{BW}$$

Oral exposure

Oral exposure related to the tested products is possible in varying degrees. The exposure time will typically be shorter than the useful life, as the children are not expected to suck on products all the time. In relation to the exposure calculations, the time at which the child will be able to suck on the products per day will be estimated

The development of the exposure scenarios will likewise be in line with the REACH guidelines (ECHA, 2012b). No migration tests with saliva have been conducted. As migration to sweat simulant is expected to provide results in the same order of magnitude as saliva simulant, the calculation of the oral exposure will be based in the results from the artificial sweat.
Children will only be exposed to a part of the product surface. In relation to the exposure calculations, the proportion of the total surface of the product that the child's mouth can be in contact with will be determined.

Parameters used in the exposure calculation are shown in Table 6-5.

TABLE 6-5
PARAMETERS USED IN THE EXPOSURE SCENARIOS FOR ORAL EXPOSURE (FROM ECHA, 2012B).

Parameters	Description	Unit
Migr.	Amount of substance migrating to artificial sweat per surface area of the product per unit time	mg/cm²/hour
$T_{contact}$	Contact duration between article and saliva per hour per day	hour/day
$A_{product}$	Area of total surface of contact between product and saliva	cm²
bw	Body weight	kg
F_{abs} *	Oral absorption	%
Resulting parameters	**Description**	**Unit**
D_{oral}	Oral dose per day and body weight	mg/kg bw/d

* For a Tier 1 estimate an oral absorption of 100 % is usually applied.

In connection with the chemical analyses only migration test to artificial sweat and not specifically to the artificial saliva have been conducted. The calculation of the daily oral dose is therefore carried out based on measurements of the migration to artificial sweat in accordance with the following formula:

$$D_{oral} = \frac{Migr \cdot T_{contact} \cdot A_{product} \cdot}{BW}$$

If the absorption by oral intake is inserted in the formula, the internal daily dose can be calculated as follows:

$$D_{oral,int} = \frac{Migr \cdot T_{contact} \cdot A_{produkt} \cdot n \cdot F_{abs}}{BW}$$

6.3.2 Estimation of dermal exposure

The parameters used for the scenarios for dermal exposure via car safety seats, baby slings and mattresses are shown for each of the substances TCEP, TCPP and TDCP in Table 6-6 , Table 6-7 and **TABLE 6-8** , respectively. The values are based on children aged 6-12 months and with a weight of 9.2 kg for the investigated car safety seats, children aged 1-3 months and weighing 5.6 kg for the investigated baby slings and children aged 3-6 months and with a weight of 7.4 kg for the investigated baby mattresses (US EPA, 2011). The exposed skin surfaces reflect the age of the children, as well as the different body parts that are expected to be in contact with the textile surfaces from the different products.

Different contact surface areas (A_{skin}) between the product and skin are assumed in the worst-case scenarios. For car safety seats a total skin area of 1835 cm² is applied, based on an assumption that half of the 6-12 months child's torso, legs and head, and a quarter of the child's arms are in contact with the surface of the textile product. For baby slings a skin area of 740 cm² is used, based on an assumption that half of the 1-3 month baby's torso and a quarter of the baby's head are in contact with the product's textile surface. For baby mattresses it is assumed that half of the 3-6 month baby's skin surface in contact with the textile surface of the product, which means a contact surface of 1900 cm² (US EPA, 2011). For all products, it is assumed that children sweat when using the products. It is generally assumed that the results of the individual samples are representative of the entire contact area, although this will not be the case in all situations.

Dermal exposure based on the results of the migration test from artificial sweat. The substance specific parameters used for the exposure calculations are shown in the tables below.

TABLE 6-6
PARAMETERS FOR THE CALCULATION OF WORST-CASE SCENARIOS FOR DERMAL ABSORPTION OF TCEP FROM CAR SAFETY SEATS, BABY SLINGS AND BABY MATTRESSES. AN ABSORPTION OF 100% IS APPLIED (F_{ABS} = 1).

TCEP	$T_{contact}$	n	A_{skin}	bw	Migration	L_{der}	$D_{der, external}$	$D_{der, internal}$
Product	**h**	**d^{-1}**	**cm^2**	**Kg**	**(mg/cm²/h)**	**(mg/cm²)**	**mg/kg bw/d**	
Car safety seats								
A3B[1]	1	1	1835	9.2	< 1.67 x 10^{-5}	< 1.67 x 10^{-5}	< 3.32 x 10^{-3}	< 3.32 x 10^{-3}
A4[2]	1	1	1835	9.2	< 3.3 x 10^{-6}	< 3.3 x 10^{-6}	< 6.65 x 10^{-4}	< 6.65 x 10^{-4}
A5A[2]	1	1	1835	9.2	< 1 x 10^{-5}	< 1 x 10^{-5}	< 1.99 x 10^{-3}	< 1.99 x 10^{-3}
A8A[3]	1	1	1835	9.2	4.3 x 10^{-3}	4.3 x 10^{-3}	0.864	0.864
Baby slings								
B12A[4]	1	1	740	5.6	3.67 x 10^{-4}	3.67 x 10^{-4}	3.67 x 10^{-2}	3.67 x 10^{-2}
B18A[5]	1	1	740	5.6	2.07 x 10^{-2}	2.07 x 10^{-2}	2.07	2.07
Baby matresses								
M24B[4]	3	1	1900	7.4	< 1.67 x 10^{-5}	< 5 x 10^{-5}	< 1.70 x 10^{-2}	< 1.70 x 10^{-2}

1 Grey textile and foam + backside; 2 textile with foam; 3 textile and foam; 4 foam; 5 foam and felt

TABLE 6-7
PARAMETERS FOR THE CALCULATION OF WORST-CASE SCENARIOS FOR DERMAL ABSORPTION OF TCPP FROM CAR SAFETY SEATS, BABY SLINGS AND BABY MATTRESSES. AN ABSORPTION OF 40 % IS APPLIED (F_{ABS} = 0.4)

TCPP	$T_{contact}$	n	A_{skin}	bw	Migration	L_{der}	$D_{der, external}$	$D_{der, internal}$
Product	**h**	**d^{-1}**	**cm^2**	**Kg**	**(mg/cm²/h)**	**(mg/cm²)**	**mg/kg bw/d**	
Car safety seats								
A3B[1]	1	1	1835	9.2	2.1 x 10^{-3}	2.1 x 10^{-3}	0.42	0.17
A4[2]	1	1	1835	9.2	3.67 x 10^{-5}	3.67 x 10^{-5}	7.31 x 10^{-3}	2.93 x 10^{-3}
A5A[2]	1	1	1835	9.2	1.07 x 10^{-4}	1.07 x 10^{-4}	2.13 x 10^{-2}	8.51 x 10^{-3}
A8A[3]	1	1	1835	9.2	8.67 x 10^{-3}	8.67 x 10^{-3}	1.73	0.69
Baby slings								
B12A[4]	1	1	740	5.6	2.37 x 10^{-2}	2.37 x 10^{-2}	3.13	1.25
B18A[5]	1	1	740	5.6	3.67 x 10^{-2}	3.67 x 10^{-2}	4.85	1.94
Baby matresses								
M24B[4]	3	1	1900	7.4	< 1 x 10^{-4}	< 3 x 10^{-4}	7.70 x 10^{-2}	3.08 x 10^{-2}

1 Grey textile and foam + backside; 2 textile with foam; 3 textile and foam; 4 foam; 5 foam and felt

Table 6-8
PARAMETERS FOR THE CALCULATION OF WORST-CASE SCENARIOS FOR DERMAL ABSORPTION OF TDCP FROM CAR SAFETY SEATS, BABY SLINGS AND BABY MATTRESSES. AN ABSORPTION OF 30% IS APPLIED (F_{ABS} = 0.3)

TDCP	$T_{contact}$	n	A_{skin}	bw	Migration	L_{der}	$D_{der,\ external}$	$D_{der,\ internal}$
Product	h	d^{-1}	cm^2	Kg	($mg/cm^2/h$)	(mg/cm^2)	mg/kg bw/d	
Car safety seats								
A3B[1]	1	1	1835	9.2	1.40×10^{-3}	1.40×10^{-3}	0.28	8.38×10^{-2}
A4[2]	1	1	1835	9.2	1.57×10^{-3}	1.57×10^{-3}	0.31	9.37×10^{-2}
A5A[2]	1	1	1835	9.2	5×10^{-3}	5×10^{-3}	1.00	0.30
A8A[3]	1	1	1835	9.2	6.67×10^{-4}	6.67×10^{-4}	0.13	3.99×10^{-2}
Baby slings								
B12A[4]	1	1	740	5.6	$< 2 \times 10^{-5}$	$< 2 \times 10^{-5}$	$< 2.64 \times 10^{-3}$	$< 7.93 \times 10^{-4}$
B18A[5]	1	1	740	5.6	2.20×10^{-3}	2.20×10^{-3}	0.29	8.72×10^{-2}
Baby mattresses								
M24B[4]	3	1	1900	7.4	7×10^{-3}	2.10×10^{-2}	5.39	1.62

1 Grey textile and foam + backside; 2 textile with foam; 3 textile and foam; 4 foam; 5 foam and felt

6.3.3 Oral exposure

The parameters used for the scenarios for oral exposure via car safety seats, baby slings and mattresses are shown for each of the substances TCEP, TCPP and TDCP in Table 6-9, Table 6-10 and Table 6-11, respectively. The values are based on children aged 6-12 months and with a weight of 9.2 kg for the investigated car safety seats, children aged 1-3 months and weighing 5.6 kg for the investigated baby slings and children aged 3-6 months and with a weight of 7.4 kg for the investigated baby mattresses (US EPA, 2011).

It is assumed in the worst-case scenario that the child sucks on the textile from the car seat and baby sling, respectively, for half of the total use period, equivalent to 30 min. and that the child sucks on an area of 10 cm^2 textile, which corresponds to the area normally considered in relation to toys. For baby mattresses, it is assumed that the child sucks on the textile in contact with the mattress for 30 min. of the total usage time of 3 hours per occurrence and likewise an area of 10 cm^2. In this case, the worst-case assumption is that the substances will migrate from the mattress foam to the textile cover in an area corresponding to the analysed samples. Migration analyses have been performed on samples with a thickness of 2.8 cm and the estimated exposure is based on the contents herein. An oral absorption of 100% is applied for TDCP and TCEP and an absorption of 80% is used for TCPP.

TABLE 6-9
PARAMETERS FOR THE CALCULATION OF WORST-CASE SCENARIOS FOR ORAL ABSORPTION OF TCEP FROM CAR SAFETY SEATS, BABY SLINGS AND BABY MATTRESSES. AN ABSORPTION OF 100% IS APPLIED (F_{ABS} = 1).

TCEP	$T_{contact}$	n	$A_{product}$	bw	Migration	$D_{oral,\ external}$	$D_{oral,\ internal}$
Product	h	d^{-1}	cm^2	Kg	($mg/cm^2/h$)	mg/kg bw/d	
Car safety seats							
A3B[1]	0.5	1	10	9.2	$< 1.67 \times 10^{-5}$	$< 9.06 \times 10^{-6}$	$<9.06 \times 10^{-6}$
A4[2]	0.5	1	10	9.2	$< 3.3 \times 10^{-6}$	$< 1.81 \times 10^{-6}$	$< 1.81 \times 10^{-6}$
A5A[2]	0.5	1	10	9.2	$< 1 \times 10^{-5}$	$< 5.43 \times 10^{-6}$	$< 5.43 \times 10^{-6}$
A8A[3]	0.5	1	10	9.2	4.3×10^{-3}	2.36×10^{-3}	2.36×10^{-3}

TCEP	$T_{contact}$	n	$A_{product}$	bw	Migration	$D_{oral,\ external}$	$D_{oral,\ internal}$
Product	**h**	**d^{-1}**	**cm^2**	**Kg**	**($mg/cm^2/h$)**	**mg/kg bw/d**	
Baby slings							
B12A[4]	0.5	1	10	5.6	3.67×10^{-4}	3.27×10^{-4}	3.27×10^{-4}
B18A[5]	0.5	1	10	5.6	2.07×10^{-2}	1.85×10^{-2}	1.85×10^{-2}
Baby mattresses							
M24B[4]	0.5	1	10	7.4	$< 1.67 \times 10^{-5}$	$< 1.13 \times 10^{-5}$	$< 1.13 \times 10^{-5}$

1 Grey textile and foam + backside; 2 textile with foam; 3 textile and foam; 4 foam; 5 foam and felt

TABLE 6-10
PARAMETERS FOR THE CALCULATION OF WORST-CASE SCENARIOS FOR ORAL ABSORPTION OF TCPP FROM CAR SAFETY SEATS, BABY SLINGS AND BABY MATTRESSES. AN ABSORPTION OF 80% IS APPLIED (F_{ABS} = 0.8).

TCPP	$T_{contact}$	n	$A_{product}$	bw	Migration	$D_{oral,\ external}$	$D_{oral,\ internal}$
Product	**h**	**d^{-1}**	**cm^2**	**Kg**	**($mg/cm^2/h$)**	**mg/kg bw/d**	
Car safety seats							
A3B1	0.5	1	10	9.2	2.1×10^{-3}	1.14×10^{-3}	9.13×10^{-4}
A42	0.5	1	10	9.2	3.67×10^{-5}	1.99×10^{-5}	1.59×10^{-5}
A5A2	0.5	1	10	9.2	1.07×10^{-4}	5.80×10^{-5}	4.64×10^{-5}
A8A3	0.5	1	10	9.2	8.67×10^{-3}	4.71×10^{-3}	3.77×10^{-3}
Baby slings							
B12A4	0.5	1	10	5.6	2.37×10^{-2}	2.11×10^{-2}	1.69×10^{-2}
B18A5	0.5	1	10	5.6	3.67×10^{-2}	3.27×10^{-2}	2.62×10^{-2}
Baby mattresses							
M24B4	0.5	1	10	7.4	$< 1 \times 10^{-4}$	$< 6.76 \times 10^{-5}$	$< 5.41 \times 10^{-5}$

1 Grey textile and foam + backside; 2 textile with foam; 3 textile and foam; 4 foam; 5 foam and felt

TABLE 6-11
PARAMETERS FOR THE CALCULATION OF WORST-CASE SCENARIOS FOR ORAL ABSORPTION OF TDCP FROM CAR SAFETY SEATS, BABY SLINGS AND BABY MATTRESSES. AN ABSORPTION OF 100% IS APPLIED (F_{ABS} = 1).

TDCP	$T_{contact}$	n	$A_{product}$	bw	Migration	$D_{oral,\ external}$	$D_{oral,\ internal}$
Product	**h**	**d^{-1}**	**cm^2**	**Kg**	**($mg/cm^2/h$)**	**mg/kg bw/d**	
Car safety seats							
A3B[1]	0.5	1	10	9.2	1.40×10^{-3}	7.61×10^{-4}	7.61×10^{-4}
A4[2]	0.5	1	10	9.2	1.57×10^{-3}	8.51×10^{-4}	8.51×10^{-4}
A5A[2]	0.5	1	10	9.2	5×10^{-3}	2.72×10^{-3}	2.72×10^{-3}
A8A[3]	0.5	1	10	9.2	6.67×10^{-4}	3.62×10^{-4}	3.62×10^{-4}
Baby slings							
B12A[4]	0.5	1	10	5.6	$< 2 \times 10^{-5}$	$< 1.79 \times 10^{-5}$	$< 1.79 \times 10^{-5}$
B18A[5]	0.5	1	10	5.6	2.20×10^{-3}	1.96×10^{-4}	1.96×10^{-4}
Baby mattresses							
M24B[4]	0.5	1	10	7.4	7×10^{-3}	4.73×10^{-3}	4.73×10^{-3}

1 Grey textile and foam + backside; 2 textile with foam; 3 textile and foam; 4 foam; 5 foam and felt

6.4 Health risk assessment

Based on the results of the exposure assessment and the identified or predicted DNELs, the risk characterization ratio is calculated as:

$$RCR = \frac{Eksponering}{DNEL}$$

The calculation of the risk characterization ratio is based on internal exposure and the determined DNEL values for systemic effects. If RCR > 1 there is a risk.

The dermal exposure is based on the results of the migration test and the maximum values observed and an assumption of 100, 40 and 30 % absorption for TCEP, TCPP and TDCP, respectively. The oral exposure is also based migration to sweat (from an area of 10 cm^2) since no migration test with artificial saliva have been conducted, as well as an assumption of 100, 80 and 100 % absorption for TCEP, TCPP and TDCP, respectively (see section 6.2.2).

It is assumed that the child sits for 1 hour in the car seat and in the baby sling and lies for 3 hours on the mattress (see Table 3-1)

TABLE 6-12
CALCULATION OF RISK CHARACTERISATION RATIO FOR ORAL AND DERMAL EXPOSURE TO TCEP.

TCEP	DNEL: 0.013 mg/kg bw/d			
Product	$D_{der,\ internal}$	$D_{oral,\ internal}$	RCR_{dermal}	RCR_{oral}
	mg/kg bw/d	mg/kg bw/d		
Car safety seats				
A3B1	< 3.32×10^{-3}	< 4.53×10^{-6}	0.26	6.97×10^{-4}
A42	< 6.65×10^{-4}	< 9.06×10^{-7}	0.05	1.39×10^{-4}
A5A2	< 1.99×10^{-3}	< 2.72×10^{-6}	0.15	4.18×10^{-4}
A8A3	0.864	1.18×10^{-3}	**66.49**	0.18
Baby slings				
B12A4	4.85×10^{-2}	1.64×10^{-4}	**3.73**	2.52
B18A5	2.73	9.23×10^{-3}	**210.1**	**1.42**
Baby mattresses				
M24B4	< 1.28×10^{-2}	< 5.63×10^{-6}	0.99	8.66×10^{-4}

TABLE 6-13
CALCULATION OF RISK CHARACTERISATION RATIO FOR ORAL AND DERMAL EXPOSURE TO TCPP.

TCPP	DNEL: 0.07 mg/kg bw/d			
Product	$D_{der,\ internal}$	$D_{oral,\ internal}$	RCR_{dermal}	RCR_{oral}
	mg/kg bw/d	mg/kg bw/d		
Car safety seats				
A3B1	0.17	4.57×10^{-4}	**2.39**	$1.3\ 10^{-2}$
A42	2.93×10^{-3}	7.97×10^{-6}	0.04	$2.28\ 10^{-4}$
A5A2	8.51×10^{-3}	2.32×10^{-5}	0.12	$6.63\ 10^{-4}$
A8A3	0.69	1.88×10^{-3}	**9.88**	$5.38\ 10^{-2}$
Baby slings				
B12A4	1.25	8.45×10^{-3}	**17.87**	0.24
B18A5	1.94	1.31×10^{-2}	**27.69**	0.37

TCPP	DNEL: 0.07 mg/kg bw/d			
Product	$D_{der,\ internal}$	$D_{oral,\ internal}$	RCR_{dermal}	RCR_{oral}
	mg/kg bw/d	mg/kg bw/d		
Baby mattresses				
M24B4	3.08×10^{-2}	$< 2.70 \times 10^{-5}$	0.44	7.72×10^{-4}

TABLE 6-14
CALCULATION OF RISK CHARACTERISATION RATIO FOR ORAL AND DERMAL EXPOSURE TO TDCP.

TDCP	DNEL: 0.005 mg/kg bw/d			
Product	$D_{der,\ internal}$	$D_{oral,\ internal}$	RCR_{dermal}	RCR_{oral}
	mg/kg bw/d	mg/kg bw/d		
Car safety seats				
A3B1	8.38×10^{-2}	3.80×10^{-3}	**16.75**	0.15
A42	9.37×10^{-2}	4.26×10^{-4}	**18.75**	0.17
A5A2	0.30	1.36×10^{-3}	**59.84**	0.54
A8A3	3.99×10^{-2}	1.81×10^{-4}	**7.98**	7.25×10^{-3}
Baby slings				
B12A4	$< 7.93 \times 10^{-4}$	$< 8.93 \times 10^{-6}$	0.16	$3.57\ 10^{-3}$
B18A5	8.72×10^{-2}	9.82×10^{-4}	**17.44**	0.39
Baby mattresses				
M24B4	1.62	2.36×10^{-3}	**323.51**	0.95

First step in the risk assessment is to set up very conservative assumptions in order to stop the assessment here if possible, provided not even these conservative assumptions will lead to RCR values above 1.

As the calculations in Table 6-12 to Table 6-14 show, the RCR values indicate, based on the applied worst-case assumptions, that there may be a unaccptable risk associated with dermal exposure to TCEP and TCPP in some of the car safety seats and in baby slings and oral exposure to TCEP in one of the baby slings. For TDCP the RCR values indicate a risk associated with car safety seats, baby slings and baby mattresses.

Since the results as mentioned are based on very conservative assumptions, these assumptions are reviewed again for the affected products.

6.4.1 Revised health risk assessment

In the following section, the preconditions for risk calculations are discussed and adjusted in order to make them more realistic. It is estimated that it is not immediately relevant to adjust the uncertainty factors used in the DNEL calculations.

Car safety seats

A_{skin}: In the worst case calculation it is assumed that the textile of the car seat comes in contact with an area equivalent to 40% of the child's skin surface. This is extremely conservative as children of 6-12 months only in rare cases and only limited to the summer months can be expected to sit in the car seat wearing only a diaper. A more realistic estimate would be that 25% of the surface area of the childrens arms, hands and legs come into contact with the textile, corresponding to approximately 10% of the total area and 445 cm^2.

Migration: It is assumed in the worst case scenario that the same amount, which was measured in the migration test to the artificial sweat, will also migrate out of the material under normal use and come into contact with the child. This assumption may not be realistic, as the amount of sweat is likely to be limited in most of cases where children are sitting in the car seat. Many cars are equipped with air conditioning, and if not, it is likely that users would otherwise provide ventilation when the temperature is so high that children will sweat. Furthermore the migration analyses have been performed in a way where the sample (i.e. both the textile and the underlying foam) has been immersed in the sweat simulant and thus the substances contained in both textile and foam can been released directly to the artificial sweat. Under normal conditions, the textile in itself will act as a barrier to migration from the foam part. The amount that migrates out of the material is therefore assumed to represent a maximum of 10% of the quantity found in the migration analysis.

F_{abs}: In the worst case calculation it is assumed that 100% of the amount of TCEP that could potentially migrate out of the material in contact with sweat is absorbed through skin. Although the substance is problematic when it comes in contact with skin, 100% absorption, during the period of time the child is sitting in chairs is a very conservative assumption, as dermal absorption is expected to take place very slowly. A more realistic estimate of F_{abs} for TCEP is 50%. The dermal absorption for TCPP and TDCP is not adjusted, thus still assumed to be 40% and 30%

Baby slings

A_{skin}: It is assumed in the worst-case calculation that the textile from the baby sling comes into contact with an area equivalent to 22% of the child's skin surface. This is also considered conservative, and a more realistic assumption is that a maximum of 25% of the torso, corresponding to 295 cm² comes into contact with the baby sling, since the children are assumed to be wearing at least a diaper, and only one side of the body is exposed.

Migration: Also for baby slings, it is assumed in the worst-case scenario that the same amount, which was measured in the migration test to the artificial sweat, also will migrate out of the material under normal use and come into contact with the child. Analyses were performed on foam and on foam and felt together, respectively, since the initial screening analyses indicated that the substances were only available in the foam. The sample has been immersed in the sweat simulant and have thus the substances contained in all materials can been released directly to the liquid. For the baby sling, the felt will act as a barrier to migration from the foam part. The amount that migrates out of the material and through the felt is therefore assumed to represent a maximum of 10% of the quantity found in the migration analysis.

F_{abs}: As with car safety seats, it is initially assumed that 100% of the amount of TCEP that could potentially migrate out of the material in contact with sweat is absorbed through skin. A more realistic estimate of F_{abs} for TCEP is 50%, as the absorption is expected to take place very slowly. The dermal absorption for TCPP and TDCP is not adjusted, thus still assumed to be 40 and 30%, respectively. For TCEP the oral absorbtion is still assumed to be 100%.

Baby Mattresses

A_{skin}: In the worst-case calculation, it is assumed that the mattress is in contact with about 50% of the child's skin surface. This estimate is also be considered conservative, as it will not be possible during the total exposure period, when the child is laying on a flat surface, and a more realistic estimate of the contact surface is considered to be 25% of the surface skin, i.e. 950 cm². In addition children are expected to wear night chlothes a major part of the year.

Migration: Also for baby mattresses, it is assumed in the worst-case scenario that the same amount, which was measured in the migration test to the artificial sweat, will migrate out of the material under normal use and come into contact with the child. Baby mattresses are expected to have a textile cover to protect the mattress and in addition to be covered by a sheet during use. The

analysis was performed on the foam itself, which was immersed in the sweat simulant was able to release the substances directly to the liquid; however, during use covers and bed sheets will act as barriers to migration to the child's skin. The amount that migrates out of the material and through the textile is therefore assumed to be maximum 10% of the quantity found in the migration analysis. This is supported by results from the initial quantitative analysis of the foam from a mattress, where TDCP were found in a level of 89,700 mg/kg, whereas the content of TDCP in textile cover on the mattress 92 mg/kg, thus almost 1000 times lower.

F_{abs}: F_{abs} of TDCP assumed to continue to be 30%, since the child is expected to be in contact with mattress for a longer time than in the case of car safety seats and baby slings.

TABLE 6-15
CALCULATION OF REVISED RISK CHARACTERISATION RATIO FOR DERMAL EXPOSURE

Product	A_{skin}	Migration	F_{abs}	L_{der}	$D_{der,\ external}$	$D_{der,\ internal}$	RCR_{Dermal}
	cm^2	(mg/cm2/h)		(mg/cm^2)	mg/kg bw/d		
TCEP			**(DNEL: 0.013 mg/kg bw/d)**				
Car safety seats							
A8A[3]	445	4.33×10^{-4}	0.5	4.33×10^{-4}	2.01×10^{-2}	1.05×10^{-2}	0.81
Baby slings							
B12A[4]	295	3.67×10^{-5}	0.5	3.67×10^{-5}	1.93×10^{-3}	9.66×10^{-4}	0.07
B18A[5]	295	2.07×10^{-3}	0.5	2.07×10^{-3}	0.11	5.44×10^{-2}	**4.19**
TCPP			**(DNEL: 0.07 mg/kg bw/d)**				
Car safety seats							
A3B[1]	445	2.1×10^{-4}	0.4	2.1×10^{-4}	1.02×10^{-2}	4.06×10^{-3}	0.06
A8A[3]	445	8.67×10^{-4}	0.4	8.67×10^{-4}	4.19×10^{-2}	1.68×10^{-2}	0.24
Baby slings							
B12A[4]	295	2.37×10^{-3}	0.4	2.37×10^{-3}	0.13	4.99×10^{-2}	0.71
B18A[5]	295	3.67×10^{-3}	0.4	3.67×10^{-3}	0.19	7.73×10^{-2}	**1.1**
TDCP			**(DNEL: 0.005 mg/kg bw/d)**				
Car safety seats							
A3B[1]	445	1.40×10^{-4}	0.3	1.40×10^{-4}	6.77×10^{-3}	2.03×10^{-3}	0.41
A4[2]	445	1.57×10^{-4}	0.3	1.57×10^{-4}	7.58×10^{-3}	2.27×10^{-3}	0.45
A5A[2]	445	5×10^{-4}	0.3	5×10^{-4}	2.42×10^{-8}	7.26×10^{-3}	**1.45**
A8A[3]	445	6.67×10^{-5}	0.3	6.67×10^{-5}	3.22×10^{-3}	9.67×10^{-4}	0.19
Baby slings							
B18A[5]	295	2.2×10^{-4}	0.3	2.2×10^{-4}	1.16×10^{-2}	3.48×10^{-3}	0.70
Baby mattresses							
M24B[4]	950	7×10^{-4}	0.3	2.1×10^{-3}	0.27	8.09×10^{-2}	**16.18**

With regard to oral exposure, the assumption of 10% migration of TCEP from the baby sling, B18A, will result in a risk characterisation ratio of 0.14 and thus an indication that the exposure is not considered unacceptable.

With regard to dermal exposure, it appears from Table 6-15 that the risk characterization ratios calculated after the revision using more realistic assumptions still indicate an unacceptable risk associated with the dermal exposure from the following products:

- **Car safety seats:**
  - Migration of TDCP from the car seat A5A (RCR = 1.45)

- **Baby slings:**
  - Migration of TCEP from the baby sling B18A (RCR = 4.19)
  - Migration of TCPP from the baby sling B18A (RCR = 1.1)

- **Baby mattresses:**
  - Migration of TDCP from the mattress M24B (RCR = 16.18)

It should be emphasized that in the estimation of migration from baby mattress is does not take into account the fact that mattrasses are normally expected to be protected with a cover and an additional sheet. These two layers of textiles are expected to act as an effective barrier towards the migrating substances based on the initial quantitative analysis, and to provide substantial protection of the children.

However, if the child is lying directly on the mattress without clothes, then the calculation indicates that there may be an undesirable risk associated with the skin contact.

The test samples from the car seat and the baby sling have been taken from areas expected to be in direct contact with the face. Samples include both felt and foam and as the results are obtained from the samples immersed in the sweat simulant, it will not be reflected if the textile part may be a barrier against the migration of the substances in the foam.

The risk assessment carried out does not account for exposure from other sources of TCEP, TCPP and TDCP. The assessment by the Scientific Committee, SCHER, of TCEP in toys indicates that there is exposure to TCEP from dermal contact with furniture and dust, inhalation and drinking water, which may also be possible for the other substances. In addition, it is also possible that children are exposed to substances from car safety seats, baby slings and mattresses within the same period of time.

7. Environmental assessment

7.1 Introduction

The preliminary hazard assessment also included a screening for harmonized environmental classification of substances/groups of substances that, according to the literature survey (see Chapter 2), had been identified in various previous studies of car safety seats or other textile products intended for children.

The results of this screening are presented in Appendix 3, but virtually none of the substances identified in this study have a harmonized environmental classification (with the phosphorus-based flame retardant TCEP classified "Aquatic Chronic 2" with hazard statement H411 as an exception). This does of course not exclude substances without harmonized classification from having inherent hazardous properties.

Environmental exposure to chemicals from the selected product groups - car safety seats, baby slings and baby mattresses - is estimated to be very limited. This is partly because the chemicals in those products are released only to a very limited degree in the products' lifetime. For example, they are usually not washed regularly, and that the consumption of the chemical substances used in car safety seats, baby slings and/or baby mattresses represent only a small part of the total consumption of those chemicals.

The specific chemical analyses in this project has included phosphorus-based flame retardants, brominated flame retardants, some phthalates, azo dyes, isocyanates and formaldehyde. However, as shown in Chapter 5, only a modest number of substances have been detected in quantities that are relevant for the further (primary health) assessment. The substances are a number of phosphorus-based, chlorinated flame-retardants in a number of samples, one phthalate (di-isodecylphthalate, DIDP) and aromatic amines as indicators of azo dyes in a few samples.

7.2 Environmental effects

In the following, the main ecotoxicological data of relevance for environmental risk assessment are presented for the substances detected in the samples at concentrations that cannot automatically be considered negligible.

7.2.1 Phosphorus-based flame retardants

At the initial GC/MS screening the presence of phosphorus-based flame retardants was demonstrated in 25 sub-samples representing 15 products (8 car safety seats, 6 baby slings and 1 baby mattress), which were then analysed quantitatively for four P-based flame retardants:

- TCEP: Tris (2-chloroethyl) phosphate, CAS no. 115-96-8
- TCPP: Tris (1-chloro-2-propyl) phosphate, CAS no. 13674-84-5
- TDCP: Tris (1,3-dichloro-2-propyl) phosphate, CAS no. 13674-87-8
- TPP: Triphenyl phosphate, CAS no. 115-86-6

As shown in Section 5.3.1, the substances TCPP and TDCP were identified most frequently and in the highest concentrations, while content above 0.1% of TCEP only occurred in two products. TPP was not detected in relevant concentrations and is not discussed further here.

For TCPP and TDCP the published REACH registration data found on the EU Chemicals Agency's (ECHA) website suggested the following "Predicted No Effect Concentration (PNEC)" values, i.e. the concentrations below which effects on aquatic organisms are not expected to occur:

- TCPP: PNEC (freshwater): 0.64 mg/liter
  PNEC (soil): 1.7 mg/kg soil dw
- TDCP: PNEC (freshwater): 0.01 mg/liter
  PNEC (soil): 0.33 mg/kg soil dw

Thus, TDCP is the most toxic of the two substances, and since this was also the flame retardant that was detected in high concentrations in most samples it seems reasonable to base a realistic worst-case assessment for the aquatic environment on the data for this substance, i.e. a PNEC = 0.01 mg/L.

7.2.2 Phthalates (DIDP)

An EU environmental risk assessment of di-isodecyl phthalate (DIDP) is available (EU RAR, 2003), in which the available ecotoxicological data for the substance are reviewed and assessed. The report presents the following most sensitive endpoints for the main groups of test organisms, i.e. fish, daphnia and algae:

- LC50 (fish): ≥0,47 mg/L
- EC50 (Daphnia): ≥0,18 mg/L
- EC50 (algae): ≥1,3 mg/L

There was no evidence of impact at the stated values, and since no reliable chronic test results were reported, it was found in the EU assessment that it was not possible to derive a PNEC.

For the assessment in this report we propose instead to apply the EU environmental quality standards (EQS) for the related phthalate DEHP (di (2-ethylhexyl)phthalate), which is 1.3 µg/L (= 0.0013 mg/L) (implemented in Denmark by Statutory Order No. 1022 of 25.08.2010) and is the lowest of the EQS's set for phthalates in this Order.

In the EU risk assessment of DEHP, a PNEC for soil of >13 mg/kg soil dw is derived.

7.2.3 Azo dyes

Azo dyes are determined not directly, but through some characteristic aromatic amines (see Chapter 5) that they may degrade to and for which limits are set under the REACH Regulation. In this study, the substance 4-methyl-m-phenylenediamine (= toluene-2,4-diamine; TDA) was found in two samples at levels around or above the permitted limit of 30 mg/kg. Other amines listed in Appendix 8 of the REACH Regulation Annex XVII were not detected or only found at trace level.

TDA is described and environmentally assessed in an EU risk assessment (EU RAR, 2008). Based on the available data the following PNECs for fresh water and soil were derived for TDA:

PNEC (freshwater): 1.6 mg/L
PNEC (soil): 0.32 mg/kg soil dw

This value is proposed to be used for risk assessment of azo dyes.

7.3 Environmental exposure

Chapter 6 on health assessment describes how the identified chemicals could be released from a textile product during use, including via air, and lead to exposure of humans. Release to **air** will typically occur very slowly through migration to and evaporation from the textile surface.

With regard to the **aquatic** environment, chemical substances in textiles for children will primarily be released indirectly via the public wastewater system in connection with washing of the products. Many of the substances end up primarily in the sludge phase at the sewage treatment plants, but some of the more water-soluble will to some extent remain (unchanged) in the aqueous phase and be discharged to the aquatic environment with the treated effluent. For the products in question it is, however, assessed that the frequency of washing is low (baby sling most frequently) or absent (foam part of baby mattresses).

With regard to **soil** the only relevant exposure route is assessed to be via application of sewage sludge on agricultural land.

Environmental exposure in the **waste** phase of the products is considered to low as the textile and foam parts of the products are expected to be disposed of/destructed in a waste incineration plant.

7.3.1 Exposure of the aquatic environment via sewage

At textile washing by consumers the spent wash water is assumed to be discharged into the public sewage system and on to a sewage treatment plant, where a substance will undergo transformation to varying degrees and there will be a distribution between the water phase and solid phase (sewage sludge), depending on the specific properties of the substance.

According to the ECHA guidance document (ECHA, 2012c) a standard EU sewage treatment plant is to be used for the assessment of the environmental exposure resulting from domestic washing. Such a plant has a capacity of 10,000 PE (person equivalents) and each PE contributes with 200 liters of water/day and 0,011 kg sludge dw/day. This corresponds for a sewage treatment plant of this size 730,000 m^3 of wastewater/year and 40 tons of sludge dw/year. In the current context it is assumed that the 10,000 PE are distributed over 2,500 households of four persons each.

In principle, the daily discharge of the studied compounds with sewage from a standard household /family can be calculated using the following formula:
Daily discharge of Substance-X from textile washing per household = Number of machine wash/day * Amount (w) of textile/wash * Proportion (%) of textile containing Substance-X * Proportion (%) of Substance-X in the textile * Proportion (%) of Substance-X emitted/wash.

Here, however, initially a **simplistic worst-case exposure calculation** will be made for an arbitrary substance, "Substance X", in an arbitrary product since the exposure beforehand is assessed to be very limited:

It is assumed that the content of Substance X in the product is 10,000 mg/kg, and that the product is washed one or more times in the course of a year, whereby the entire content of Substance-X (i.e. 100%) is released and discharged with the wastewater. The weight of the textile part of the product is set to 0.5 kg.

According to data retrieved from the Danish Statistics Bank (www.statistikbanken.dk), the proportion of 0-3 year olds (inclusive) in the Danish population per 1 January 2014 was approximately 4%. For the calculation here the fraction is, a bit more conservatively, set to 5%, corresponding to 500 children aged 0-3 years in the model catchment area (10,000 PE).

From this the total annual release of Substance-X to wastewater from washing of the childrens' textile products is calculated to be:
0.5 kg x 10,000 mg/kg x 100% x 500 = 2,500,000 mg = 2.5 kg.

The concentration in the wastewater becomes:
2,500,000 mg / 730,000 m^3 = 0.0034 mg/L = 3.4 µg/L.

In relation to the aquatic environment is assumed as worst case, that there will be no degradation of Substance-X place in the sewage treatment plant and that the entire amount is released to the water environment (i.e. 100 % allocation to the aqueous phase in the STP). Thereby, the Predicted Environmental Concentration, PEC, at the discharge point becomes 3.4 µg/L.

7.3.2 Exposure of soil environment via sewage sludge

As a worst-case exposure of soil during application of sewage sludge is assumed that Substance-X undergoes no degradation in the STP and is distributed 100 % to the sludge phase, after which the produced sludge is applied to farmland.

According to the REACH scenario the annual production of sludge at the standard STP is 0.011 kg sludge dw/day/PE x 10,000 PE x 365 days = 40.150 kg sludge dw/year ~ around 40 tonnes of sludge dw/year. According to the Danish Statutory Order on the use of sludge (Order no. 1650 of 13.12.2006), the maximum amount of sludge that can be applied on arable land is 7 tonnes dw/hectare/year (as an average over 10 years), which is equivalent to 7/40 (17.5%) of the sludge produced at the plant. This means that 17.5% of the released amount of Substance-X (i.e. 437,500 mg) is applied to 1 hectare (ha) of land.

If it is assumed that the sludge is mixed homogeneously in the upper 20 cm of the soil, and that the soil density is 1.5 t/m^3, the amount of directly exposed soil per hectare will be about 3000 tonnes. The concentration of Substance-X in the soil will then be 437,500 mg/3,000,000 kg soil dw = 0.15 mg/kg soil dw.

7.3.3 Environmental exposure through air

Emissions to air are evaluated under the health part of the project. The environmental impact of this emission from childrens textiles is estimated to be marginal and will not be quantified here.

7.4 Environmental risk assessment

A worst-case environmental risk assessment is carried out based on the lowest PNEC (or EQS value) that is identified for any substance in section 7.2, which is 1.3 µg/L for the substance di-isodecyl phthalate, DIDP (actually, the value applies to DEHP, but is used here to represent DIDP). The second lowest value is 10 µg/L for TDCP.

If the PNEC (EQS) for DIDP (i.e. 1.3 µg/L) is compared to the estimated worst-case concentration (PEC) of Substance-X in the effluent from the sewage treatment plant of 3.4 µg/L the following risk quotient (= PEC/PNEC) can be derived: **PEC/PNEC (freshwater) = 3.4/1.3 = 2.6.**

In other words, a dilution of 2.6 times in the receiving water body is required to meet the environmental (water) quality standard for Substance-X in the worst case. This is normally considered to be a low dilution factor (commonly a standard initial dilution factor of 10 is used). Given the conservative assumptions that were made for derivation of the PEC and that the lowest PNEC/EQS for any of the substances in question was used, it is not considered necessary to refine the calculation further as the risk to the aquatic environment from washing of childrens textiles obviously will be very small.

Regarding soil, the lowest PNEC value is for toluene-2,4-diamine (TDA), namely 0.32 mg/kg soil dw and since the PEC for Substance-X was calculated to be 0.15 mg/kg soil this gives the following risk quotient: **PEC/PNEC (soil) = 0.15/0.32 = 0.47.**

As the PEC/PNEC is <1, the risk from exposure of the soil as a result of the release of Substance-X from washing of childrens textiles is assessed to be negligible.

8. Conclusion

8.1 Survey

The results of the literature (and questionnaire) survey can be summarized as follows:

It is estimated that 75 - 80% of the car safety seats on the Danish market originate from countries outside the EU, and of these, the majority from China. The remaining 20-25% are produced in the EU, mostly in Germany but also in Italy. Car safety seats produced in the EU are typically more expensive than the Asian products. Regarding the other children's articles, there is a major producer of prams in Europe (covering roughly half of the market), while other children's articles as cradle seats, baby slings and bunting bags mostly originate from countries outside the EU (approximately 80%).

In general, it seems that dealers do not know whether harmful chemicals are present in the products or if chemicals are added to meet certain technical or functional requirements such as water repellancy or fire retardant properties.

Previous studies have shown that the following substances/substance groups can be present in significant concentrations:
- Phosphorus-based flame retardants (many car safety seats and other product groups).
- Phthalates (some car safety seats and other product groups).
- Brominated flame retardants (in a few car safety seats, and detection of bromine as an indicator in other product groups)
- Nonylphenol (baby slings)

A preliminary hazard assessment was performed for the key substances/groups that were previously found in relevant textile products, including car safety seats. Further, a preliminary exposure assessment was made related to products with textiles for children, especially small children. Based on these assessments, car safety seats, baby slings and baby mattresses were selected as product groups for the chemical analysis programme and a total of 30 products were purchased for the purpose.

8.2 Chemical analysis and testing

The first phase in the chemical analysis programme was a screening analysis of all 30 product samples by GC/MS. This was because the survey not had clearly identified specific substances or groups of substances which occurred frequently enough in the products to justify their selection for the further programme solely on basis of the survey. In the screening analyses several unidentifiable compounds occurred in low concentrations, i.e. concentrations that did not indicate that the substance had deliberately been added to provide the textile product with a specific functionality. Only few identifiable substances occurred in concentrations that were assessed to be significant in relation to possible health impacts. A screening analysis by X-ray (only comprising car safety seats) showed a high content of bromine in some samples, which could be due to content of brominated flame retardants, while a specific analysis of formaldehyde (not detectable by GC/MS) did not detect occurrence of this substance in any sample.

The specific substances that based on the results of the GC/MS screening and initial hazatd and exposure assessment were selected for quantitative chemical analysis were: phosphorus-based flame retardants, the phthalate DIDP, azo dyes (through certain aromatic amines as indicators), isocyanates and brominated flame retardants. Of these only the substances TCEP, TCPP and TDCP (all phosphorus-based flame retardants) and the phthalate DIDP occurred in significant concentrations, i.e. above the general lower limit for classification of hazardous substances in articles = 0.1 % = 1000 mg/kg. Further, a content of the aromatic amine, 4-methyl-m-amino-phenylenediamine (= 2,4-TDA) was detected at or above the limit value of 30 mg/kg in two products. The substance can be released from certain azo dyes that are regulated in textile and leather articles.

In contrast to this, the specific analyses revealed no presence of isocyanates or brominated flame retardants in concentrations above about 1 mg/kg, despite indications of some content by the screening analyses. It is therefore concluded for isocyanates that GC/MS screening is not a useful method to give indicate presence of these substances in various matrices, while for the brominated flame retardants is it assessed that the content of bromine in the samples probably is due to polymeric brominated flame retardants, which can not be detected by the analysis performed.

Testing of migration (to sweat) was performed for phosphorus-based flame retardants. The seven products having the highest content of one or more of the flame retardants were tested and migration was observed in all tests, albeit in greatly varying extent.

Overall, it is concluded that in previous studies of textile products several chemical substances considered potentially hazardous to health or the environment have been found in a number of products, but these substances were only to a very limited extent found to be present in the 30 products analysed in this project.

8.3 Health assessment

On the basis of the results of the quantitative chemical analysis an assessment of health risks was performed for the substances that migrate out of the products to a significant extent, since this occurrence may result in exposure via the individual product types. The hazard assessment therefore focuses on the three phosphorus-based flame retardants (TCEP, TCPP and TDCP), while no risk assessment have been conducted for either diisodecyl phthalate (DIDP) or the aromatic amines from azo dyes.

Phosphorus-based flame retardants

TCEP is associated with a low to moderate acute toxicity. In rat studies, it appears that up to 90% of the substance is absorbed after oral intake. Lesions in the kidney after repeated exposure is assessed to be the most sensitive endpoint with a LOAEL of 12 mg/kg bw/d. The substance has not been shown to be mutagenic, but is classified as a carcinogen in category 2 (C2), with a carcinogenic effect related to the effects on the kidneys. TCEP has also been shown to be toxic to reproduction in mice and rats (Repr. 1B), and a NOAEL of 175 mg/kg bw/d is set because of impairment of fertility in both sexes.

TCPP is considered to have a low acute toxicity. Up to 80% of the substance is rapidly absorbed after oral intake, and dermal absorption studies have shown that a dermal absorption of 40% can be used for TCPP. Based on analogy with TCEP, TCPP is also classified as Carc. 2, H451. In a 90 day study in rats, a LOAEL value of 52 mg/kg bw/day was determined based on effects on liver and the thyroid gland. *In vitro* studies also indicate some endocrine disruption potential.

TDCP is also assessed to have low acute toxicity. Animal studies indicate an absorption of 100%, 100% and 30% for oral intake, inhalation and dermal absorption, respectively. Neurotoxic effects

were observed in studies with repeated exposure but a dose-response factor has not been established. TDCP is mutagenic *in vitro* but not *in vivo*, and it is classified Carc 2. on the basis of effects on the kidneys with a LOAEL of 5 mg/kg bw/d.

Health risk assessment
Based on the results of the chemical analyses and the worst-case exposure scenarios for the use of car safety seats, baby slings and baby mattresses, the health risk associated with the above substances has been estimated. This was done based on the procedures in the ECHA guidance document and on DNELs identified in the literature or calculated. The results, which were based on very conservative assumptions, indicated that there may be a risk associated with the exposure of children to particuarly TCEP in car safety seats and baby slings, and TDCP in car safety seats, baby slings and baby mattresses, if the children are exposed in the way described in the worst-case scenarios. The scenarios were therefore adjusted in order to make the assumptions more realistic. The assumptions in the Tier 1 calculations were adjusted with regard to the skin surface area in contact with the products, the mirgration from the products and the absorption of the substances through the skin.

The results of the Tier 1 calculation indicated an undesireable risk associated with a single car seat, a baby sling and a baby mattress.

With regard to baby mattresses it should be stressed that they are usually expected to be protected with a cover and in addition with a sheet during use and these two layers of textile are expected to act as a barrier to migration. This is supported by the results from the initial quantitative analyses, which showed that the content of TDCP in the mattress cover was approximately 1000 times lower than the content in the foam. It is therefore assumed that the textile cover is an effective barrier which can provide considerable protection of children using the mattres. However, based on the results, it cannot be excluded that there may be a risk associated with the use, if the children, are in direct contact with the mattress without cover.

The test samples from the car seat and the baby sling have been taken from areas expected to be in direct contact with the face. Samples include both felt and foam and as the results are obtained from the samples immersed in the sweat simulant, it will not be reflected if the felt part may be a barrier against the migration of the substances from the foam.

The risk assessment carried out does not account for exposure from other sources of TCEP, TCPP and TDCP. The assessment by the Scientific Committee, SCHER, of TCEP in toys indicates that there is exposure to TCEP from dermal contact with furniture and dust, inhalation, and drinking water, which may also be possible for the other substances. In addition, it is also possible that children are exposed to substances from car safety seats, baby slings and mattresses within the same period of time.

8.4 Environmental assessment

Following the initial exposure assessment, which indicated a limited environmental load with chemicals from the selected product groups, it was decided to limit the environmental risk assessment to a conservative screening assessment of environmental impact based on an arbitrary substance, "Substance X", in an arbitrary product at a concentration of 10,000 mg/kg and 100% release to wastewater within a period of one year. Assuming that all children in the age group 0-3 years use such textiles, the resulting concentrations (PEC) in sewage effluent and sludge, respectively, were estimated under worst case conditions and compared to the lowest Predicted No-Effect Level (PNEC) reported for any of the relevant, quantified substances – i.e. TCEP, TCPP, TDCP, DIDP and azo dyes (aromatic amines).

It was from this conservative screening assessment concluded that the risk of environmental effects in aquatic or soil environments due to release of the assessed substances from washing of childrens' textiles was insignificant and therefore it was not considered necessary to perform a more detailed assessment. Similarly, an environmental impact from emission of the substances to air was estimated to be insignificant.

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Appendix 1: Questionnaire for suppliers and producers of car safety seats and other textile products for children

Questions concerning chemical substances in car safety seats and textile products for children on the Danish market

COWI is in collaboration with the Danish Technological Institute preparing a survey concerning chemical substances in car safety seats and other textile products for children on the Danish market for the Danish EPA. As a part of the project, companies are asked to support the survey by providing information on the topic. Please consider the following questions, which will presumably take 10 – 30 min to fill in depending on the amount of information and knowledge available.

Thank you very much in advance!

Your company:
Contact person:
Email:
Phone:

1. The following product groups are included in the survey. Which of the following **textile products** for children does your company sell?
   Please also indicate the region of manufacture for each product category. In the case that products originate from different regions, please give an estimate on the relative distribution (e.g. EU 20%, non-EU 80%).

	Region of manufacture			*Distribution*			
	DK	EU	non-EU	% from DK	% from EU	% from non-EU	Don't know
☐ Car safety seats (Danish: Autostole)	☐	☐	☐				☐
☐ Buggies (Danish: Barnevogn)	☐	☐	☐				☐
☐ Cradle seats (Danish: Skråstole)	☐	☐	☐				☐
☐ Carriers (Danish: Bærestole)	☐	☐	☐				☐
☐ Changing mats (Danish: Skifteunderlag)	☐	☐	☐				☐
☐ Buggy sleeping bags (Danish: Køreposer)	☐	☐	☐				☐
☐ Travel- or camping beds	☐	☐	☐				☐
☐ Children's beanbag chair (Danish: Sækkestole)	☐	☐	☐				☐

2. With respect to car safety seats, would it be possible for you to indicate the *approximate* number of car safety seats (or alternatively the value of articles) that your company is selling yearly and/or the number of articles that are sold in Danmark yearly?

Number of car safety seats sold by your company:	Number of car safety seats sold in Denmark:

3. Do any of the product types have the listed functional requirements (either because suppliers label their products with those properties or because your company requires the products to fulfill those functions)?

	Functional requirement						
	Water re-pellency	Dirt re-pellency	Fire re-tardency	Odour-inhibiting	Anti fouling	Color retention	UV-proof
Car safety seats (Danish: Autostole)	☐	☐	☐	☐	☐	☐	☐
Buggies (Danish: Barnevogn)	☐	☐	☐	☐	☐	☐	☐
Cradle seats (Danish: Skråstole)	☐	☐	☐	☐	☐	☐	☐
Carriers (Danish: Bærestole)	☐	☐	☐	☐	☐	☐	☐
Changing mats (Danish: Skifteunderlag)	☐	☐	☐	☐	☐	☐	☐
Buggy sleeping bags (Danish: Køreposer)	☐	☐	☐	☐	☐	☐	☐
Travel- or camping beds	☐	☐	☐	☐	☐	☐	☐
Children's beanbag chair (Danish: Sækkestole)	☐	☐	☐	☐	☐	☐	☐

4. Do you know if any of the following substances are used **intentionally** in the above mentioned products? Please tick both YES and NO if some products in a category contain the substance while others do not.

	YES	NO	Don't know	If yes, please indicate which product(s) (only textile and foam parts) and brand(s):
Organotin compounds	☐	☐	☐	
Formaldehyde	☐	☐	☐	
Triclosan	☐	☐	☐	
Other biocides:	☐	☐	☐	
Pesticides	☐	☐	☐	
Flame retardants	☐	☐	☐	
UV filters and/or stabilizers	☐	☐	☐	
Ftalates	☐	☐	☐	
Azo dyes	☐	☐	☐	

Alkylphenols and alkylphenolethoxylates	☐	☐	☐
Solvents (e.g. NMP, DMAc, DMF)	☐	☐	☐
Per- or polyfluorinated substances	☐	☐	☐
Chlorinated phenols, benzenes or toluenes	☐	☐	☐
Polycyclic aromatic hydrocarbons (PAH)	☐	☐	☐
Heavy metals	☐	☐	☐
Aniline	☐	☐	☐
Other:	☐	☐	☐

5. Do you know if any of the following substances are contained **unintentionally** in the above mentioned products? The substances may be contained *e.g*. as residues from textile processing.

	YES	NO	Don't know	If yes, please indicate which product(s) (only textile and foam parts) and brand(s):
Organotin compounds	☐	☐	☐	
Formaldehyde	☐	☐	☐	
Triclosan	☐	☐	☐	
Other biocides:	☐	☐	☐	
Pesticides	☐	☐	☐	
Flame retardants	☐	☐	☐	
UV absorbers and/or stabilizers	☐	☐	☐	
Ftalates	☐	☐	☐	
Azo dyes	☐	☐	☐	
Alkylphenols and alkylphenolethoxylates	☐	☐	☐	
Solvents (e.g. NMP, DMAc, DMF)	☐	☐	☐	
Per- or polyfluorinated substances	☐	☐	☐	
Chlorinated phenols, benzenes or toluenes	☐	☐	☐	
Polycyclic aromatic hydrocarbons (PAH)	☐	☐	☐	
Heavy metals	☐	☐	☐	
Aniline	☐	☐	☐	
Other:	☐	☐	☐	

6. Does your company have any requirements restricting the use or content of certain substances in your products? If yes, to which products do the requirements apply?

Requirement	YES	NO	Don't know	If yes, please indicate which product(s) and brand(s):
OEKO-TEX® Standard 100	☐	☐	☐	
OEKO-TEX® Standard 1000	☐	☐	☐	
EU flower	☐	☐	☐	
Nordic Ecolabel – Swan	☐	☐	☐	
Other:	☐	☐	☐	

7. Has any analysis of chemical substances in the textile products sold in your company been performed? Can you provide any results from textiles analyses on possible concentration ranges of the substances?

		Compound detected			
	Analysis	YES	NO	Don't know	If yes, please indicate product(s) (textile and foam parts) and concentration range:
Organotin compounds	☐	☐	☐	☐	
Formaldehyde	☐	☐	☐	☐	
Triclosan	☐	☐	☐	☐	
Other biocides:	☐	☐	☐	☐	
Pesticides	☐	☐	☐	☐	
Flame retardants	☐	☐	☐	☐	
UV absorbers and/or stabilizers	☐	☐	☐	☐	
Ftalates	☐	☐	☐	☐	
Azo dyes	☐	☐	☐	☐	
Alkylphenols and alkylphenolethoxylates	☐	☐	☐	☐	
Solvents (e.g. NMP, DMAc, DMF)	☐	☐	☐	☐	
Per- or polyfluorinated substances	☐	☐	☐	☐	
Chlorinated phenols, benzenes or toluenes	☐	☐	☐	☐	
Polycyclic aromatic hydrocarbons (PAH)	☐	☐	☐	☐	
Heavy metals	☐	☐	☐	☐	
Aniline	☐	☐	☐	☐	
Other:	☐	☐	☐	☐	

8. Other comments:

Appendix 2: List of chemical substances from the Danish Consumer Council survey of car safety seats

PAH
Naphthalene
Acenaphthylene
Acenaphthene
Fluorene
Phenanthrene
Anthracene
Fluoranthene
Pyrene
Benzo[a]anthracene
Chrysene
Benzo[b]fluoranthene
Benzo[j]fluoranthene
Benzo[k]fluoranthene
Benzo[e]pyrene
Benzo[a]pyrene
Indeno[1,2,3,c,d]pyrene
Dibenzo[a,h]anthracene
Benzo[g,h,i]perylene
Phthalates
Dimethylphthalate
Diethylphthalate
Diisobutylphthalate
Dibutylphthalate
Benzyl-Butylphthalate
DEHP
Diisononylphthalate
Diisodecylphthalate
Di-n-Octylphthalat
Diethylhexyladipate
Acetyltributylcitrate (Citroflex)
Plasticizers/flameretardants
TCEP (Tris-Chlorethylphosphate)
TCPP (Tris-Chlorpropylphosphate)
TDCPP (Tris-Dichlorpropylphosphate)
Tris-Butylphosphate
Tri-Phenylphosphate
TKP (Tris-Kresylphosphate)
TBEP (Tris-(Butoxyethyl)phosphate)
Phenolic compounds
Bisphenol A (frei und freigesetzt)
Phenol (frei und freigesetzt)
Nonylphenol (frei und freigesetzt)
Antimicrobial
Triclosan
o-Phenylphenol
Chlorkresol
PCP
Premethrin
Organo tin
MBT
DBT
TBT
MOT
DOT
TPhT

Brominated flameretardants
Hexabrombiphenyl
Pentabromdiphenylether
Octabromdiphenylether
Decabromdiphenylether
Hexabromoxyclododecan
Tetrabrombisphenol A
Metals
Antimon
Arsen
Barium
Blei
Cadmium
Chrom
Quecksilber
Selen
Colourants
Acid Red 26
Basic Red 9
Basic Violet 14
Direct Black 38
Direct Blue 6
Direct Red 28
Disperse Blue 1
Disperse Orange 11
Disperse Yellow 3
Disperse Blue 3
Disperse Blue 7
Disperse Blue 26
Disperse Blue 35
Disperse Blue 102
Disperse Blue 106
Disperse Blue 124
Disperse Brown 1
Disperse Orange 1
Disperse Orange 3
Disperse Orange 37
Disperse Red 1
Disperse Red 11
Disperse Red 17
Disperse Yellow 1
Disperse Yellow 9
Disperse Yellow 39
Disperse Yellow 49
Solvent Yellow 1
Solvent Yellow 2
Solvent Yellow 3
Basic Violet 1
Basic Violet 3

4-Chloranilin
Benzidin
o-Toluidin
4.4'-Diamino-3.3'-dichlorodiphenylmethan
2-Naphthylamin
3.3'-Dimethylbenzidin
4.4'-Diamino-3.3'-dimethyldiphenylmethan
3.3'-Dimethoxybenzidin
4-Chloro-o-toluidin
Anilin
2-Methyl-5-Nitroanilin (2-Amino-4-nitrotoluen)
4.4'-Thiodianilin
4-Aminobiphenyl
2.4-Diaminotoluol (2.4-Toluylendiamin)
o-Anisidin (2-Methoxyanilin)
4-Aminoazobenzol (4-Aminoazobenzene)
2.4.5-Trimethylanilin
4.4'-Diaminodiphenylmethan
o-Aminoazotoluol
p-Kresidin
4.4'Oxydianilin
3.3'-Dichlorbenzidin
2.4-Diaminoanisole
2.4-Xylidine
2.6-Xylidine

Appendix 3: Health screening of a range of substances previously identified in textile products for children (in Danish)

De følgende afsnit giver en oversigt over sundhedseffekter af de kemiske stoffer, der jf. kortlægningen er påvist i relevante produkter med tekstil til børn i forskellige tidligere undersøgelser. Beskrivelserne er baseret på klassificering, forekomst på EU's liste over hormonforstyrrende stoffer[4] og informationer fra tidligere forbrugerprojekter fra Miljøstyrelsens hjemmeside samt forbrugerkemi.dk. Derudover er miljøprojektet "Kemikalier i tekstiler" (Larsen et al., 2000) brugt som opslagsværk for identifikation af stoffer fra de enkelte stofgrupper, som anvendes i tekstilproduktionen.

Forklaringer på de enkelte faresætningskoder kan ses bagest i oversigten, der også indeholder en tabel med de generiske afskæringsværdier, som angiver den koncentration, hvor der skal tages hensyn til tilstedeværelsen af et stof med henblik på klassificeringen. For nogle af stofferne gælder dog specifikke afskæringsværdier. Hvis det er tilfældet, er dette angivet ved de enkelte fareklasser. De specifikke afskæringsværdier kan slås op i CLP-forordningens Bilag VI og er ikke gengivet her.

Stofferne på EU's liste over hormonforstyrrende stoffer er blevet inddelt i tre kategorier for hhv. mennesker (hum.) og dyr (wildlife) afhængigt af påvisning af hormonforstyrrende effekter:

- Kategori 1 - bevis for hormonforstyrrende aktivitet i mindst én art ved hjælp af intakte dyr
- Kategori 2 - i det mindste nogle *in vitro* tegn på biologisk aktivitet relateret til hormonforstyrrelser
- Kategori 3 - ingen tegn på hormonforstyrrende aktivitet eller ingen data tilgængelige

Hvis stofferne eller nogle stoffer fra stofgruppe er klassificeret iht. kategori 1 eller 2 for mennesker, er dette gengivet her.

Phenoler, f.eks: pentachlorphenol (PCP), tetrachlorphenol (TeCP), trichlorphenol (TCP), orto-fenylphenol (OPP)

Nogle af de chlorerede phenoler er mistænkt for at være kræftfremkaldende, mens stort set alle virker irriterende ved hudkontakt. Andre sundhedsegenskaber fremgår af klassificeringen i nedenstående tabel.

På forbrugerkemi angives nogle af stofferne også for at være mistænkt for at virke hormonforstyrrende, dog er kun 2,4-dichlorophenol på EU's liste over stoffer, der mistænkt for at være hormonforstyrrende (Kat. 2).

[4] Tilgængelig på: http://ec.europa.eu/environment/chemicals/endocrine/strategy/substances_en.htm#priority_list

TABEL B3- 1
HARMONISERET KLASSIFICERING AF NOGLE PHENOLERFORBINDELSER (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
604-002-00-8	pentachlorophenol	87-86-5	Acute Tox. 3 * Acute Tox. 3 * Skin Irrit. 2 Eye Irrit. 2 Acute Tox. 2 * STOT SE 3 Carc. 2 Aquatic Acute 1 Aquatic Chronic 1	H301 H311 H315 H319 H330 H335 H351 H400 H410
604-013-00-8	2,3,4,6-tetrachlorophenol	58-90-2	Acute Tox. 3 * Skin Irrit. 2 Eye Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H301 H315 H319 H400 H410
604-018-00-5	2,4,6-trichlorophenol	88-06-2	Acute Tox. 4 * Skin Irrit. 2 Eye Irrit. 2 Carc. 2 Aquatic Acute 1 Aquatic Chronic 1	H302 H315 H319 H351 H400 H410
604-020-00-6	2-phenylphenol	90-43-7	Skin Irrit. 2 Eye Irrit. 2 STOT SE 3 Aquatic Acute 1	H315 H319 H335 H400

* Der findes specifikke afskæringsværdier for stoffet mht. til de markerede fareklasser.

Organotinforbindelser
For gruppen af tributyltin-forbindelser og triphenyltin hydroxid er der vedtaget en harmoniseret klassificering, mens der for andre stoffer fra den stofgruppe ikke er vedtaget en harmoniseret klassificering.

De største bekymringer mht. tinorganiske stoffer gælder effekter i miljøet, da nogle stoffer fra gruppen har vist sig at virke hormonforstyrrende i miljøet og at kunne påvirke immunforsvaret på længere sigt. Tributyltin og tributyltin oxid er klassificerede som kat. 2, mens triphenyltin (stoffer) er klassificeret som kat. 3 på EU's liste over hormonforstyrrende stoffer.

TBT angives desuden til at kunne forårsage moderat til svær hud- og øjenirritation, ligesom der også er set tegn på irritation af luftveje efter inhalation[5].

[5] Datablad om TBT forbindelser: http://mst.dk/media/mst/83373/TBT%20datablad%20final%20version%20apr%202007.pdf

TABEL B3- 2
HARMONISERET KLASSIFICERING AF NOGLE ORGANOTINFORBINDELSER (CLP FORORDNINGEN 1272/2008).

Index Nr*	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
050-008-00-3	Tributyltin compounds with the exceptionof those specified elsewhere in this Annex	-	Acute Tox. 3 * Acute Tox. 4 * Skin Irrit. 2 Eye Irrit. 2 STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H301 H312 H315 H319 H372 H400 H410
050-004-00-1	Triphenyltin hydroxid	76-87-9	Acute Tox. 3 * Acute Tox. 3 * Skin Irrit. 2 Eye Dam. 1 Acute Tox. 2 * STOT SE 3 Carc. 2 Repr. 2 STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H301 H311 H315 H318 H330 H335 H351 H361d H372 H400 H410

* Der findes specifikke afskæringsværdier for stoffet mht. til de markerede fareklasser.

Dimethylfumarat (DMFu)
For DMFu er der ikke vedtaget en harmoniseret klassificering. Skadelig ved hudkontakt, hudirriterende, kan forårsage en allergisk hudreaktion og øjenirriterende er de hyppigste effekter nævnt under selvklassificeringen af stoffet.

I EU er der konstateret tusindvis af tilfælde af allergi overfor DMFu. DMFu har vist sig at kunne trænge igennem tøj og ind på huden, hvor det kan medføre en hudallergisk reaktion, med kløe, rødmende og væskende hævelser, som kan være vanskelig at behandle[6].

Formaldehyd
Formaldehyd anvendes som biocid og kan derudover fraspaltes fra andre konserveringsmidler (eksempler findes på forbrugerkemi). Formaldehyd kan give risiko for kræft hos mennesker. Desuden er stoffet klassificeret som akut giftig ved indtagelse, indånding eller hudkontakt og kan forårsage allergisk hudreaktion og irritere hud og øjnene (tabel B3-3).

TABEL B3- 3
HARMONISERET KLASSIFICERING AF FORMALDEHYD (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
605-001-00-5	Formaldehyde, % *	50-00-0	Acute Tox. 3 * Acute Tox. 3 * Skin Corr. 1B	H301 H311 H314

[6] http://mst.dk/virksomhed-myndighed/kemikalier/regulering-og-regler/faktaark-om-kemikaliereglerne/dmf/

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
			Skin Sens. 1 Acute Tox. 3 * Carc. 2	H317 H331 H351

* Der findes specifikke afskæringsværdier for stoffet mht. til de markerede fareklasser.

Triclosan

Triclosan er mistænkt for at være hormonforstyrrende og mistænkes derudover for at kunne øge risikoen for, at børn udvikler allergi over for andre stoffer på grund af triclosans virkning på bakterier og dermed immunsystemet (forbrugerkemi.dk). Stoffet er for nylig blevet forbudt som biocid i tekstiler[7] og er desuden reguleret i kosmetiske produkter.

TABEL B3- 4
HARMONISERET KLASSIFICERING AF TRICLOSAN (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
604-070-00-9	triclosan 2,4,4'-trichloro-2'-hydroxy-diphenyl-ether 5-chloro-2-(2,4-dichlorophenoxy)phenol	3380-34-5	Skin Irrit. 2 Eye Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H315 H310 H400 H410

Sølv og sølvforbindelser

Sølv eller sølvforbindelser kan ligesom Triclosan være tilsat som antibakterielt middel. Sølv på nanoform er ligeledes blevet fundet i tøj, især sportstøj, hvor det skal modvirke dårlig lugt (Poulsen et al., 2011). Sundhedseffekterne af nanosølv er ikke velundersøgte, men udover at være meget giftig for vandmiljøet (Tabel B3-5) kan sølv og sølvforbindelser bidrage til bakteriernes resistensdannelse overfor antibiotika (Klif, 2010).

TABEL B3- 5
HARMONISERET KLASSIFICERING AF TRICLOSAN (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
047-001-00-2	silver nitrate	7761-88-8	Ox. Sol. 2 Skin Corr. 1B Aquatic Acute 1 Aquatic Chronic 1	H272 H314 H400 H410

[7] Beslutning i EU om ikke-optagelse af triclosan under Biocidforordningen i produkttype 2, 7 og 9 blev vedtaget den 14. marts i år og er således allerede trådt i kraft. Forbuddet gælder al brug af triclosan som konserveringsmiddel i tekstiler (som er PT9, deriblandt fibre, læder, gummi og polymeriserede materialer) (Kilde: Marianne Schmidt, Miljøstyrelsen, 17.06.2014).

Bromerede flammehæmmere - polybromerede biphenyler (PBB) og polybromerede diphenyl ether (PBDE)

Nogle af de bromerede flammehæmmere mistænkes for bl.a. at kunne skade fostre, fremkalde kræft, forstyrre hormonbalancen og nedsætte fertiliteten. Gruppen af polybromerede biphenyler og 4 af de bromerede diphenyl ethere er ligeledes på EU liste over hormonforstyrrende stoffer (hhv. kat. 1 og 2). Kun to af stofferne har en harmoniseret klassificering.

TABEL B3- 6
HARMONISERET KLASSIFICERING AF NOGLE BROMEREDE FLAMMEHÆMMERE (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
602-094-00-4	diphenylether; octabromo derivate	32536-52-0	Repr. 1B	H360Df
602-083-00-4	diphenyl ether, pentabromo derivative pentabromodiphenyl ether	32534-81-9	STOT RE 2 * Lact. Aquatic Acute 1 Aquatic Chronic 1	H373 H362 H400 H410

* Klassificeringen skal betragtes som et minimum klassifikation.

Fosforbaserede flammehæmmere

De i Tabel B3-7 listede stoffer er de mest almindelige fosforbaserede flammehæmmere i tekstilprodukter (Andersen et al. ,2014). Flere af stofferne anvendes kun til skum og fyldmateriale og ikke til selve tekstilet. To af stofferne har en klassificering som kræftfremkaldende (TDCP og TCEP), mens TCEP er også klassificeret som reproduktionstoksisk.

TABEL B3- 7
HARMONISERET KLASSIFICERING AF NOGLE FOSFORBASEREDE, CHLOREREDE FLAMMEHÆMMERE (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
015-199-00-X	tris[2-chloro-1-chloromethyl)ethyl] phosphate (TDCP)	13674-87-8	Carc. 2	H351
015-102-00-0	tris(2-chloroethyl)phosphate (TCEP)	115-96-8	Acute Tox. 4 * Carc. 2 Repr. 1B Aquatic Chronic 2	H302 H351 H360F H411
015-188-00-X	(1-methylethylidene)di-4,1-phenylenetetraphenyl diphosphate	5945-33-5	Aquatic Chronic 4	H413

* Der findes specifikke afskæringsværdier for stoffet mht. til de markerede fareklasser.

UV-absorbere og -stabilisatorer
Der anvendes overordnet 3 grupper af UV beskyttende stoffer i tekstiler: Benzophenoner, triazoler og triaziner. Nogle benzophenoner er mistænkt for at være kræftfremkaldende, hormonforstyrrende og/eller kunne skade barnet under graviditeten, mens andre ikke anses for at være problematiske i samme grad. I mange tilfælde mangler der også data for at foretage en vurdering (forbrugerkemi.dk).

I forbindelse med en endnu ikke afsluttet kortlægning af UV-filtre i forskellige produkter igangsat af Miljøstyrelsen, har tekstilvirksomheden Gabriel oplyst, at der benyttes et sulfoneret benzotriazolderivat i eksempelvis møbeltekstiler, og at leverandøren af benzotriazolen ligeledes leverer triazin til polyesterfibre i bilindustrien.

I forbindelse med samme kortlægningsprojekt er det fundet, at data fra litteraturen peger på, at typiske UV absorbere anvendt til tekstiler (herunder auto-tekstiler) omfatter blandt andet: 2-hydroxybenzophenon (117-99-7) (tekstil af bomuld), 2,4-dihydroxybenzophenon (131-56-6) (tekstil af polypropylen), 2,2'-dihydroxy-4,4'-dimethoxybenzophenon (131-54-4) (tekstil af poly(m-phenylen-terephthalamid-fibre). Andre absorbere, som nævnes er: 2-hydroxyphenylbenzotriazoler og 2-hydroxyphenyl-s-triaziner. Til polyester anvendes råvarerne Tinovin 326 (Bumetrizol/3896-11-5) og Uvinul D-49 (131-54-4). Ingen af de nævnte stoffer har en harmoniseret klassificering.

Ftalater
Denne stofgruppe omfatter en lang række stoffer, hvor 6 af dem (DEHP, DBP, BBP, DINP, DIDP, DNOP) er reguleret under REACH. For DEHP, DBP og BBP må koncentrationen ikke overstige 0,1% i alt legetøj og alle småbørnsartikler, mens den for de tre øvrige ikke må overstige 0,1% i legetøj og småbørnsartikler, som kan puttes i munden. Ud over disse regler, som gælder i hele EU, er det i Danmark i følge bekendtgørelse om forbud mod ftalater i legetøj og småbørnsartikler (BEK nr 855 af 05/09/2009) forbudt at producere, importere eller sælge legetøj og småbørnsartikler eller dele deraf, der indeholder ftalater i koncentrationer over 0,05%.

Flere af ftalaterne påvirker evnen til at få børn og/eller skader det ufødte barn. Derudover er mange mistænkt for at være hormonforstyrrende, mens nogle ftalater anses for at være uproblematiske. Forbrugerkemi.dk har vurderet 18 ftalater mht. deres sundheds- og miljøeffekter.

DEHP, DBP og BBP (butylbenzylphtalat) er klassificeret som kat. 1, DINP og DIDP som kat. 2 på EU's liste over stoffer, der er mistænkt for at være hormonforstyrrende.

TABEL B3- 8
HARMONISERET KLASSIFICERING AF NOGLE FTALATER (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
607-317-00-9	di-(2-ethylhexyl) ftalat (DEHP)	117-81-7	Repr. 1B	H360FD
607-318-00-4	dibutyl ftalat (DBP)	84-74-2	Repr. 1B Aquatic Acute 1	H360Df H400
607-430-00-3	benzyl butyl ftalat (BBP)	85-68-7	Repr. 1B Aquatic Acute 1 Aquatic Chronic 1	H360-Df H400 H410

Azofarvestoffer /aromatiske aminer

Azofarvestoffer kan give anledning til forekomst af en række aromatiske aminer i tekstiler, som f.eks. biphenyl-4-amin eller benzidin. Mange af de aromatiske aminer virker kræftfremkaldende, herunder de 22 navngivne aminer, som er listet under tillæg 8 i REACH Bilag XVII. Endvidere er en række af stofferne klassificeret med en eller flere af følgende risikosætninger: kan give overfølsomhed ved hudkontakt, giftig ved hudkontakt, fare for varige alvorlige skader på helbred ved hudkontakt, alvorlige sundhedsfare ved længere tids påvirkning ved hudkontakt, mulighed for varige skader på helbred, kan forårsage arvelige genetiske skader, og mulighed for skade på forplantningsevnen.

TABEL B3- 9
HARMONISERET KLASSIFICERING AF NOGLE AZOFARVESTOFFER OG AROMATISKE AMINER (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
612-072-00-6	biphenyl-4-amine	92-67-1	Acute Tox. 4 * Carc. 1A	H302 H350
612-042-00-2	benzidine	92-87-5	Acute Tox. 4 * Carc. 1A Aquatic Acute 1 Aquatic Chronic 1	H302 H350 H400 H410
612-008-00-7	aniline	62-53-3	Acute Tox. 3 * Acute Tox. 3 * Skin Sens. 1 Eye Dam. 1 Acute Tox. 3 * Muta. 2 Carc. 2 STOT RE 1 Aquatic Acute 1	H301 H311 H317 H318 H331 H341 H351 H372 H400

* Der findes specifikke afskæringsværdier for stoffet mht. til de markerede fareklasser.

Alkylphenoler og alkylphenolethoxylater

Alkylphenolethoxylaterne kan nedbrydes til alkylphenolerne, blandt disse er nonylphenol den bedst undersøgte. Nonylphenol kan skade forplantningsevnen samt barnet under graviditet. Desuden er stoffet mistænkt for at kunne give allergi og anses for at være hormonforstyrrende.

Af de 5 listede alkylphenoler på EU's liste over mistænkte hormonforstyrrende stoffer er nonylphenol og 4-ter-octylphenol klassificeret som kat. 1, mens 4-tert-Butylphenol er klassificeret som kat. 2.

TABEL B3- 10
HARMONISERET KLASSIFICERING AF ENKELTE ALKYLPHENOLER OG ALKYLPHENOLETHOXYLATER (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
601-053-00-8	nonylphenol	25154-52-3	Acute Tox. 4 * Skin Corr. 1B Repr. 2 Aquatic Acute 1 Aquatic Chronic 1	H302 H314 H361fd H400 H410

* Der findes specifikke afskæringsværdier for stoffet mht. til de markerede fareklasser.

N-Methyl-2-pyrrolidone (NMP)
Sundhedseffekterne af NMP er tidligere blevet beskrevet i et forbrugerprojekt om rengøringsmidler (Andersen et al., 2010). Blandt sundhedseffekterne af NMP er irritation af slimhinder i øjne og luftveje hos mennesker, sløvhed og uregelmæssig vejrtrækning, og effekter på fosterudviklingen. Derudover trænger NMP nemt igennem huden og kan dermed fremme hudgennemtrængeligheden af andre stoffer.

TABEL B3- 11
HARMONISERET KLASSIFICERING AF NMP (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
606-021-00-7	N-methyl-2-pyrrolidone	872-50-4	Skin Irrit. 2 Eye Irrit. 2 STOT SE 3 Repr. 1B	H315 H319 H335 H360D

N,N-Dimethylacetamid (DMAc)
N,N-Dimethylacetamid er klassificeret som reproduktionstoksisk (Kan skade det ufødte barn) og som farligt ved indånding og hudkontakt (Tabel B3-12). Blandt kroniske effekter er der fundet mulige "kroniske lever- og nyreskader". Stoffet kan give systemiske skader ved indånding og optagelse over hud i tilstrækkelige mængder over en længere periode (Svendsen et al., 2004).

TABEL B3- 12
HARMONISERET KLASSIFICERING AF DMAC (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
616-011-00-4	N,N-dimethylacetamide	127-19-5	Acute Tox. 4 * Acute Tox. 4 * Repr. 1B	H312 H332 H360D

* Der findes specifikke afskæringsværdier for stoffet mht. til de markerede fareklasser.

N,N-dimethylformamid; dimethyl formamid (DMF)
Dimethylformamid er klassificeret som farligt ved hudkontakt og indånding, samt øjenirriterende og reproduktionstoksisk (Kan skade det ufødte barn).

Selvom dyreforsøg ikke kunne påvise, at stoffet er mutagent eller kræftfremkaldende, har adskillige test af personer som har været udsat for dimethylformamid indikeret, at stoffet måske medvirker til udvikling af testikelkræft. Det er derudover vist, at stoffet medfører leverskader (Hansen et al., 2004).

TABEL B3- 13
HARMONISERET KLASSIFICERING AF DIMETHYL FORMAMID (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
616-001-00-X	N,N-dimethylformamide	68-12-2	Acute Tox. 4 * Eye Irrit. 2 Acute Tox. 4 * Repr. 1B	H312 H319 H332 H360D

* Der findes specifikke afskæringsværdier for stoffet mht. til de markerede fareklasser.

Polyfluoroalkylforbindelser (PFAS)
PFAS kan inddeles i en lang række undergrupper, såsom perfluoralkylsulfonsyrer (PFS) og salte (sulfonater; PFSA), sulfonamiderne (FOSA, FOSE etc.), perfluoralkylcarboxylsyrer (PFCA), og telomererne – fluortelomeralkoholer (FTOH), fluortelomersulfonater (FTS), fluortelomerphosphater (FTP), samt fluortelomeriodider og fluortelomeralkener. Alle disse telomere kan i flere trin og med tiden nedbrydes til PFCA.

Stoffernes sundhedsegenskaber er i højere grad knyttet til længden af perfluoralkylkæden (C_nF_{2n+1}- eller $F(CF_2)_n$-) end til den funktionelle gruppe. En perfluoralkylkæde af 6-8 carbon (fx PFHxS, PFOA, PFOS og PFNA) er tilsyneladende de mest sundhedsskadelige.

Det er kun C8-stofferne PFOS og PFOS derivater som har en harmoniseret klassificering i henhold til CLP-forordningen, som angivet i Tabel B3-14.. Ifølge klassificeringen har stofferne både kræftfremkaldende og reproduktionstoksiske egenskaber.

TABEL B3- 14
HARMONISERET KLASSIFICERING AF PFAS (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
607-624-00-8	perfluorooctane sulfonic acid (PFOS); potassium perfluorooctane sulfonate (K-PFOS); diethanolamine perfluorooctane sulfonate ; ammonium perfluorooctane sulfonate (NH4-PFOS); lithium perfluorooctane sulfonate (Li-PFOS)	1763-23-1 2795-39-3 70225-14-8 29081-56-9 29457-72-5	Carc. 2 Repr. 1B STOT RE 1 Acute Tox. 4 * Acute Tox. 4 * Lact. Aquatic Chronic 2	H351 H360D H372 H332 H302 H362 H411

* Der findes specifikke afskæringsværdier for stoffet mht. til de markerede fareklasser.

Tungmetaller
Blandt tungmetaller som primært kan forekomme i tekstiler, enten pga. deres anvendelse i farvning, trykning eller som urenhed, er chrom, nikkel, kobber og kobolt.

Trivalente chromforbindelser betragtes som relativt ugiftige, chrom anses således også som et essentielt næringsstof. Chrom(VI)forbindelser er meget giftige og kan ved hudkontakt forårsage allergi. Ved lang tids eksponering for chrom(VI)-forbindelser ses forskellige former for mavetarmgener og øget forekomst af lungekræft[8].

Nikkel kan forårsage hudallergi, og en sensibilisering over for nikkel kan føre til kontaktdermatitis. Derudover har eksponering i arbejdsmiljøet ført til forøget risiko for lungekræft (Strandesen og Poulsen, 2008).

Længerevarende, oral eksponering for kobber kan føre til leverskader. Kobber og kobbersalte kan frembringe allergiske reaktioner ved kontakt med huden hos følsomme individer (Strandesen og Poulsen, 2008). En harmoniseret klassificering af kobber, kobber nitrat eller kobber acetat er ikke tilgængelig.

Kobolt kan virke sensibiliserende og er klassificeret som ”Kan forårsage en allergisk hudreaktion” og ”Kan forårsage allergi-eller astmasymptomer og åndedrætsbesvær ved indånding”.

[8] http://mst.dk/media/mst/67609/Chrom%20dec2002.pdf

TABEL B3- 15
HARMONISERET KLASSIFICERING AF UDVALGTE METALLER (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
024-017-00-8	Chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in the Annex	-	Skin Sens. 1 Carc. 1B Aquatic Acute 1 Aquatic Chronic 1	H317 H350i H400 H410
028-002-01-4	Nikkel (pulver)	7440-02-0	Skin Sens. 1 Carc. 2 STOT RE 1 Aquatic Chronic 3	H317 H351 H372 H412
027-001-00-9	Kobolt	7440-48-4	Skin Sens. 1 Resp. Sens. 1 Aquatic Chronic 4	H317 H334 H413

Polycykliske aromatiske hydrocarboner (PAH)
PAH dækker over en stofgruppe på mere end 100 stoffer, som er sammensat af benzenringe. Benzo[a]pyren (BaP) bruges tit som en indikator for forekomst og sundhedseffekter for PAH og er samtidig det bedst undersøgte stof fra gruppen.

BaP og nogle andre PAH har vist sig at være giftige ved indånding, indtagelse eller hudoptagelse. Nogle er kræftfremkaldende, mutagene og reproduktionstoksiske. Langvarig indånding kan medføre et fald i lungefunktion, brystsmerter og irritation, samt langvarig hudkontakt kan forårsage dermatitis og vorter. BaP menes at forårsage lungekræft og hudkræft hos mennesker (PHE, 2008). Nogle af sundhedseffekterne fremgår også af klassificeringerne i Tabel B3-16.

TABEL B3- 16
HARMONISERET KLASSIFICERING AF PAH'ER (CLP FORORDNINGEN 1272/2008).

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
601-032-00-3	benzo[a]pyrene	50-32-8	Skin Sens. 1 Muta. 1B Carc. 1B Repr. 1B Aquatic Acute 1 Aquatic Chronic 1	H317 H340 H350 H360FD H400 H410

Index Nr	Stof	CAS Nr	Klassificering	
			Fareklasse- og kategorikode(r)	Faresætnings-kode(r)
601-049-00-6	benzo[e]pyrene	192-97-2	Carc. 1B Aquatic Acute 1 Aquatic Chronic 1	H350 H400 H410
601-033-00-9	benz[a]anthracene	56-55-3	Carc. 1B Aquatic Acute 1 Aquatic Chronic 1	H350 H400 H410
601-048-00-0	chrysene	218-01-9	Muta. 2 Carc. 1B Aquatic Acute 1 Aquatic Chronic 1	H341 H350 H400 H410
601-034-00-4	benz[e]acephenanthrylene	205-99-2	Carc. 1B Aquatic Acute 1 Aquatic Chronic 1	H350 H400 H410

GHS-Faresætninger og generiske afskæringsværdier for klassificeringskategorier jf. CLP-forordningen (EF Nr. 1272/2008)

TABEL B3- 17

Sundhedsfaresætninger	
H300	Livsfarlig ved indtagelse.
H301	Giftig ved indtagelse.
H302	Farlig ved indtagelse.
H304	Kan være livsfarligt, hvis det indtages og kommer i luftvejene.
H310	Livsfarlig ved hudkontakt.
H311	Giftig ved hudkontakt.
H312	Farlig ved hudkontakt.
H314	Forårsager svære forbrændinger af huden og øjenskader.
H315	Forårsager hudirritation.
H317	Kan forårsage allergisk hudreaktion.
H318	Forårsager alvorlig øjenskade.
H319	Forårsager alvorlig øjenirritation.
H330	Livsfarlig ved indånding.
H331	Giftig ved indånding.

H332	Farlig ved indånding.
H334	Kan forårsage allergi- eller astmasymptomer eller åndedrætsbesvær ved indånding.
H335	Kan forårsage irritation af luftvejene.
H336	Kan forårsage sløvhed eller svimmelhed.
H340	Kan forårsage genetiske defekter <*angiv eksponeringsvej, hvis det er endeligt påvist, at faren ikke kan frembringes ad nogen anden eksponeringsvej*>.
H341	Mistænkt for at forårsage genetiske defekter <*angiv eksponeringsvej, hvis det er endeligt påvist, at faren ikke kan frembringes ad nogen anden eksponeringsvej*>.
H350	Kan fremkalde kræft <*angiv eksponeringsvej, hvis det er endeligt påvist, at faren ikke kan frembringes ad nogen anden eksponeringsvej*>.
H351	Mistænkt for at fremkalde kræft <*angiv eksponeringsvej, hvis det er endeligt påvist, at faren ikke kan frembringes ad nogen anden eksponeringsvej*>.
H360	Kan skade forplantningsevnen eller det ufødte barn <*angiv specifik effekt, hvis kendt*> <*angiv eksponeringsvej, hvis det er endeligt påvist, at faren ikke kan frembringes ad nogen anden eksponeringsvej*>.
H361	Mistænkt for at skade forplantningsevnen eller det ufødte barn <*angiv specifik effekt, hvis kendt*> <*angiv eksponeringsvej, hvis det er endeligt påvist, at faren ikke kan frembringes ad nogen anden eksponeringsvej*>.
H362	Kan skade børn, der ammes.
H370	Forårsager organskader <*eller angiv alle berørte organer, hvis de kendes*> <*angiv eksponeringsvej, hvis det er endeligt påvist, at faren ikke kan frembringes ad nogen anden eksponeringsvej*>.
H371	Kan forårsage organskader <*eller angiv alle berørte organer, hvis de kendes*> <*angiv eksponeringsvej, hvis det er endeligt påvist, at faren ikke kan frembringes ad nogen anden eksponeringsvej*>.
H372	Forårsager organskader <*eller angiv alle berørte organer, hvis de kendes*> ved længerevarende eller gentagen eksponering <*angiv eksponeringsvej, hvis det er endeligt påvist, at faren ikke kan frembringes ad nogen anden eksponeringsvej*>.
H373	Kan forårsage organskader <*eller angiv alle berørte organer, hvis de kendes*> ved længerevarende eller gentagen eksponering <*angiv eksponeringsvej, hvis det er endeligt påvist, at faren ikke kan frembringes ad nogen anden eksponeringsvej*>.
Miljøfaresætninger	
H400	Meget giftig for vandlevende organismer.
H410	Meget giftig med langvarige virkninger for vandlevende organismer.
H411	Giftig for vandlevende organismer, med langvarige virkninger.
H412	Skadelig for vandlevende organismer, med langvarige virkninger.
H413	Kan forårsage langvarige skadelige virkninger for vandlevende organismer.

Fareklasse	Generiske afskæringsværdier, som der skal tages hensyn til

Akut toksicitet:	
— Kategori 1–3 — Kategori 4	0,1 % 1 %
Hudætsning/-hudirritation	1 % (1)
Alvorlig øjenskade/øjenirritation	1 % (2)
Farlig for vandmiljøet	
— Akut kategori 1 — Kronisk kategori 1 — Kronisk kategori 2–4	0,1 % (3) 0,1 % (3) 1 %
(1) Eller < 1 %, når dette er relevant, jf. 3.2.3.3.1. (2) Eller < 1 %, når dette er relevant, jf. 3.3.3.3.1. (3) Eller < 0,1 %, når dette er relevant, jf. 4.1.3.1. i CLP forordningen (EF Nr. 1272/2008)	

Appendix 4: Results from GC/MS screening analyses for volatile and semi-volatile organic substances (in Danish)

4A. Screeningsanalyseresultater - autostole

TABEL B4- 1
RESULTATER AF GC/MS-SCREENING AF PRØVE A1, AUTOSTOL 0-13 KG, SORT BETRÆK INKLUSIV SKUM

Komponent	CAS-nr.	Indhold i mg/kg
N-Ethyl-N-(2-cyanoethyl)-anilin	148-87-8	9,0
2,6-Dichlor-4-nitroanilin	99-30-9	3,0
Tris(2-chlorisopropyl)-phosphat (TCPP)	13674-84-5	130
Bis(2-chlor-1-methylethyl) 3-chlorpropyl-phosphat	137909-40-1	82
Bis(3-chlor-1-propyl)(1-chlor-2-propyl)-phosphat	137888-35-8	26
6-Chlor-2,4-dinitroanilin	3531-19-9	30
Ikke identificeret komponent	-	32
Ikke identificeret komponent	-	17
Bisphenol A	80-05-7	9
3,3',5,5'-Tetramethylbiphenyl	25570-02-9	10
Bis(1,3-dichlor-2-propyl)-2,3-dichlor-1-propyl-phosphat	68460-03-7	600
Tris-(1,3-dichlorisopropyl)-phosphat (TDCP)	13674-87-8	50
Ikke identificeret komponent	-	13
Methyl-6-methoxy-2-anthracencarboxylat	297144-04-8	8
Ikke identificeret komponent	-	38
Ikke identificeret komponent	-	42
Ikke identificeret komponent	-	120

TABEL B4- 2
RESULTATER AF GC/MS-SCREENING AF PRØVE A2A, AUTOSTOL 9-36 KG, GRÅ TEKSTIL OG SKUM

Komponent	CAS-nr.	Indhold i mg/kg
3,5-di-tert-Butyl-4-hydroxybenzaldehyd	1620-98-0	24
Tris-(2-chlorisopropyl)-phosphat (TCPP)	13674-84-5	390
Bis-(1-chlor-2-propyl)(3-chlor-1-propyl)-phosphat	137909-40-1	270
Bis-(3-chlor-1-propyl)(1-chlor-2-propyl)-phosphat	137888-35-8	81
Ikke identificeret komponent	-	130
Ikke identificeret komponent	-	41
Ikke identificeret komponent	-	32

Bis-(1,3-dichlor-2-propyl)-2,3-dichlor-1-propyl-phosphat	68460-03-7	2300
Tris-dichlorpropylphosphat	78-43-3	160
Ikke identificeret komponent	-	120
Ikke identificeret komponent	-	110

TABEL B4- 3
RESULTATER AF GC/MS-SCREENING AF PRØVE A2B, AUTOSTOL 9-36 KG, SORT PLAST

Komponent	CAS-nr.	Indhold i mg/kg
Indeholder primært siloxaner	-	Påvist

TABEL B4- 4
RESULTATER AF GC/MS-SCREENING AF PRØVE A3A, AUTOSTOL 9-36 KG, SORT BETRÆK INKLUSIV SKUM OG BAGSIDE

Komponent	CAS-nr.	Indhold i mg/kg
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	120
Butyleret hydroxytoluen (BHT)	128-37-0	8
Tris-(2-chlorisopropyl)-phosphat (TCPP)	13674-84-5	650
Bis-(1-chlor-2-propyl)(3-chlor-1-propyl)-phosphat	137909-40-1	490
Bis-(3-chlor-1-propyl)(1-chlor-2-propyl)-phosphat	137888-35-8	130
Ikke identificeret komponent		1040
p-(p-Ethoxyphenyliminomethyl)-benzonitril	34128-02-4	49
Ikke identificeret komponent	-	97
Ikke identificeret komponent	-	140
Ikke identificeret komponent	-	67
Bis-(1,3-dichlor-2-propyl)-2,3-dichlor-1-propyl-phosphat	68460-03-7	6700
Bis-(1,3-dichlor-2-propyl)-2,3-dichlor-1-propyl-phosphat	68460-03-7	780
Ikke identificeret komponent	-	67
Ikke identificeret komponent	-	70
Ikke identificeret komponent	-	140

TABEL B4- 5
RESULTATER AF GC/MS-SCREENING AF PRØVE A3B, AUTOSTOL 9-36 KG, GRÅT BETRÆK INKLUSIV SKUM OG BAGSIDE

Komponent	CAS-nr.	Indhold i mg/kg
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	98
Tris-(2-chlorisopropyl)-phosphat (TCPP)	13674-84-5	1450
Bis-(1-chlor-2-propyl)(3-chlor-1-propyl)-phosphat	137909-40-1	500
Bis-(3-chlor-1-propyl)(1-chlor-2-propyl)-phosphat	137888-35-8	64
Ikke identificeret komponent	-	1200
Ikke identificeret komponent	-	290
Ikke identificeret komponent	-	86
Ikke identificeret komponent	-	56
Ikke identificeret komponent	-	68
Ikke identificeret komponent	-	37
Bis-(1,3-dichlor-2-propyl)-2,3-dichlor-1-propyl-phosphat	68460--03-7	7450
Tris-(1,3-dichlorisopropyl)-phosphat (TDCP)	13674-87-8	560
Ikke identificeret komponent	-	250
Ikke identificeret komponent	-	52
Ikke identificeret komponent	-	180
Ikke identificeret komponent	-	300
Ikke identificeret komponent	-	130
Ikke identificeret komponent	-	35
Ikke identificeret komponent	959-26-2	220

TABEL B4- 6
RESULTATER AF GC/MS-SCREENING AF PRØVE A4, AUTOSTOL 0-13 KG, BLÅ TEKSTIL OG SKUM PLUS BAGSIDE

Komponent	CAS-nr.	Indhold i mg/kg
Ikke identificeret komponent	-	1290
Ikke identificeret komponent	-	27
Tris-(2-chlorisopropyl)-phosphat (TCPP)	13674-84-5	25
Ikke identificeret komponent	-	82
6-Chlor-2,4-dinitroanilin	3531-19-9	140
Ikke identificeret komponent	-	180
Ikke identificeret komponent	-	61
Triphenoxyphosphin	101-02-0	110
Ikke identificeret komponent	-	130

Bis-(1,3-dichlor-2-propyl)-2,3-dichlor-1-propyl phosphat	68460-03-7	10100
Tris-(1,3-dichlorisopropyl)-phosphat (TDCP)	13674-87-8	760
Ikke identificeret komponent	-	190
Ikke identificeret komponent	-	45
Ikke identificeret komponent	-	190
Ikke identificeret komponent	-	180
Ikke identificeret komponent	-	430
Ikke identificeret komponent	-	54
Ikke identificeret komponent	-	43
Diisodecylftalat, isomer	-	88
Ikke identificeret komponent	-	37
Ikke identificeret komponent	-	82
Ikke identificeret komponent	-	1500
Ikke identificeret komponent	-	890

TABEL B4- 7
RESULTATER AF GC/MS-SCREENING AF PRØVE A5A, AUTOSTOL 0-18 KG, RØD TEKSTIL OG SKUM MED BÅND

Komponent	CAS-nr.	Indhold i mg/kg
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	54
2,4-Di-tert-butylphenol	96-76-4	51
Ikke identificeret komponent	-	780
Tris-(2-chlorisopropyl)-phosphat (TCPP)	13674-84-5	18
Ikke identificeret komponent	-	69
Ikke identificeret komponent	-	130
Ikke identificeret komponent	-	13
Bis-(1,3-dichlor-2-propyl)-2,3-dichlor-1-propyl-phosphat	68460-03-7	9400
Tris-(1,3-dichlorisopropyl)-phosphat (TDCP)	13674-87-8	580
Triphenylphosphat	115-86-6	84
Ikke identificeret komponent	-	150
Ikke identificeret komponent	-	120
Ikke identificeret komponent	-	320
Ikke identificeret komponent	-	1540

TABEL B4- 8
RESULTATER AF GC/MS-SCREENING AF PRØVE A5B, AUTOSTOL 0-18 KG, SORT BAGSIDE AF GUMMI

Komponent	CAS-nr.	Indhold i mg/kg
Alifatiske kulbrinter	-	140000

TABEL B4- 9
RESULTATER AF GC/MS-SCREENING AF PRØVE A6A, AUTOSTOL 0-4 ÅR, GRÅ TEKSTIL YDERSIDE MED SKUM

Komponent	CAS-nr.	Indhold i mg/kg
Dibutylftalat	84-64-0	20
Ikke identificeret komponent	-	22
4,4'-diphenylmethan-diisocyanat (MDI)	101-68-8	Påvist
4,4'-Diaminostilben	621-96-5	43
Ikke identificeret komponent	-	89
Ikke identificeret komponent	-	59
Ikke identificeret komponent	-	190
Bumetrizol	3896-11-5	74
Ikke identificeret komponent	-	59
Ikke identificeret komponent	-	40
4,4'-Dioctyldiphenylamin	101-67-7	32

TABEL B4- 10
RESULTATER AF GC/MS-SCREENING AF PRØVE A6B, AUTOSTOL 0-4 ÅR, BAGSIDE

Komponent	CAS-nr.	Indhold i mg/kg
Hexamethylen-diisocyanat	822-06-0	79
Isophoron-diisocyanat	4098-71-9	79
Ikke identificeret komponent	-	190
Ikke identificeret komponent	-	400
Ikke identificeret komponent	-	140
Ikke identificeret komponent	-	360
Ikke identificeret komponent	-	88
Mono-(2-ethylhexyl)-ftalat	4376-20-9	200
Ikke identificeret komponent	-	110
Ikke identificeret komponent	-	260
Diisodecylftalat, isomer	-	>12100
Diisodecylftalat, isomer	-	>3320
Diisodecylftalat, isomer	-	1520

Ikke identificeret komponent	-	180
Ikke identificeret komponent	-	300
Ikke identificeret komponent	-	120
Ikke identificeret komponent	119-07-3	58

> Betyder større end. Systemet er overbelastet.

TABEL B4- 11
RESULTATER AF GC/MS-SCREENING AF PRØVE A7A, AUTOSTOL 0-13 KG, SORT TEKSTIL MED SKUM

Komponent	CAS-nr.	Indhold i mg/kg
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	920
7-Hydroxy-1-indanon	6968-35-0	200
Ikke identificeret komponent	-	210
Diethyl isofthalat	636-53-3	59
Ikke identificeret komponent	-	220
Ikke identificeret komponent	-	220
Ikke identificeret komponent	-	590
Ikke identificeret komponent	-	530
4,4'-Dioctyldiphenylamin	101-67-7	56
Ikke identificeret komponent	-	610
Ikke identificeret komponent	-	370
Irganox 1076	2082-79-3	110

TABEL B4- 12
RESULTATER AF GC/MS-SCREENING AF PRØVE A7B, AUTOSTOL 0-13 KG, PRINT/SKRIFT

Komponent	CAS-nr.	Indhold i mg/kg
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	940
7-Hydroxy-1-indanon	6968-35-0	210
Ikke identificeret komponent	-	250
Diethyl-isoftalat	636-53-3	60
Ikke identificeret komponent	-	230
Ikke identificeret komponent	-	24
Ikke identificeret komponent	-	220
Ikke identificeret komponent	-	51
Ikke identificeret komponent	-	150
Ikke identificeret komponent	-	210
Ikke identificeret komponent	-	70

Ikke identificeret komponent	-	650
4,4'-Dioctyldiphenylamin	101-67-7	56
Ikke identificeret komponent	-	590
Ikke identificeret komponent	-	100
Ikke identificeret komponent	-	450
Irganox 1076	2082-79-3	110

TABEL B4- 13
RESULTATER AF GC/MS-SCREENING AF PRØVE A8A, AUTOSTOL 0-13 KG, SORT TEKSTIL OG SKUM FRA SELEN

Komponent	CAS-nr.	Indhold i mg/kg
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	28
Ikke identificeret komponent	-	16
Ikke identificeret komponent	-	300
1,3,5-Triazin-2,4,6-triamin	108-78-1	160
Ikke identificeret komponent	-	40
Tri-(2-chlorethyl)-phosphat	115-96-8	580
3,5-di-tert-Butyl-4-hydroxybenzaldehyd	1620-98-0	81
Tris-(2-chlorisopropyl)-phosphat (TCPP)	13674-84-5	6600
Bis-(1-chlor-2-propyl)(3-chlor-1-propyl)-phosphat	137909-40-1	2490
Bis-(3-chlor-1-propyl)(1-chlor-2-propyl)-phosphat	137888-35-8	320
Ikke identificeret komponent	-	270
Ikke identificeret komponent	-	520
Bis-(1,3-dichlor-2-propyl)-2,3-dichlor-1-propyl phosphat	68460-03-7	2800
Tris-(1,3-dichlorisopropyl)-phosphat (TDCP)	13674-87-8	250
Ikke identificeret komponent	-	170

TABEL B4- 14
RESULTATER AF GC/MS-SCREENING AF PRØVE A8B, AUTOSTOL 0-13 KG, RØD TEKSTIL OG SKUM

Komponent	CAS-nr.	Indhold i mg/kg
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	21
Ikke identificeret komponent	-	130
Ikke identificeret komponent	-	290
Ikke identificeret komponent	-	41
1,3,5-Triazine-2,4,6-triamin	108-78-1	51
Ikke identificeret komponent	-	66

Tri(2-chlorethyl) phosphat	115-96-8	61
3,5-di-tert-Butyl-4-hydroxy-benzaldehyd	1620-98-0	53
Tris(2-chlor-isopropyl)-phosphat (TCPP)	13674-84-5	6230
Bis(1-chlor-2-propyl)(3-chlor-1-propyl)phosphat	137909-40-1	2100
2,4-Dinitroanilin	97-02-9	25
Ikke identificeret komponent	-	440
4,4'-Diaminostilbene	621-96-5	55
Bis-(1,3-dichlor-2-propyl)-2,3-dichlor-1-propyl-phosphat	68460-03-7	2590
Tris-(1,3-dichlorisopropyl)-phosphat (TDCP)	13674-87-8	260

TABEL B4- 15
RESULTATER AF GC/MS-SCREENING AF PRØVE A29, AUTOSTOL 0-13 KG, SORT TEKSTIL OG SKUM SAMT HJERTE

Komponent	CAS-nr.	Indhold i mg/kg
Benzo-[f]-1,5-diazabicyclo[3.2.2]nonen	7092-76-4	25
Ikke identificeret komponent	-	660
Tributylprop-1-en-1,2,3-tricarboxylat	7568-58-3	28
Tributylacetylcitrat	77-90-7	1900
Triphenylphosphat	115-86-6	330
Diphenyl-isopropylphenyl-phosphat	28108-99-8	460
Ikke identificeret komponent	2240-47-3	84
Ikke identificeret komponent	-	120
Ikke identificeret komponent	-	190
Ikke identificeret komponent	-	62
Ikke identificeret komponent	-	124
Ikke identificeret komponent	-	48
Tris-(2-isopropylphenyl)-phosphat	64532-95-2	14
Ikke identificeret komponent	-	16
Ikke identificeret komponent	-	11
Ikke identificeret komponent	-	1060

TABEL B4- 16
RESULTATER AF GC/MS-SCREENING AF PRØVE A30, AUTOSTOL 0-13 KG, GRÅ TEKSTIL OG SKUM

Komponent	CAS-nr.	Indhold i mg/kg
Benzo-[f]-1,5-diazabicyclo[3.2.2]nonen	7092-76-4	47
Butyleret hydroxytoluen (BHT)	128-37-0	22
Ikke identificeret komponent	-	540

4B. Screeningsanalyseresultater - bæreseler

TABEL B4- 17
RESULTATER AF GC/MS-SCREENING AF PRØVE B9A, BABYBÆRESELE, 0-3 ÅR, LYS TEKSTIL MED SKUMFIBRE

Komponent	CAS-nr.	Indhold i mg/kg
Ekstraherbare organiske komponenter	-	-

- : Ikke påvist.

TABEL B4- 18
RESULTATER AF GC/MS-SCREENING AF PRØVE B9B, BABYBÆRESELE, 0-3 ÅR, SKUMPLADE MELLEM TEKSTILER OG INDVENDIGE TEKSTILER

Komponent	CAS-nr.	Indhold i mg/kg
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	220
1-[2-(Isobutyryloxy)-1-methylethyl]-2,2-dimethylpropyl-2-methylpropanoat	74381-40-1	48
Ikke identificeret komponent	-	131
Methyl (2E,4E,6E)-2-cyano-7-(dimethylamino)-2,4,6-heptatrienoat	58064-21-4	260
4,4'-diphenylmethan-diisocyanat (MDI)	101-68-8	700
Ikke identificeret komponent	-	240
Ikke identificeret komponent	-	97
Tris-(2,4-di-tert-butylphenyl)-phosphat	95906-11-9	68
Ikke identificeret komponent	-	31

TABEL B4- 19
RESULTATER AF GC/MS-SCREENING AF PRØVE B9C, BABYBÆRESELE, 0-3 ÅR, SMAL STROP MED PLASTINDLÆG OG LYS TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
Alifatisk kulbrinte	-	21
Kodaflex/txib (2,2,4-Trimethylpentanediol diisobutyrat)	6846-50-0	62
Alifatisk kulbrinte	-	50
Alifatisk kulbrinte	-	18
Alifatisk kulbrinte (284)	-	20
Ikke identificeret komponent	-	33
Ikke identificeret komponent	-	22
Ikke identificeret komponent	-	42
Tris-(2,4-di-tert-butylphenyl)-phosphat	95906-11-9	82

TABEL B4- 20
RESULTATER AF GC/MS-SCREENING AF PRØVE B10A, BÆRESELE, 3- 24 MDR., SKUM FRA RØD, GRÅ OG GRÅ SMÆK

Komponent	CAS-nr.	Indhold i mg/kg
Dibutylftalat	84-74-2	74
Ikke identificeret komponent, evt. amin	-	110
Ikke identificeret komponent, evt. amin	-	140
Ikke identificeret komponent, evt. amin	-	65
Ikke identificeret komponent	-	150
Ikke identificeret komponent, evt. en thiazolforbindelse	-	140
Ikke identificeret komponent	-	67
Irganox 1076	2082-79-3	270

TABEL B4- 21
RESULTATER AF GC/MS-SCREENING AF PRØVE B10B, BÆRESELE, 3- 24 MDR., RØD TEKSTIL MED FILT, GRÅ TEKSTIL OG HAGESMÆK

Komponent	CAS-nr.	Indhold i mg/kg
Ikke identificeret komponent	-	41
Ikke identificeret komponent	-	16

TABEL B4- 22
RESULTATER AF GC/MS-SCREENING AF PRØVE B10C, BÆRESELE, 3- 24 MDR., HVID SKUMPLADE I SMÆKKEN

Komponent	CAS-nr.	Indhold i mg/kg
Alifatisk kulbrinte	-	16
Alifatisk kulbrinte	-	23
Methyl-hexadecanoat	112-39-0	28
Alifatisk kulbrinte	-	24
Methyl 7-octadecenoat	57396-98-2	26
Alifatisk kulbrinte	-	150
Erucylamid	112-84-5	53
2,6,10-Trimethyl-1,5,9-undecatrien	62951-96-6	34

TABEL B4- 23
RESULTATER AF GC/MS-SCREENING AF PRØVE B11, BÆRESELE, 3,5 – 15 KG, GRÅ TEKSTIL OG SKUM

Komponent	CAS-nr.	Indhold i mg/kg
Ikke identificeret komponent	-	54

TABEL B4- 24
RESULTATER AF GC/MS-SCREENING AF PRØVE B12A, BÆRESELE 3,5-6 KG, SKUM FRA SELE STROP, SKUM SAMT FILT

Komponent	CAS-nr.	Indhold i mg/kg
2-Ethylhexansyre	149-57-5	110
Tris-(2-chlorisopropyl)-phosphat (TCPP)	13674-84-5	4670
Bis-(1-chlor-2-propyl)(3-chlor-1-propyl)-phosphat	137909-40-1	2340
Bis-(3-chlor-1-propyl)(1-chlor-2-propyl)-phosphat	137888-35-8	510
Ikke identificeret komponent	-	550
Ikke identificeret komponent	-	630
Ikke identificeret komponent	-	580
Ikke identificeret komponent	-	440

TABEL B4- 25
RESULTATER AF GC/MS-SCREENING AF PRØVE B12B, BÆRESELE 3,5-6 KG, GRÅ, SORT OG HVID TEKSTIL FRA HAGESMÆK

Komponent	CAS-nr.	Indhold i mg/kg
Tris-(2-chlorisopropyl)-phosphat (TCPP)	13674-84-5	310
Bis-(1-chlor-2-propyl)(3-chlor-1-propyl)-phosphat	137909-40-1	140
Bis-(3-chlor-1-propyl)(1-chlor-2-propyl)-phosphat	137888-35-8	25
Ikke identificeret komponent	-	90
Bumetrizol	3896-11-5	150
Ikke identificeret komponent	-	96
Ikke identificeret komponent	-	46

TABEL B4- 26
RESULTATER AF GC/MS-SCREENING AF PRØVE B12C, BÆRESELE 3,5-6 KG, PLAST PLADE I HAGESMÆK

Komponent	CAS-nr.	Indhold i mg/kg
Tris-(2-chlorisopropyl)-phosphat (TCPP)	13674-84-5	270
Bis-(1-chlor-2-propyl)(3-chlor-1-propyl)-phosphat	137909-40-1	97
Ikke identificeret komponent	-	760
Ikke identificeret komponent	-	550
Ikke identificeret komponent	-	88
Ikke identificeret komponent	-	330

TABEL B4- 27
RESULTATER AF GC/MS-SCREENING AF PRØVE B13A, BÆRESELE 4-48 MDR., SKUM I SELESTROP MED PLASE OG FILT I SMÆKKEN

Komponent	CAS-nr.	Indhold i mg/kg
Benzophenon	119-61-9	14
Acetophenon-azin	729-43-1	33
Irganox 1076	2082-79-3	170

TABEL B4- 28
RESULTATER AF GC/MS-SCREENING AF PRØVE B13B, BÆRESELE 4-48 MDR, HULLET TEKSTIL FRA SELESTROP MED FIBRE, SORT TEKSTIL FRA SELESTROP SAMT SORT TEKSTIL FRA INDERSIDE AF SMÆK

Komponent	CAS-nr.	Indhold i mg/kg
Benzophenon	119-61-9	7
2-Chlor-4,6-dinitroanilin	3531-19-9	46
6-Brom-2,4-dinitroanilin	1817-73-8	5
Ikke identificeret komponent	-	17
Spinacen	111-02-4	18
Ikke identificeret komponent	-	18
Ikke identificeret komponent	-	110

TABEL B4- 29
RESULTATER AF GC/MS-SCREENING AF PRØVE B14A, BÆRESELE 3,5-9 KG, SKUM I SMÆKKEN

Komponent	CAS-nr.	Indhold i mg/kg
Diethylftalat	84-66-2	67
Isopropyllaurat	10233-13-3	46
Ikke identificeret komponent	-	82
Ikke identificeret komponent, evt. siloxan-forbindelse	-	340
Ikke identificeret komponent	-	460
Ikke identificeret komponent	-	220
4,4'-Dioctylphenylamin	101-67-7	88

TABEL B4- 30
RESULTATER AF GC/MS-SCREENING AF PRØVE B14B, BÆRESELE 3,5-9 KG, HVID TEKTIL PÅ SMÆKENS BAGSIDE SAMT GRÅ OG SORT TEKSTIL PÅ STROPPEN

Komponent	CAS-nr.	Indhold i mg/kg
4,4,5,7,8-Pentamethyldihydrocoumarin	39170-97-3	54
Diethylftalat	84-66-2	17
Isopropyl-laurat	10233-13-3	23
Benzyl-benzoat	120-51-4	46
Ikke identificeret komponent		190
Ikke identificeret komponent		61

TABEL B4- 31
RESULTATER AF GC/MS-SCREENING AF PRØVE B15A, BÆRESELE 3,5-15 KG, SKUM MED FILT PÅ SMÆKEN

Komponent	CAS-nr.	Indhold i mg/kg
3,3,5,7-Tetramethyl-1-indanon	54789-23-0	49
2-Ethyl-2-methyl-1,3-indandion	70292-52-3	96
1-[2-(Isobutyryloxy)-1-methylethyl]-2,2-dimethylpropyl 2-methylpropanoat	74381-40-1	390
Methylhexadecanoat	112-39-0	1210
Bis(2-ethylhexyl)-tereftalat	6422-86-2	190

TABEL B4- 32
RESULTATER AF GC/MS-SCREENING AF PRØVE B15B, BÆRESELE 3,5-15 KG, SORT REM/SELE SAMT MØRKEBLÅ TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
Dodecansyre	143-07-7	56
Methyl-hexadecanoat	112-39-0	100
Hexadecansyre	57-10-3	45
6-Chlor-2,4-dinitroanilin	3531-19-9	140
2,4-Dinitroanilin	97-02-9	17
Ikke identificeret komponent	-	57
Ikke identificeret komponent	-	77
Ikke identificeret komponent	-	570

TABEL B4- 33
RESULTATER AF GC/MS-SCREENING AF PRØVE B16A, BÆRESELE 3,5-18 KG, SKUM I SELEN

Komponent	CAS-nr.	Indhold i mg/kg
Ikke identificeret komponent	-	490
Ikke identificeret komponent	-	120
Ikke identificeret komponent	-	120
4,4'-Bis-(α,α-dimethyl-benzyl)-diphenylamin	10081-67-1	250

TABEL B4- 34
RESULTATER AF GC/MS-SCREENING AF PRØVE B16B, BÆRESELE 3,5-18 KG, SORT OG GRÅ TEKSTIL FRA SELEN INDVENDIG

Komponent	CAS-nr.	Indhold i mg/kg
Spor af kulbrinter	-	Påvist

TABEL B4- 35
RESULTATER AF GC/MS-SCREENING AF PRØVE B17A, BÆRESELE 6 MDR. – 12 KG, SKUM I SMÆK, HAGESMÆK OG I SELEN

Komponent	CAS-nr.	Indhold i mg/kg
Alifatiske kulbrinter	-	Højt indhold
Ikke identificeret komponent	-	450
2-Monopalmitin	23470-00-0	850
2-Monostearin	621-61-4	250

TABEL B4- 36
RESULTATER AF GC/MS-SCREENING AF PRØVE B17B, BÆRESELE 6 MDR. – 12 KG, HVID OG SORT TEKSTIL FRA SMÆK OG HAGESMÆK

Komponent	CAS-nr.	Indhold i mg/kg
2-chloro-4,6-dinitro-benzamin	3531-19-9	26
Ikke identificeret komponent	-	5
Ikke identificeret komponent	-	5
Ikke identificeret komponent	-	14

TABEL B4- 37
RESULTATER AF GC/MS-SCREENING AF PRØVE B18A, BÆRESELE 3,6-18,2 KG, SKUM FRA SELE SAMT FILT FRA SMÆKKEN

Komponent	CAS-nr.	Indhold i mg/kg
Tris-(chlorethyl)-phosphat	115-96-8	2690
Tris-(1-chlor-2-propyl)-phosphat (TCPP)	13674-84-5	6800
Bis-(2-chlor-1-methylethyl)-3-chloropropyl phosphate	137909-40-1	3000
2-Chloro-1-methylethyl-bis-(3-chloropropyl)-phosphat	137888-35-8	450
Ikke identificeret komponent	-	1770
Bis-(1,3-dichloro-2-propyl)-2,3-dichloro-1-propyl phosphat	68460-03-7	7010
Tris-(1,3-dichloro-2-propyl)-phosphat (TDCP)	13674-87-8	460
Ikke identificeret komponent	-	110
Ikke identificeret komponent	-	3400

TABEL B4- 38
RESULTATER AF GC/MS-SCREENING AF PRØVE B18B, BÆRESELE 3,6-18,2 KG, GRÅ TEKSTIL FRA REM PÅ SELE OG SORT TEKSTIL FRA KANTBÅND

Komponent	CAS-nr.	Indhold i mg/kg
Tris-(chloroethyl)-phosphat	115-96-8	51
Tris-(1-chloro-2-propyl)-phosphat (TCPP)	13674-84-5	150
Bis-(2-chloro-1-methylethyl)-3-chloropropyl-phosphat	137909-40-1	43
Alifatiske kulbrinter	-	Påvist

TABEL B4- 39
RESULTATER AF GC/MS-SCREENING AF PRØVE B18C, BÆRESELE 3,6-18,2 KG, HVIDT NET-TEKSTIL I SELEN SAMT HVID TEKSTIL I SMÆKKEN

Komponent	CAS-nr.	Indhold i mg/kg
Flygtige og semiflygtige organiske stoffer	-	-

- Kun meget lave indhold af uidentificerede komponenter

4C. Screeeningsanalyseresultater - babymadrasser

TABEL B4- 40
RESULTATER AF GC/MS-SCREENING AF PRØVE M19A, LIFTMADRAS, TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
1,4-Butandiol	110-63-4	4,4
Dibutylftalat, DIBP	84-69-5	11
4,4'-diphenylmethan-diisocyanat (MDI)	101-68-8	58
Ikke identificeret komponent	-	20
Ikke identificeret komponent	-	26
Ikke identificeret komponent	-	63
Ikke identificeret komponent	-	53
Ikke identificeret komponent	-	12
Ikke identificeret komponent	-	30
Ikke identificeret komponent	-	33
Ikke identificeret komponent	-	24
Ikke identificeret komponent	-	14

TABEL B4- 41
RESULTATER AF GC/MS-SCREENING AF PRØVE M19B, LIFTMADRAS, SKUM

Komponent	CAS-nr.	Indhold i mg/kg
Benzylalkohol	100-51-6	14
2-Ethylhexansyre	149-57-5	66
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	360
3,4-Toluendiamin	496-72-0	Påvist
5-Methylbenzimidazolon	5400-75-9	450
5-Methylbenzimidazolon	5400-75-9	411
1,6-Dioxacyclododecane-7,12-dion	777-95-7	23
4,4'-Vinylendianilin	621-96-5	62
Tert-octyldiphenylamin	NIST 370313 *	180
Ikke identificeret komponent	-	310
Ikke identificeret komponent	-	210
Ikke identificeret komponent	-	700
Ikke identificeret komponent	-	160
Ikke identificeret komponent	-	20
4,4'-Dioctyldiphenylamin	101-67-7	82
Ikke identificeret komponent	-	29

* Stoffet har ikke noget CAS-nr. i NIST biblioteket

TABEL B4- 42
RESULTATER AF GC/MS-SCREENING AF PRØVE M20A, LIFTMADRAS, TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
Methyl hexadecanoat	112-39-0	13
Ikke identificeret komponent	-	19
Methyl 9-octadecenoat	2462-84-2	67
Methyloctadecanoat	112-61-8	13
Alifatiske kulbrinter	-	Påvist*
Ikke identificeret komponent	-	61
Ikke identificeret komponent	-	47

* Påvist i høje koncentrationer

TABEL B4- 43
RESULTATER AF GC/MS-SCREENING AF PRØVE M20B, LIFTMADRAS, SKUM

Komponent	CAS-nr.	Indhold i mg/kg
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	42
1,1,3-Trimethyl-3-phenylindan	3910-35-8	230
Dicumyl	1889-67-4	360
2,4-Diphenyl-4-methyl-2(E)-penten	22768-22-5	610
4-Cumylphenol	599-64-4	530
Methylhexadecanoat	112-39-0	76
13-Epimanool	1438-62-6	39
Biformen	5957-33-5	47
Isopimaradien	1686-66-4	100
Methyloleat	112-62-9	260
Abetinsyre (usikker identifikation)	514-10-3	Påvist

TABEL B4- 44
RESULTATER AF GC/MS-SCREENING AF PRØVE M20C, LIFTMADRAS, FLAMINGO-SKUM

Komponent	CAS-nr.	Indhold i mg/kg
1-Phenyl-1,3,3-trimethylindan	3910-35-8	17
2,3-Dimethyl-2,3-diphenylbutan	1889-67-4?	26
(E)–bis-1,1'-(1,3,3-Trimethyl-1-propen-1,3-diyl)-benzen	22768-22-5	51
Palmitinsyre (hexadecansyre)	57-10-3	280

Komponent	CAS-nr.	Indhold i mg/kg
Ikke identificeret komponent	-	17
Ikke identificeret, evt palmitinsyre	57-10-3	950
Ikke identificeret komponent	-	68
Ikke identificeret komponent	-	43
Ikke identificeret komponent	-	100
Ikke identificeret komponent	-	43
Ikke identificeret komponent	-	60
Ikke identificeret komponent	-	43
Ikke identificeret komponent	-	17
Ikke identificeret komponent	-	17
Ikke identificeret komponent	-	17
Ikke identificeret komponent	-	9
Ikke identificeret komponent	-	17
4,4'-Butylen-bis-(6-tert-butyl-methylphenol)	85-60-9	26
cis-13-Docosenoamid	112-84-5	140
Oleamid	301-02-0	34

Der ses en meget stor, bred top i chromatogrammet, som forstyrrer identifikationen af komponenter fra efter palmitinsyren. Det kan muligvis stor mængde af abetinsyre, CAS 514-10-3.

TABEL B4- 45
RESULTATER AF GC/MS-SCREENING AF PRØVE M21A, LIFT, TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
Acetophenon	98-86-2	4,1
Ikke identificeret komponent	-	4
Ikke identificeret komponent	-	6

TABEL B4- 46
RESULTATER AF GC/MS-SCREENING AF PRØVE M21B, LIFT, SKUM

Komponent	CAS-nr.	Indhold i mg/kg
Ikke identificeret component	-	69
Ikke identificeret component	-	13
Ikke identificeret component	-	1170
Ikke identificeret component	-	140
Ikke identificeret komponent	-	36

TABEL B4- 47
RESULTATER AF GC/MS-SCREENING AF PRØVE M22A, LIFT, TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
Alifatiske kulbrinter (C20-C30)	-	2250
Ikke identificeret komponent	-	140
gamma-Sitosterol	83-47-6	71
Ikke identificeret komponent	-	23
Ikke identificeret komponent	-	43

TABEL B4- 48
RESULTATER AF GC/MS-SCREENING AF PRØVE M22B, LIFT, SKUM

Komponent	CAS-nr.	Indhold i mg/kg
Benzylalkohol	100-51-6	24
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	32
3,4-Toluendiamin	496-72-0	12
5-Methylbenzimidazolon	5400-75-9	62
5-Methylbenzimidazolon	5400-75-9	62
Uidentificeret ftalat	-	44
4,4'-Vinylendianilin	621-96-5	33
4,4'-Vinylendianilin	621-96-5	69
Ikke identificeret komponent	-	100
Ikke identificeret komponent	-	68
Ikke identificeret komponent	-	230
Ikke identificeret komponent	-	77
4,4'-Dioctyldiphenylamin	101-67-7	48
Irganox 1076	2082-79-3	480

TABEL B4- 49
RESULTATER AF GC/MS-SCREENING AF PRØVE M23A, BLØD LIFT, TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
Benzylalkohol	100-51-6	7
Acetophenon	98-86-2	18
2-Phenyl-butanol-2	1565-75-9	4
Alifatiske kulbrinter (C20-C30)	-	207
Ikke identificeret komponent	-	70
Ikke identificeret komponent	-	130

TABEL B4- 50
RESULTATER AF GC/MS-SCREENING AF PRØVE M23B, BLØD LIFT, SKUM

Komponent	CAS-nr.	Indhold i mg/kg
Alifatiske kulbrinter	100-51-6	75
Ikke identificeret component	98-86-2	78
Ikke identificeret component	1565-75-9	625
Ikke identificeret component	-	127
Ikke identificeret komponent	-	34

TABEL B4- 51
RESULTATER AF GC/MS-SCREENING AF PRØVE M24A, LIFT, TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
Benzaldehyd	100-52-7	3
Benzylalkohol	100-51-6	3
Acetophenon	98-86-2	14
2-Hydroxy-N-methyl-2-phenylpropanamid	2019-70-7	2
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	9
5-Methylbenzimidazolon	5400-75-9	3
5-Methylbenzimidazolon	-	4
Bis-(2-hydroxyethyl)-terefthalat	959-26-2	6
Tris-(1,3-dichlorisopropyl)-phosphat (TDCP)	13674-87-8	65
Alifatiske kulbrinter	-	64
Ikke identificeret component	-	71
Ikke identificeret component	-	6
Ikke identificeret silan	-	72

TABEL B4- 52
RESULTATER AF GC/MS-SCREENING AF PRØVE M24B, LIFT, SKUM

Komponent	CAS-nr.	Indhold i mg/kg
2,4-Toleundiisocyanat (2,4-TDI)	584-84-9	170
5-Methylbenzimidazolon	5400-75-9	150
5-Methylbenzimidazolon	5400-75-9	130
Ikke identificeret komponent	-	72
Ikke identificeret komponent	-	37
4,4'-Vinylendianilin	621-96-5	50
Ikke identificeret komponent, chlorholdig	-	100
Ikke identificeret komponent, chlorholdig	-	750
tert-Octyldiphenylamin	NIST 370313*	390
Tris-(1,3-dichlorisopropyl)-phosphat (TDCP)	13674-87-8	29700
Tris-(1,3-dichlorisopropyl)-phosphat (TDCP)	13674-87-8	310
Ikke identificeret komponent	-	150
Ikke identificeret komponent	-	170
Ikke identificeret komponent	-	340
Ikke identificeret komponent	-	300
Ikke identificeret komponent	-	210
Ikke identificeret komponent	-	100
Ikke identificeret komponent	-	3190
Ikke identificeret komponent	-	1570
Ikke identificeret komponent	-	190
4,4'-Dioctyldiphenylamin	101-67-7	72

* Stoffet har ikke noget CAS-nr. i NIST-biblioteket

TABEL B4- 53
RESULTATER AF GC/MS-SCREENING AF PRØVE M25A, LIFTMADRAS, TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
Ikke identificeret komponent	-	6
N,N-Dimethyldodecylamin	112-18-5	9
Evt. Siloxan	-	6
Ikke identificeret komponent	-	24
Ikke identificeret komponent	-	220
Ikke identificeret komponent	-	71
Ikke identificeret komponent	-	42
Ikke identificeret komponent	-	42
Tris-(2,4-di-tert-butylphenyl)-phosphat	95906-11-9	40

TABEL B4- 54
RESULTATER AF GC/MS-SCREENING AF PRØVE M25B, LIFTMADRAS, SKUM

Komponent	CAS-nr.	Indhold i mg/kg
Glycerin	56-81-5	200
Evt. Siloxan	-	100
Evt. Siloxan	-	70
4,4'-Vinylendianilin	621-96-5	94
Evt. Siloxan	-	64
4,4'-Diphenylmethane diisocyanat	101-68-8	310
4,4'-Diphenylmethane diisocyanat	101-68-8	420
Evt. Siloxan	-	120
Tributylacetylcitrat	77-90-7	2900
Tert-octyldiphenylamin	-	170
Ikke identificeret komponent	-	110
Ikke identificeret komponent	55255-72-6	610
Ikke identificeret komponent	-	77
Ikke identificeret komponent	-	1200
Ikke identificeret komponent	-	97
Evt. Equilenin	517-09-9	160
4,4'-Dioctyldiphenylamin	101-67-7	140
4,4'-Dioctyldiphenylamin	-	33
Irganox 1076	2082-79-3	1300

TABEL B4- 55
RESULTATER AF GC/MS-SCREENING AF PRØVE M26A, LIFTMADRAS, TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
1,6-Hexamethylene-diisocyanat (HDI)	822-06-0	6
Ikke identificeret komponent	-	49
Ikke identificeret komponent	-	9
Ikke identificeret komponent	-	10
Ikke identificeret komponent	-	47

TABEL B4- 56
RESULTATER AF GC/MS-SCREENING AF PRØVE M26B, LIFTMADRAS, SKUM

Komponent	CAS-nr.	Indhold i mg/kg
Phenylisocyanat	103-71-9	62
Anilin	62,53-3	210
Benzothiazol	95-16-9	61
1H-Indazol	271-44-3	190
N,N'-Diphenylcarbodiimid	622-16-2	67
cis-9-Hexadecensyre	373-49-9	58
Haxadecansyre	57-10-3	110
Oleinsyre	112,80,1	1860
N,N'-Diphenylguanidin (accelerator)	102-06-7	390
Ikke identificeret component	-	54
Ethylziram	14324-55-1	130
N-phenyl-9-oktadecenamid	5429-85-6	157
Ikke identificeret komponent	-	53
Ikke identificeret komponent	-	160
Ikke identificeret komponent	-	160
Ikke identificeret komponent	-	650

TABEL B4- 57
RESULTATER AF GC/MS-SCREENING AF PRØVE M27A, LIFTMADRAS, TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
1,8-Diazacyclotetradecan-2,9-dion	5776-79-4	8
Dodecylpalmitat	42232-29-1	22
Ikke identificeret komponent	-	38
Oleinsyre, eicosylester	22393-88-0	410
Ikke identificeret komponent	-	31
Ikke identificeret komponent	-	110
Ikke identificeret komponent	-	44

TABEL B4- 58
RESULTATER AF GC/MS-SCREENING AF PRØVE M27B, LIFTMADRAS, SKUM

Komponent	CAS-nr.	Indhold i mg/kg
2-Ethylhexansyre	149-57-5	110
2,4-Toleundiisocyanat (2,4-TDI)	584-84-9	130
2,4-Toluendiamin	95-80-7	15
5-Methylbenzimidazolon	5400-75-9	130
5-Formyl-2,4-dimethyl-1H-pyrrole-3-carbonitril	32487-71-1	120
4,4'-Vinylenedianilin	621-96-5	49
4,4'-Vinylenedianilin	621-96-5	83
Ikke identificeret komponent	-	44
Ikke identificeret komponent	-	66
Ikke identificeret komponent	-	45
Ikke identificeret komponent	-	179
Evt. 1,4-Bis(aminomethyl)-anthra-9,10-quinon	77862-13-6	130
4,4'-Dioctyldiphenylamin	101-67-7	56
Irganox 1076	2082-79-3	310

TABEL B4- 59
RESULTATER AF GC/MS-SCREENING AF PRØVE M28A, LIFTMADRAS, TEKSTIL

Komponent	CAS-nr.	Indhold i mg/kg
Dimethylvinylmethanol	115-18-4	11
3-Penten-2-on	625-33-2	34
3-Penten-2-ol	1569-50-2	20
1-Octen-4-ol	40575-42-6	110
1-Octen-4-ol	40575-42-6	100
Styren	100-42-5	6
Ikke identificeret komponent	-	22
1,1,2,2-Tetrachlorethan	79-34-5	47
Benzylalkohol	100-51-6	12
Hexaglycerol	77-99-6	16
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	410
5-Formyl-2,4-dimethyl-1H-pyrrole-3-carbonitril	32487-71-1	13
Ikke identificeret komponent	-	67
Ikke identificeret komponent	-	87
Ikke identificeret komponent	-	20
Ikke identificeret komponent	-	240
Ikke identificeret komponent, evt. isocyanat	-	38
Ikke identificeret komponent, evt. isocyanat	-	5
Diphenylmethane 4,4'-diisocyanat	101-68-8	17
Ikke identificeret komponent	-	3
Isocyanat	-	3
Benzo[a]fluoren	238-84-6	1
Diethylhexylftalat (DEHP)	117-81-7	22
Ikke identificeret komponent	-	44
C.I. Disperse red 60	17418-58-5	42
Ikke identificeret komponent	-	44

TABEL B4- 60
RESULTATER AF GC/MS-SCREENING AF PRØVE M28B, LIFTMADRAS, SKUM

Komponent	CAS-nr.	Indhold i mg/kg
Acetophenon	98-86-2	17
2,4-Toluendiisocyanat (2,4-TDI)	584-84-9	25
5-Methylbenzimidazolon	5400-75-9	51
5-Formyl-2,4-dimethyl-1H-pyrrole-3-carbonitril	32487-71-1	51
Ikke identificeret komponent	-	15
Diisobutylftalat	84-69-5	57
Dibutylftalat	84-74-2	22
4,4'-Vinylenedianilin	621-96-5	47
4,4'-Vinylenedianilin	621-96-5	78
Ikke identificeret komponent	-	35
Ikke identificeret komponent	-	53
Ikke identificeret komponent	-	47
Ikke identificeret komponent	-	170
Fx 1,4-Bis(aminomethyl)anthra-9,10-quinon	77862-13-6	130
4,4'-Dioctyldiphenylamin	101-67-7	65

Appendix 5: Analysis results – formaldehyde (in Danish)

TABEL B5- 1
RESULTATER FOR FORMALDEHYD I TEKSTILER FRA AUTOSTOLE

		Formaldehyd
Prøve mrk.	**Produktnavn**	**mg/kg**
A1	Tekstil	<2
A2A	Tekstil	<2
A3A	Tekstil	< 2
A3B	Tekstil	< 2
A4	Tekstil	< 2
A5A	Tekstil	< 2
A5B	Tekstil	< 2
A6A	Tekstil	< 2
A6B	Tekstil	< 2
A7A	Tekstil	< 2
A7B	Tekstil	< 2
A8A	Tekstil	< 2
A8B	Tekstil	< 2
A29	Tekstil	< 2
A30	Tekstil	< 2

TABEL B5- 2
RESULTATER FOR FORMALDEHYD I TEKSTILER FRA BÆRESELER

		Formaldehyd	
Prøve mrk.	**Produktnavn**	**mg/kg**	**Gennemsnit mg/kg**
9A	Tekstil	<2	< 2
9C	Tekstil	<2	
10B	Tekstil	< 2	< 2
11	Tekstil	< 2	
12A	Tekstil	< 2	< 2
12B	Tekstil	< 2	

13A	Tekstil	< 2	< 2
13B	Tekstil	< 2	
14B	Tekstil	< 2	< 2
15B	Tekstil	< 2	
16B	Tekstil	< 5	< 2
17B	Tekstil	< 2	
18B	Tekstil	< 5	< 2
18C	Tekstil	< 5	

<: Betyder mindre end den angivne detektionsgrænse.

TABEL B5- 3
RESULTATER FOR FORMALDEHYD I TEKSTILER FRA MADRASSER

		Formaldehyd	
Prøve mrk.	**Produktnavn**	**mg/kg**	**Gennemsnit mg/kg**
19A	Tekstil	<2	< 2
20A	Tekstil	<2	
21A	Tekstil	< 2	< 2
22A	Tekstil	< 2	
23A	Tekstil	< 2	< 2
24A	Tekstil	< 2	
25A	Tekstil	< 2	< 2
26A	Tekstil	< 2	
27A	Tekstil	< 2	< 2
28A	Tekstil	< 2	

<: Betyder mindre end den angivne detektionsgrænse.

Appendix 6: List of azo dyes and other amines included in the analyses for azo dyes (in Danish)

TABEL B6- 1
OVERSIGT OVER STOFFER UNDERSØGT VED ANALYSEN FOR AZOFARVESTOFFER

Farvestof	CAS-nr.
4-Aminobiphenyl	92-67-1
Benzidin	92-87-5
4-Chloro-o-toluidin	95-69-2
2-Naphthylamin	91-59-8
o-Aminoazotoluen	97-56-3
5-Nitro-o-toluidin	99-55-8
4-Chloroanilin	106-47-8
4-Methoxy-m-phenylenediamin	615-05-4
4,4'-Diaminodiphenylmethan	101-77-9
3,3'- Dichlorobenzidin	91-94-1
3,3'- Dimethoxybenzidin	119-90-4
3,3'- Dimethylbenzidin	119-93-7
4,4'-Methylenedi-o-toluidin	838-88-0
p-Cresidin	120-71-8
4,4'-Methylen-bis-(2-chloranilin)	101-14-4
4,4'-Oxydianilin	101-80-4
4,4-Thiodianilin	139-65-1
o-Toluidin	95-53-4
4-Methyl-m-phenylenediamin	95-80-7
2,4,5-Trimethylanilin	137-17-7
o-Anisidin	90-04-0
2,4-Xylidin / 2,6-Xylidin	95-68-1/87-62-7
4-Amino-azobenzen*	60-09-3
Øvrige aromatiske aminer	
Anilin	62-53-3
p-Phenylendiamin	106-50-3
2,6-Dichlor-p-phenylendiamin/4,5-Dichlor-o-phenylendiamin	609-20-1/5348-42-5

* Analyse af 4-aminoazobenzen blev ikke udført, da der ikke blev påvist anilin eller p-phenhylendiamin i betydelige mængder.

Appendix 7: List of polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) included in the analyses for brominated flame retardants (in Danish)

TABEL B7- 1
OVERSIGT OVER STOFFER UNDERSØGT VED ANALYSEN FOR PBB OG PBDE

Flammehæmmer
Polybromerede biphenyler (PBB), enkelt stoffer:
2,2',5,5'-TetraBB # 52
2,2',4,5,5'-PentaBB # 101
2,2',4,4',5,5'-HexaBB # 153
2,2',3,4,4',5,5'-HeptaBB # BB 180
2,2',3,3',4,4',5,5'-OctaBB # BB 194
2,2',3,3',4,4',5,5',6-NonaBB # BB 206
DecaBB # 209
Polybromerede diphenylethere (PBDE), enkelt stoffer:
2,2',4-TriBDE (BDE-17)
2,4,4'-TriBDE (BDE-28)
2,2‘,4,4‘-TetraBDE (BDE-47)
2,2',4,5'-TetraBDE (BDE-49)
2,3‘,4,4‘-TetraBDE (BDE-66)
2,3‘,4‘,6-TetraBDE (BDE-71)
3,3‘,4,4‘-TetraBDE (BDE-77)
2,2‘,3,4,4‘-PentaBDE (BDE-85)
2,2‘,4,4‘,5-PentaBDE (BDE-99)
2,2',4,4',6-PentaBDE (BDE-100)
2,3‘,4,4‘,6-PentaBDE (BDE-119)
3,3',4,4',5-PentaBDE (BDE-126)
2,2',3,4,4',5'-HexaBDE (BDE-138)
2,2‘,4,4‘,5,5‘-HexaBDE (BDE-153)
2,2',4,4',5,6'-HexaBDE (BDE-154)
2,3,3',4,4',5-HexaBDE (BDE-156)
2,2‘,3',4,4‘,5',6-HeptaBDE (BDE-183)
2,2',3,4,4',6,6'-HeptaBDE (BDE-184)
2,2',3,4,4',6,6'-HeptaBDE (BDE-184)
2,3,3',4,4',5',6-HeptaBDE (BDE-191)
2,2',3,4,4',5,5',6-OctaBDE (BDE-196)
2,2',3,3',4,4',6,6'-OctaBDE (BDE-197)
2,2',3,3',4,4',5,5',6-NonaBDE (BDE-206)
2,2',3,3'4,4',5,6,6'-NonaBDE (BDE-207)
DecaBDE (BDE-209)

Chemical substances in car safety seats and other textile products for children

The objective with this report is to examine and assess whether there are chemical substances in car safety seats and other textile products for children that may pose a risk, and to evaluate whether the regulations on the area are met. The analyzed product groups are car safety seats, baby slings, and baby mattresses and 10 products from each product groups are investigated.

The specific substances selected for quantitative chemical analysis based on the results of the screening analyses and initial hazard/exposure assessment were phosphorus-based flame retardants, the phthalate DIDP, azo dyes (through certain aromatic amines as indicators), isocyanates and brominated flame retardants. The substances found in most samples in significant concentrations were the phosphorus-based flame retardants TCEP, TCPP and TDCP and two isomers of diisodecyl phthalate (DIDP).Furthermore, an illegal level of an aromatic amine, indicating use of azodyes, was found in one product.

Migration tests were performed for the phosphorus-based flame retardants. The seven products having the highest content of one or more of these substances – 4 car safety seats, 2 baby slings and 1 baby mattress – were tested for migration to artificial sweat over a period of 3 hours. Migration was observed in all tests, varying from <1 % up to 30% of the material's content (by weight). Three products were shown to pose a risk under foreseeable use of the product.

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