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Survey, health and environmental assessment of flame retardants in textiles

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Introduction

This project on flame retardants in textiles was carried out between August 2012 and December 2013.

This report describes the results of the project, including the survey and the results of the survey. The report also specifies which products were selected for chemical analysis for content of flame retardants. Results of chemical analyses are presented, and finally, a health and environmental assessment of the identified flame retardants has been made.

The project has been undertaken by DHI and FORCE Technology. FORCE Technology has been responsible for the chemical analyses of selected interiors products.

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The project was observed by a reference group consisting of Dorte Bjerregaard Lerche, Lærke Ambo Nielsen and Mette Tingleff Skaanild (took over the project from October 2013) from the Environmental Protection Agency.

The project was financed by the Environmental Protection Agency.

Conclusion and summary

Flame retardants are added to some products with the purpose of making it more difficult for a fire to develop. Flame retardants are added to products of flammable materials such as textiles, foam materials, and plastic, i.e. consumer products such as furniture, plastic, textiles, carpets, mattresses, and electronics, such as TVs, computers, mobile phones, etc.

For certain product groups (such as furniture, carpets, curtains and mattresses) there may be direct requirements to the fire safety of the products, which mean that the flame retardants are necessary to use in these types of products. Especially the UK and the US (California in particular) have stricter requirements to fire safety, which in some cases necessitate the use of flame retardants in products. California, for instance, has special statutory fire safety standards for upholstered furniture (Technical Bulletin 117). This means that there are flame retardants in almost all upholstered furniture on the US market[1]. A study of 102 upholstered pieces of furniture from all over the US showed that 85% of all tested furniture contained flame retardants (Stapleton et al., 2012). California, however, in late 2013 decided to amend the test requirements specified in TB 117, which means that the requirements can be complied without the use of flame retardants. This amendment in the legislation will come into force on 1 January 2015[2].

It is unknown whether something similar is true for Europe; that is whether upholstered furniture imported to Europe, in practice also meets the UK fire safety requirements and thus contain flame retardants in order to meet these requirements.

The EU Commission is now under strong pressures from England regarding fire safety requirements, and this may lead to requirements for the use of flame retardants in the rest of the EU at one point. Furthermore, the Norwegian authorities have also started to look at stricter fire safety requirements[3].

Purpose and delimitation

Therefore, the Danish Environmental Protection Agency launched this project in 2012 to investigate whether there are flame retardants in interior design sold on the Danish market. The purpose of the project has been to identify and assess the health and environmental risks of the content of flame retardants in textiles and foam parts used for interior design, with emphasis on curtains, furniture, mattresses and carpets.

The focus of the project has been solely on textiles for interior design. Textiles for products such as car seats, child car seats or other means of transport are not included in the survey.

History

Previously, the use of polybrominated diphenyl ethers (PBDEs - including penta, octa, and deca-BDE) has been widespread, but global restrictions (in the EU and Japan) and phasing out (in the US) of PBDEs around 2004 has meant that there has been a demand for alternative flame retardants, such as organophosphate flame retardants and new forms of brominated flame retardants.

[1] http://www.ireadlabelsforyou.com/flame-retardant-law-is-about-to-change/
[2] http://www.ireadlabelsforyou.com/flame-retardant-law-is-about-to-change/
[3] Personal communication with Kjeld Bülow, counselor in the Furniture+Interior Trade Association, February 2013.

The use of flame retardants in interior design in Denmark

The survey of use of flame retardants in interior design in Denmark was partly conducted by contact with the industry and partly by internet search. A total of 64 companies were contacted, and 30 of these companies provided input to the project. Companies within the following areas were contacted: textiles in general (for curtains and furniture), carpets, curtains and furniture. A summary of the use of flame retardants within these areas is indicated in Table 1.

Area	Comments	Specific flame retardants mentioned
Textiles	Primarily textiles to be used for furniture or curtains in public buildings with specific fire safety requirements contain flame retardants or are retreated with flame retardants. Home textiles/furniture textiles produced with flame retardants are exported mainly to England. Textiles made of polyester are typically always flame retarded as the fibre itself contains a built-in flame retardant.	Trevira CS (phosphorus based) built into the fibre Zirpro (zirconium based) Flovan (phosphorus based) Pekoflam (phosphorus and nitrogen based)
Carpets	Primarily carpets sold to the professional market contain flame retardants. Carpets sold to the private market do typically not contain flame retardants.	Aluminium trihydroxide is used on the back of the carpet
Curtains	Curtains are typically based on textile fabrics with flame retardants built into the fibre. The Trevira CS fibre seems to be most prevalent in the industry. Retreatment with flame retardant may be done (Zirpro). Curtains for special use are flame retarded (for instance theater curtains).	Trevira CS (phosphorus based) built into the fibre FR-fibre (unknown type) Zirpro (zirconium based) Flovan (phosphorus based) Pekoflam (phosphorus and nitrogen based)
Furniture	Flame retardants are not generally used in Danish-produced furniture for the Danish market, but furniture produced abroad may contain flame retardants both in fabric covers and upholstery (foam). The upholstery of the furniture may contain flame retardants, especially where there are special fire safety requirements (e.g. furniture and mattresses used in ships and trains, institutions, etc.). Especially in PUR (polyurethane) foam, there is information on the use of flame retardants (outside DK).	Trevira CS (phosphorus based) built into the fibre of the fabric TCPP (in PUR foam) TDCPP (in PUR foam) TMCP (in PUR foam) BTMCP/V6 (in PUR foam)

TABLE 1
OVERVIEW OF THE USE OF FLAME RETARDANTS ACCORDING TO THE INDUSTRY

The survey generally showed that the flame retardant is either built into the product or subsequently added to the textile (cover) or the foam of the furniture. The flame retardant may be built into the fibre of polyester or built into the backs of the carpets.

Analyses of selected products

Based on the survey results as well as consideration of exposure and screening for health risks of flame retardants in the products, it was decided to focus on furniture and mattresses, as exposure to possible flame retardants in curtains and backs of carpets was considered to be low. Subsequently, a total of 15 products on the Danish market were purchased for analyses for content of flame retardants.

The selection of the purchased products focused on purchasing furniture and mattresses, which were also available on the UK market; i.e. products were purchased from shops or producers, who also produce for the UK market.

In total, the following 15 products were purchased and analysed:

- 3 office chairs
- 8 mattresses
- 3 chairs/armchairs
- 1 rug

For these 15 products, X-ray screenings (XRF elements analysis) of each material layer (subsamples) of the products were initially performed to determine whether there was content of elements in each layer of material, which could indicate content of flame retardants.
The conclusions of the XRF screenings were as follows:

- Aluminium was seen in all subsamples in concentrations up to 1.8%, but the content of aluminium in several of the examined subsamples indicates a content of fillers (and not flame retardant), as the content of aluminum and silicon go together in terms of volume.
- Few of the examined subsamples contain titanium in concentrations indicating that it may originate from a flame retardant. But content of titanium may also be due to the colorant titanium dioxide. As flame retardants based on titanium do not pose environmental or health risks, it was decided not to focus on titanium in future analyses.
- Zirconium was measured in just five subsamples above the detection limit and in concentrations so small that content of zirconium-based flame retardants is unlikely.
- Generally, there were not high contents of phosphorus and chlorine except in a few subsamples (total 5 layers). The concentrations of phosphorus and chlorine go together, which may indicate a flame retardant consisting of both chlorine and phosphorus, i.e. TCPP, TDCPP or TCEP.
- Bromine was seen in about half of the subsamples (layers), but generally in very small concentrations. A few subsamples had little higher concentrations, but generally the levels of bromine were so small (maximum content measured to approx. 0.04%) that it is hardly due to the content of brominated flame retardants.

Based on this X-ray analysis of each layer of the purchased furniture, a total of 13 subsamples (layers) were selected, for which a GCMS screening (gas chromatography mass spectrometry) was made for content of flame retardants. This GCMS screening indicated that TCPP and TDCPP were present in four of the 13 subsamples, and TDCPP in a very small concentration in a single subsample. The chromatograms from the GCMS screening showed no signs of other components, such as brominated flame retardants.

TCPP and TDCPP, belonging to the group of chlorinated alkyl phosphates, were therefore subsequently quantified in the four subsamples, which were all foam granules from office chairs or chairs. One chair had two foam layers, and TCPP and TDCPP were observed in both foam layers.

The contents of TCPP and TDCPP were quantified to between 0.07 and 0.46% for TCPP and between 0.9 and 1.3% for TDCPP in the foam layers.

The conclusion of the analysis was that:

- 1 out of 3 examined office chairs contained flame retardants in the form of TCPP (0.46%) and TDCPP (0.9%).
- 2 out of 3 examined chairs/armchairs contained flame retardants in the form of TCPP (max 0.44%) and TDCPP (max 0.61%). Both chairs had a content of TDCPP in two layers. One of the chairs had a content of TCPP in two layers.
- None of the 8 examined mattresses or the rug contained flame retardants.

Risk assessment

Subsequently, a health and environmental risk assessment was performed of the two observed flame retardants TCPP and TDCPP in products on the Danish market.

TCPP does not have an EU harmonised hazard classification. If swallowed, TCPP is rapidly and extensively absorbed (approx. 80% of the dose) and is widely distributed in the organs of the body. TCPP's acute toxicity is low and can by skin contact cause moderate degrees of skin irritation. TCPP is not evaluated to be allergenic. Studies have shown that the target organs of the harmful effects of the substance by long-term exposure are liver and thyroid with a LAOEL value of 52 mg/kg bw/day. The substance is not mutagenic. There is no cancer study on the substance and there has been and still is an ongoing discussion on whether the substance should be classified as carcinogenic, as it is very similar to the substances TCEP and TDCPP, both of which are classified carcinogenic. (Carc. 2; H351). Effects on foetal development and reproduction of TCPP were studied in a 2-generation reproduction toxicity study. A LOAEL value of 99 mg /kg body weight was derived based on effects on the uterine weight seen in all dosed females and the increased number of dwarfism in the offspring. Similarly, observations in this study point out that TCPP may cause hormonal disruption due to the discovery of uterine weight and extension of the oestrogen cycle. These results indicate that TCPP may alter the hormonal balance.

Based on the presented data, a tolerable exposure level (a DNEL value) for TCPP has been calculated to 0.07 mg/kg body weight/day derived based on a LOAEL of 52 mg/kg bw/day in a 90-days study, corresponding to an internal dose of 41.6 mg/kg bw/day (absorption of 80% by oral ingestion) and using a total assessment factor of 600.

Regarding environmental effects, TCPP does not meet the requirements to be a PBT substance. TCPP is considered to fulfil the criteria as persistent (P) or potentially very persistent (vP). Available information on bioaccumulation (BCF (fish) of 0.8 to 4.6) shows that TCPP does not meet the criterion for bioaccumulation (B). The criterion for toxicity (T) is not met either.

TDCPP has an EU harmonised classification as Carc.2;H451. TDCPP is rapidly and extensively absorbed (approx. 100% of the dose) after oral administration and is widely distributed in the organs of the body. TDCPP's acute toxicity is low and only moderate degrees of skin irritation have been observed. TDCPP is estimated not to be sensitising. The substance is evaluated not to be mutagenic. Studies have indicated the kidneys to be the target organ. In a chronic 2-year cancer study, kidney tumours were found after 24 months in the medium and high dose groups. A LOAEL of 5 mg/kg body weight was determined based on the findings of renal hyperplasia (increased cell growth) in all exposed groups. Hyperplasia of the renal tubule epithelium is considered a pre-neoplastic lesion, which may cause adenoma and then carcinoma.
Effects on foetus and reproduction were studied in rats. There was no evidence of embryotoxicity in the absence of toxic effects in the dams. NOAEL for the offspring was 100 mg/kg bw/day based on increased resorption and reduced viability index of foetuses at a dose of 400 mg/kg bw/day. A 12-

week male fertility study in rabbits showed no effects on mating, fertility, semen analysis and male reproductive organs, indicating that TDCPP has no effect on male fertility.
Based on the presented data, a DNEL value of 0.005 mg/kg bw/day was derived on the basis of data from a chronic study with a LOAEL of 5 mg/kg bw/day, using an overall assessment factor of 1000.

Regarding environmental risk, TDCPP does not meet the requirements to be a PBT substance. TDCPP is considered to fulfill the criteria as persistent (P) or potentially very persistent (vP). Available information on bioaccumulation (BCF (fish) of 31-59) shows that TDCPP does not meet the criterion for bioaccumulation (B). The criterion for toxicity (T) is not met either.

In addition to the above risk assessment, exposure to the two found flame retardants, TCPP and TDCPP, was assessed in order to be able to assess the risk by exposure to the two substances. Exposure to the two substances may be due to inhalation of the substances via the indoor air and via skin exposure by direct contact with products containing the flame retardant, and finally by intake of dust particles containing the substance in the home or in the office. These three routes of exposure were assessed, and a daily exposure was calculated for each route of exposure and the total exposure for a 2-3 year old child and an adult. The values appear from the table below. Data have been obtained from the literature on the quantity of TCPP and TDCPP that may be contained in the dust, partly in the home and partly in office areas. These data represent total concentrations of TCPP and TDCPP, where the sources of the observed quantities do not necessarily come from the home interiors, but may also come from other sources.

Substance	Scenario	Daily exp. DERMAL (µg/kg/day)	Daily exp. INHAL (µg/kg/day)	Daily exp. DUST (µg/kg/day)	Daily exp. TOTAL (µg/kg/day)
TCPP	Children	1.68	2.217	1.120	5.015
TCPP	Adults	1.47	0.95	0.093	2.515
TDCPP	Children	2.46	0.0875	0.720	3.270
TDCPP	Adults	2.16	0.0375	0.060	2.258

TABLE 2
THE CALCULATED EXPOSURE TO TCPP AND TDCPP VIA DERMAL EXPOSURE, INHALATION AND INTAKE OF DUST, RESPECTIVELY

The calculated exposure to TCPP and TDCPP gave rise to the following risk coefficients RCR (exposure in mg/kg/day / DNEL value):

Substance	Scenario	DNEL	RCR_{DUST}	RCR_{INHAL}	RCR_{DERMAL}	RCR_{TOTAL}
TCPP	Children	70	0.0160	0.0317	0.024	0.07
TCPP	Adults	70	0.0013	0.0136	0.021	0.04
TDCPP	Children	5	0.1440	0.0175	0.493	0.65
TDCPP	Adults	5	0.0120	0.0075	0.432	0.45

TABLE 3
THE CALCULATED RISK (RCR) BY EXPOSURE TO TCPP AND TDCPP

If RCR is less than 1, exposure is not considered to pose a risk of harmful effects. The largest contribution to the total RCR comes from dermal exposure, but most likely it is considerably overestimated in the calculations because the flame retardants for computational reasons were assumed to be in the outer foam layer, while in fact they were measured in the lower foam layer. In the specified calculations, dermal exposure was found to be a significant route of exposure. However, there are large uncertainties associated with the assessment of the migration of the flame retardant from a deeper foam layer to the surface of the chair, so more experimental knowledge in this area will be required to make a more accurate assessment of the dermal exposure and the risk by using the chair. After the dermal exposure, dust intake contributes the most to the total RCR, and a small fraction comes from inhalation. The total RCR is less than 1 for both substances and for children and adults, indicating that the substances do not pose an unacceptable risk of harmful effects in the use scenarios (worst case scenarios) laid down in this project. The largest RCR is obtained for the most sensitive group, the 2-3 year old child, for the substance TDCPP with a lower DNEL value than TCPP, but also here the RCR value is less than 1 (0.65), and therefore is not considered to pose a risk of health effects.

Risk of harmful effects in the environment of the two substances was not found.

Conclusion

Based on this survey and study of interior design on the Danish market, it is concluded that no immediate risk was found for Danish consumers associated with exposure to possible flame retardants in the products. It should be pointed out that only a small selection of products on the market were studied, and therefore it cannot be excluded that there are other products on the Danish market, which may contain flame retardants in higher quantities.
In contrast to what was seen in studies from the US, where 80% of the studied furniture contained flame retardants, this study indicates that a smaller percentage of furniture on the Danish market contains flame retardants. This is partly based on the analyses, where 50 % of the studied furniture (chairs and office chairs) contained a flame retardant; partly on contact with the industry that gave the impression that the Danish furniture produced exclusively for the Danish market is not added flame retardants. In addition, this study also indicated that the use of the harmful brominated flame retardants in interior design on the Danish market may not be as big an issue as feared, as no bromine was found in any of the 15 analysed products, but again it should be pointed out that the study is based on a small selection of all interior design products on the market.

List of abbreviations

BTMCP: Bis(chloromethyl) trimethylenbis(bis(chloromethyl)phosphate
CME: Combustient Modified Ether
CMHR: Combustient Modified High Resilient
decaBDE: decabromodiphenylether
DNEL: Derived no effect level
GCMS-screening: Gas chromatography mass spectrometry
HBCDD: Hexabromocyclododecane
HR: High Resilient
LOAEL: Lowest observed adverse effect level
NOAEL: No observed adverse effect level
MDI: Methylene diphenyl isocyanate
octaBDE: Octabromodiphenylether
PET: polyethylenetereftalate
PBB: Polybrominated biphenyles
PBDE'er: Polybrominated diphenylethers
PBT stof: Persistent (P), bioaccumulating (B), toxic (T)
pentaBDE: Pentabromodiphenylether
PUR: Polyurethane
QSAR: Quantitative Structure-Activity Relationship
RCR: Risk Characterisation ratio
SCCP: Short-Chain Chlorinated Paraffins
TCPP: Tris(2-chloro-1-methylethyl)phosphate
TCEP: Tris(2-chloroethyl)phosphate
TDCPP: Tris (1,3-dichloro-2-propyl)phosphate
TEPA: Tris (1-aziridinyl) phosphinoxide
TRIS: Tris(2, 3-dibromopropyl
XRF-screening: X-ray fluorescence screening

1. Introduction

A flame retardant can make it harder for a fire to develop than if the retardant was not present. Therefore flame retardants are added to some consumer products, such as furniture, plastics, textiles, carpets, mattresses and electronics such as televisions, computers, mobile phones, etc. For certain product groups (such as furniture, carpets, curtains and mattresses) there may be direct requirements for fire safety of the products, which means that the flame retardants can be necessary to use in these types of products (Ali et al., 2012; Brommer et al., 2012; Stapleton et al., 2009; Stapleton et al., 2011; Arcadis, 2011).

Generally, it is described in the literature that global restrictions on polybrominated diphenyl ethers (PBDEs - including penta-, octa- and deca-BDE) have meant that there has been a demand for alternative flame retardants, such as organophosphate flame retardants and new forms of brominated flame retardants (Ali et al., 2012). With the phasing out/ limitation of PBDEs worldwide around 2004 (limited in i.a. Japan and the EU, and phased out in the US), the new alternative flame retardants are being used instead. This is indicated in studies on the use of flame retardants in furniture, as well as studies of flame retardants in house dust (Dodson et al., 2012; Stapleton et al., 2012).

Previous studies have specifically shown that the flame retardants may be present in textile and foam materials (SCHER, 2012; Tænk, 2012; Stapleton et al., 2011; Stapleton et al., 2012). Therefore, the survey focuses on the products consisting of textile and/or foam materials, for instance chairs with foam seats and upholstery fabric were mapped, while chairs of wood and metal were not included.

1.1 Purpose of the project

The project aims to identify and assess the health and environmental risks of the content of flame retardants in textiles used in interior design, with emphasis on curtains, furniture, mattresses and blankets.

1.2 Scope of the project

This report therefore focuses solely on textiles for interior design. Textiles for products as car seats, child seats or other means of transportation are not included in the survey.

2. Survey

In this project we have made a survey of textiles for interior design, which are expected to contain flame retardants, in order to identify the flame retardants used on the Danish market in carpets, curtains, furniture, mattresses and textiles for interior design.

2.1 Method for survey

The survey has been carried out partly by internet search, and partly by contact with a number of selected manufacturers, shops and suppliers of interior fabrics and textiles. For the internet search, search words such as "flame retardants", "flame retardant", "flame resistant" and specific brominated and chlorinated flame retardants were used in order to uncover partly types and partly specific products which are flame retardant, as well as companies supplying these products. In addition, we have performed a literature search to identify previous studies of flame retardants in consumer products.
In addition to the above, search was made for manufacturers and suppliers of carpets, curtains, furniture and textiles, yarn and foam, in order to identify the flame retardants used in selected product groups. As stricter fire safety requirements apply in England, we also searched for companies supplying both the Danish and British markets, as these products are estimated to contain flame retardants to a greater extent than products, which are only sold on the Danish market.

In order to cover the companies that manufacture and supply interior textiles widely, a search has been made on the product groups on the internet. This procedure ensured that even internet stores were included, and both startups as well as older companies on the market were covered. There has also been focus on the coverage of large European suppliers of fabrics with flame retardants, as Trevira. Among the surveyed companies, a total of 92 companies, 64 were contacted by mail and/or by phone (see Appendix 1 for an example of a mail). The contacted companies are selected to cover both small and large companies as well as newer and older ones. In addition, we have focused on covering the companies that are suppliers to the major part of the Danish market and companies that also deliver to other countries such as the UK. Information search on corporate websites have been used partly to locate business activities, product groups and market shares, and partly to supplement the information from telephone and mail correspondence. Response has been received from a total of 30 out of the 64 contacted companies. The companies that responded cover carpets, curtains, furniture (including beds and mattresses) and textile manufacturers and suppliers. The full list of companies entered in the survey appears in Appendix 2. All the companies on this list have not been contacted; for some of the companies, only information on their website has been used in the survey. The reason that not all companies have been contacted is that soon there was a pattern of the types of companies that could and would provide information to the project. Therefore, the focus has been on this type of companies (manufacturers/producers). In addition, it has of course been a matter of resources, i.e. what could be achieved within the frames of this project.

2.2 Survey of the types of textile products within the category 'interior design', containing flame retardants

2.2.1 Textiles in general – for i.a. curtains and upholstery fabrics

This category covers home textiles used for e.g. furniture (upholstery, etc.) or curtains, and therefore covers a broad spectrum of the different types of products included in the survey.

The survey showed that the Danish shops generally have no knowledge of their products' content of flame retardants. Manufacturers and suppliers of home textiles were contacted for information on the use of flame retardants. 18 companies were included in the survey. Three manufacturers provided information on the use of flame retardants in their home textiles. This information gave the following insight into the market:
It is primarily textiles to be used for furniture or curtains in public buildings that contain flame retardant, or are post-treated with flame retardants. This is due to fire requirements for public buildings such as hospitals, hotels, theaters, etc. An example of a flame retardant product type may be office chairs (Fire requirements described in Section 2.7 "Applicable rules in DK"):

- The home textiles being produced with flame retardants are for the export market, especially the UK market that has particularly strict fire safety requirements.
- There is no demand for flame retardants in home textiles for private homes. However, a textile manufacturer informs that polyester is always flame retardant, because it is the textile fibre that is fire retardant, i.e. the flame retardant is built into the textile fibre. In this case, the textile manufacturer chooses to produce polyester fabrics with built-in flame retardants by default regardless of whether it is textiles for public buildings or private homes.
- Of other textiles outside the category of home textiles can be mentioned that bedding for the nursing sector (hospitals, nursing and disability homes) and working clothes are flame retardant.

2.2.2 Carpets

This category covers carpets, carpet tiles and rugs (e.g. smaller rugs for sofa/dining environments and oriental carpets).
Six carpet and carpet tile manufacturers were contacted and provided information about the use of flame retardants in their carpets. A total of 13 companies were part of the survey. The overall picture of this area (which is confirmed by information from five carpet manufacturers and suppliers) is that:
It is primarily carpets sold to the professional market (hotels, public buildings, etc.) that contain flame retardants. This is typically due to fire safety requirements, as e.g. carpets placed in escape routes must comply with certain fire safety requirements, i.e. the use of flame retardants is necessary. The carpet industry reports that textile floorings are generally considered to be building elements, so also carpets must comply with certain fire safety requirements in certain situations (fire safety requirements described above in section 2.7 "Applicable rules in DK"):

- Carpets sold to private owners typically contain no flame retardants - neither rugs nor wall-to-wall carpeting.
- According to the carpet manufacturers, the use of flame retardants makes the product more expensive. That is, it will typically be the more expensive carpets that contain flame retardants. According to the carpet manufacturers, flame retardants are consequently not used in carpets for the private market, as it will make the carpets more expensive. The price of flame retardants or how much more expensive the products are, were not disclosed.
- The type of flame retardants used in carpets (when flame retardants are used) is aluminum trihydroxide, also known as aluminum trihydrate ($Al(OH)_3$, CAS 21645-51-2). Aluminium trihydroxide is a powder that is mixed in the paste used for carpet backings.
- Aluminum hydroxide is considered in the industry to be the best type of flame retardant from an indoor environment perspective. Alternatively, wool can be used when you wish to focus on a healthy indoor environment, as wool has a certain natural flame retardant effect.

2.2.3 Curtains

Curtains include roller blinds, pleated blinds, vertical blinds, roman blinds and venetian blinds. Seventeen different manufacturers and importers of curtains were included in the survey. Four curtain manufacturers provided information on the use of flame retardants in their curtains. In addition to the information mentioned under textiles in general, their response gave the following insight into the market:

- Certified flame retardant fabric and/or Oeko-Tex labeled textiles, often from Germany (e.g. Drapilux and Hoechst) for roller blinds, vertical blinds, pleated and Duette ® from e.g. Hunter Douglas (U.S.) are used. Duette ® is curtains with an energy-efficient folding system. The responses from the industry all show that they are very attentive to buy certified branded products for the Danish market and are very focused on the Oekotex labelled textiles.
- It is reported that many flame retardant curtains on the Danish market are produced from textile fibres with reactive flame retardants, often Trevira CS (phosphorus-based, tied in the fabric) and FR-fibre (Flame Retardant, but no information on what type of flame retardant). Other curtains are treated with Zirpro instead, based on zirconium salts, which are a flame retardant coating applied to the finished textile. According to an internet search, Zirpro can also be based on titanium salts (Csiro, 2012), but the curtain industry in Denmark indicates that their Zirpro is based on zirconium salts.
- Some special applications, for example theatre curtains, are consistently treated with flame retardants, but there was no knowledge of the type of flame retardant applied to the textiles.
- A Danish curtain manufacturer mentions that they, out of fear for all kinds of flame retardants mixtures in textiles from the East, exclusively import pure cotton, viscose and polyester from the East, so they can control what is added to the curtains.

Based on the responses from the industry, it has not been possible to determine how widespread the solid-bottomed flame retardants contra coatings are, but the responses indicate that the Trevira fibre is the most commonly used when the curtains are flame retardant.

2.2.4 Furniture

This category covers furniture containing some form of textile and/or plastic foam. It may be sofas, chairs, beds, mattresses and stools.

Manufacturers and importers of furniture, foam for furniture manufacturing and furniture stores were contacted to inquire about the use of flame retardants in their products. 41 different companies were included in the survey.

This gave the following picture of textiles for furniture:

- In Denmark, flame retardants are generally not used in furniture. Two of the major textile manufacturers for the furniture industry report that about 20% of their production of textiles contains flame retardants, and this production is mainly for the English or German markets, which have different rules about fire safety, so the products for these markets are typically flame retardant to meet these requirements.
- Furniture containing flame retardants from Danish producers is produced only if the customer wants it. It is typically foreign customers who want a flame retardant product. Three of the contacted companies reported that in those cases they recommend wool because it has a certain natural flame retardant effect.
- One producer indicates that about 10% of the production uses textiles based on synthetic fibres from Trevira CS, which have a built in flame retardant.

Textile types used for furniture are, for example, wool, polyester, cotton and polyurethane. [4].
There are several different types of foam used for furniture and mattresses including polyurethane (PUR) foam, polyether foam, cold foam, memory foam, foam latex of natural rubber and methylene diphenyl isocyanate (MDI) foam (s-ms, 2012; B6 gruppen, 2012, KBE, 2012 and Skandinavisk Skum, 2012).

[4] http://www.kvadrat.dk/fileadmin/user_upload/downloads/Maintenance/Anvendelsesvejledning_for_moebelstoffer.pdf

The survey gave the following picture of foam for upholstery of furniture:

- Danish producers of polyurethane foam for furniture inform on their websites that the flame retardant foam is mainly used for mattresses and furniture in ships and trains, institutions, etc., where fire safety often imposes special requirements.
- Cold foam of type HR (High Resilient) is a padding material, which is typically used for furniture and mattresses and can be fire-resistant, while the type marked HRu is added flame retardants.
- The polyether foam type CME (Combustient Modified Ether) and the HR cold foam type CMHR (Combustient Modified High Resilient) are made fire retardant to meet the English fire safety requirements. These two types are used for furniture and mattresses.
- On foreign sites the Internet search showed upholstered office chairs, garden furniture/ sun loungers and dining room and living room chairs, and mattresses for medical use with the flame retardant CMHR foam. The products were not identified on Danish websites.

Kjeld Bülow, a counselor in the trade organisation for Furniture+Interior, said in an article in "Ingeniøren" that there is generally no detailed knowledge of flame retardants in upholstered furniture in Danish homes and shops. Kjeld Bülow indicates, however, that the companies that produce in Denmark are very careful not to use brominated flame retardants. But it is different for imported upholstered furniture, which constitute a growing proportion of sales in this country. A very large part of upholstered furniture comes from Poland or the Far East, and it is not known which flame retardants they may contain.

It has not been possible to obtain information about the types of flame retardants used in the different types of foam in the furniture industry, but the European Flame Retardant Association (EFRA) states on their website (www.cefic-efra.com) that mainly phosphorus-based flame retardants such as Tris(monochloropropyl)phosphate (TMCP or TCPP), tris(dichloropropyl)phosphate (TDCPP) and bis(chloromethyl)trimethylenebis(bis(chloromethyl) phosphate (BTMCP or V6) are used, and melanin salts are also used as flame retardants in foam for furniture. This is consistent with US studies of furniture showing that attention is mainly focused on the use of TDCPP in furniture on the US market (Stapleton et al., 2012).

Generally, the survey gave the following information about furniture (fabric and foam):

- A supplier reports that they import only chairs and sofas, which are fire retardant and that this furniture is produced in Asia and delivered directly to the UK, i.e. it does not come on the Danish market.
- Three companies in the industry mentions that although they do not sell furniture with flame retardants to the Danish market, there are probably flame retardants in foam and fabrics from developing countries such as China.
- It is seen from the questionnaire in Appendix 1 that the survey also has tried to identify where in the products flame retardants occur. We have not received information about this through the contacted companies, but analyses from "Tænk" of child seats show that flame retardants can occur in both cases and belts as well as upholstery (Tænk, 2012).

Generally, the use of flame retardants does not seem to be widespread in Danish-produced furniture. Previous analyses of foams in furniture and upholstery, however, show that flame retardants have been measured (SCHER, 2012; Stapleton et al., 2012), so it is likely that flame retardants may occur in textiles as well as in foam parts of furniture, however, probably mainly in imported products.

2.3 Survey of the types of flame retardants used, and how they are used in the production

2.3.1 What types of flame retardants are used

Chemically, the substances acting as flame retardants are quite different. They can be divided into four groups [5]:

- Inorganic flame retardants such as boric acid and salts of boric acid, magnesium hydroxide and aluminium trihydroxide.
- Organic halogenated flame retardants, including brominated and chlorinated flame retardants such as tetrabromobisphenol A (TBBPA) and decabromodiphenyl ether (deca-BDE).
- Phosphorus-based flame retardants such as tris(1,3-dichloro-2-propyl)phosphate (TDCPP), tris(chloropropyl) phosphate (TCPP), tris(2-chloroethyl) phosphate (TCEP) and tris(2-butoxyethyl) phosphate (TBEP).
- Nitrogen-based flame retardants such as melamine.

Based on the survey, it is estimated that the organic halogenated flame retardants and nitrogen-based flame retardants are not used in textiles or foam for interior design produced in Denmark or by Danish producers.

The survey gave only sparse information about the specific flame retardants used in textiles for interiors on the Danish market (carpets, furniture, curtains, and mattresses). The industry reported different trade names for the flame retardants they use the most. The specific chemical names are trade secrets.

Table 4 shows the flame retardants or groups of flame retardants that are specifically stated to be contained in products on the Danish market. Besides these, we received information about an FR fibre (flame retardant textile fibre), but without information about the type of flame retardant used in the textile, so this is not included in the table. There are studies on the content of flame retardants in American furniture (Stapleton et al., 2012), but it is not known whether this furniture occurs on the Danish market. Therefore, these flame retardants are not indicated in Table 4 below.

[5] Sources: Informationscenter for Miljø & Sundhed's website on flame retardants (www.forbrugerkemi.dk) and EFRA's website (The European Flame Retardants Association) (http://www.cefic-efra.com/index.php?option=com_content&view=article&id=3&Itemid=1&lang=en).

Type of flame retardant	Identification of the flame retardant	Product contained in
Inorganic	**Aluminium trihydrate** (Al(OH)3) (content is generally 3% (of the back of the carpet) or more)	Carpets
	Zirpro (the flame retardant is based on zirconium salts or titanium salts such as zirconium or titanium hexafluoride. Zirpro is a general term for the use of this type of salts.)	Home textiles for curtains / upholstery fabric. Zirpro is typically applied to wool or textile mixtures with wool. This type of flame retardant is used exclusively for textiles with especially high fire safety requirements, such as seats in trains.
Organic halogenated	None identified	-
Phosphorous-based	**Trevia** (The content of phosphorous is typically 0.5 – 1%. It is approved for use in Oeko-Tex 100.)	Home textiles for curtains, upholstery fabric among others
	Flovan (flame retardant is based on phosphorous. Typical use 50-100 g/kg textile. It is approved for use in Oeko-Tex 100.)	Home textiles for curtains, upholstery fabric among others
	Pekoflam (flame retardant is based on phosphorous and nitrogen. Typical use 50-100 g/kg textile. It is approved for use in Oeko-Tex 100.)	Home textiles for curtains, upholstery fabric among others
Nitrogen-based	None identified	-

TABLE 4

FLAME RETARDANTS DESIGNATED IN THE SURVEY TO BE INCLUDED IN PRODUCTS (CARPETS / FURNITURE / CURTAINS / INTERIOR DESIGN) ON THE DANISH MARKET

In 2011 a major study on flame retardants in consumer products was published, prepared for the European Commission (Arcadis, 2011). The study found more than 700 different applications of flame retardants in consumer products, including textiles and furniture. A total of 42 specific flame retardants were examined to clarify their health and environmental risks.

The Commission study indicates that a variety of phosphorus-based flame retardants are used in polyurethane foam for furniture such as several chlorinated alkyl phosphates (tris(1,3-dichloro-2-propyl)phosphate (TDCPP), tris(2-chlorophyll-1-methylethyl)phosphate (TCPP) and tris(2-chloroethyl)phosphate (TCEP)). It is also mentioned in the study that magnesium and melanin phosphate too are used as flame retardants in textiles (Arcadis, 2011).

The European Flame Retardants Association (EFRA) likewise reports on their website (www.cefic-efra.com) that primarily phosphorus-based flame retardants, such as tris(monochloropropyl)phosphate (TMCP or TCPP), tris(dichloropropyl)phosphate (TDCPP) and bis(chloromethyl)trimethylenebis (bis(chloromethyl)phosphate (BTMCP or V6) and melanin salts, are used in foam for furniture.

Studies in the US have analysed the content of flame retardants in polyurethane foam in 102 American sofas. The sofas were sold between 1985 and 2010. In the 41 sofas from before 2005, polybrominated flame retardants are most commonly used. In the 61 sofas that were purchased after 2005, TDCPP is the most widely used flame retardant (Stapleton *et al*, 2012).

Similarly, flame retardants has been found in Denmark in car seats for children containing both TDCPP, TCPP and TCEP, and triphenylphosphate and decaBDE in covers, belts and upholstery (Tænk, 2012). In a chair, 7 mg tris(1,3-dichloro-2-propyl)phosphate (TDCPP)/kg and 190 mg triphenylphosphate/kg in the upholstery, and 5.5 mg tris(2-chloro-1-methylethyl)phosphate (TCPP)/kg and 15.9 g TDCPP/kg was measured in the belts. In another chair, 7.3 mg triphenylphosphate/kg and 723 mg decabromdephenyl ether/kg was measured in the cover, and 4.6 g tris(2-choroethyl)phosphate (TCEP)/kg, 302 mg TCPP/kg and 12 mg TDCPP/kg in the upholstery.
From the above it is assessed that the most common phosphorus-based flame retardants in the products identified in this project are the following compounds:

- Tris (1,3-dichloro-2-propyl)phosphate (TDCPP)
- Tris(2-chloro-1-methylethyl) phosphate (TCPP)
- Tris(2-chloroethyl) phosphate (TCEP)
- Bis(chloromethyl) trimethylenbis(bis(chloromethyl) phosphate (BTMCP or V6)
- Tris(isopropylphenyl) phosphate
- Melanin phosphate
- Bisphenol A-bis(diphenyl phosphate)

2.3.2 How are flame retardants added

Flame retardants are included in the treated products in two different ways: 1) either as reactive flame retardants chemically bound in the product/material, i.e. the flame retardant is incorporated in the production of the product, or 2) as additive flame retardants added to the product at the end of the production. Additive flame retardants are more loosely bound, and therefore released more easily from the products than those chemically bound.

Flame retardants used in home textiles can be built in the textile fibre or applied to the finished textile[6]. For some of the flame retardants identified in this survey, the following kind of additions can be seen:

Inorganic:

- Zirpro is applied to the finished fabric, but is to some extent absorbed in the textile fibre in the same way as dyes.

Phosphorous-based:

- Trevira CS is a polyester fibre (polyethylene terephtalate (PET)) containing a built in (reactive) phosphorous-based flame retardant.
- Flovan is used on the finished fabric.
- Pekoflam[7] is used on the finished fabric.

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[6] http://www2.dupont.com/personal-protection/en-us/dpt/article/flame-resistant-technology.html

[7] http://www.clariant.com/C12575E4001FB2B8/vwLookupDownloads/20110922_ITMA_Pekoflam.pdf/$FILE/20110922_ITMA_Pekoflam.pdf

In the case of synthetic textiles such as polyester, it is possible to incorporate the flame retardant in the textile fibre, but it is also possible to use a conventional surface treatment, i.e. the flame retardant is applied to the fabric afterwards. For natural fibres such as cotton and wool, it is not possible to incorporate the flame retardant in the fibre itself. This requires subsequent treatment with flame retardant[8]. The method used to add the flame retardant of course depends on the kind of material the product is be made of, and any fire safety requirements for the product. According to producers of textiles incorporating a flame retardant, these have the advantage that the flame retardant cannot be washed out or worn away, as is the case with the flame retardant is added to the product at the end of the production[9]. An example has been identified where the textile fibre is produced with an incorporated flame retardant (polyester). Thus it is in the production of the textile fibre that the flame retardant is used. In the case of carpets, the flame retardant is added reactively, i.e. incorporated in the backing material of the carpet. For the remaining home textiles, the overall picture is that the flame retardant is added additively to the finished textile.
FIRA (2011) describes the rather unusual situation that urethane foam (used for upholstery) does not need to be treated with flame retardant to be flame retardant. However, if textile with an integrated flame retardant is used as a cover on top of urethane foam upholstery, it may mean that it is necessary with an additional flame retardant layer on the back of the cover - a backcoat - to form a fireproof barrier between cover and upholstery. Covers with incorporated flame retardant may in fact have a tendency to melt when exposed to flames, which could mean that the furniture upholstery may ignite. This means that it is not enough that each layer in a piece of furniture is fire retardant in order for the overall product (furniture) to be fireproof.

2.3.3 How do flame retardants work

Flame retardants work by stopping or attenuating the processes involved in developing a fire, i.e.:

- Flame retardants may act cooling, e.g. the flame retardant may form water in fire, thus stopping development of flammable gases when the solid material is exposed to heat.
- Flame retardants may form a layer which helps to enclose the material and to impede the addition of oxygen and/or heat needed to start a fire.
- Flame retardants may act by developing non-flammable gases which dilute the flammable gases.

Aluminium trihydroxide in carpets acts by forming water when the carpet burns. The flame retardant is used in a concentration of about 3% (by weight relative to the entire carpet's weight), but it depends on the product. The concentration may well be higher.

2.3.4 Correlation between choice of material and use of flame retardants

The use of the flame retardant depends on the material used. Synthetic materials such as polypropylene (PP) have a lower melting point than e.g. polyamide (PA) or polyester (PES), and will therefore be easier ignited. Conversely, carpets with pile material of 100% wool are very difficult to ignite.

According to Cefic (Cefic, 2012), each flame retardant is selected depending on the textile it will be used for:

- For flame retardancy of cotton is used brominated flame retardants and phosphorous-based flame retardants in synergy with nitrogen derivatives.
- For flame retardancy of wool is used a combination of wool and other fibres such as polyamide, polyester or polyacrylic, thereby the mixture is naturally flame-retardant itself.
- For flame retardancy of synthetic fibres such as polyester, halogenated flame retardants may be used. It is possible to incorporate the flame retardant directly into the textile fibre, but traditional surface treatment is also a possibility.

[8] http://www2.dupont.com/personal-protection/en-us/dpt/article/flame-resistant-technology.html
[9] http://www2.dupont.com/personal-protection/en-us/dpt/article/flame-resistant-technology.html

For the surveyed flame retardants, it applies to
Inorganic:

- Zirpro is used in wool or textile mixtures containing wool, if there is a need to increase the natural flame retardant properties of wool.

Phosphorous-based:

- Flovan is suitable for use on cellulose, polyester, wool, polypropylene and polyethylene fibres, and mixtures of these[10].
- Pekoflam[11] is particularly suitable for use in cotton or cotton-containing textile mixtures.

2.4 Initial risk screening for health, including a description of the degradability of the flame retardants

The flame retardants based on the survey may occur in textiles and foam for home interiors, carpets; furniture, curtains, or mattresses are screened for health risks. Thus knowledge can be achieved on the health damaging potential of the substances, which can be used in the assessment of which products and materials to buy for analyses.

2.4.1 Inorganic flame retardants

According to the survey, aluminium trihydroxide can be found as a flame retardant in home interior on the Danish market. We have obtained information that zirconium compounds are also used (no information on their exact form). In addition, the study made for the European Commission in 2011 (Arcadis, 2011) states that magnesium hydroxide (CAS 1309-42-8) is also used as a flame retardant in furniture.

In summary, based on the below screening of the three inorganic flame retardants, it is assessed that they will not pose any significant risk to health associated with use as flame retardants in home interiors. The inorganic flame retardants are assessed partly to have low toxicity, low uptake by dermal exposure and a hard binding in textile fibres, which minimise the exposure.

2.4.1.1 Aluminium trihydroxide (aluminium trihydrate) $Al(OH)_3$ CAS 21645-51-2

The survey specifically reveals knowledge about aluminium trihydroxide used in carpets. Aluminium trihydroxide is a powder that is mixed into the paste used for application on carpet backings.

Classification

The substance is not classified according to Regulation (EC) No 1272/2008 (Annex VI, part 3, Table 3.1). The substance is registered according to the European chemicals regulation REACH. According to the "C&L Inventory"-database on ECHA's website on industry self-classifications, it is mainly eye and skin irritating classifications that have been reported by the companies (ECHA, 2012).

Toxicity

There is limited information about the health damaging effects of the substance, but data from other similar compounds can be used, such as aluminium compounds as aluminium hydroxide (CAS 1318-23-7), to assess the substance.

The acute toxicity of metallic aluminium and aluminium compounds is low. The substances do not cause skin or eye irritation, and allergy is considered to be rare based on the widespread use of aluminium compounds in cosmetics (Arcadis, 2011).

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[10] http://www.expresstextile.com/20040205/dyeschemicals03.shtml

[11] http://www.clariant.com/C12575E4001FB2B8/vwLookupDownloads/20110922_ITMA_Pekoflam.pdf/$FILE/20110922_ITMA_Pekoflam.pdf

A DNEL value has been determined for aluminium trihydroxide from a 28 days inhalation study in rats (see Table 5). Aluminium compounds are found not mutagenic and not carcinogenic in animal studies (Arcadis, 2011).

Study	Species/duration/dose	NOAEC	DNEL*
Inhalation – repeated dose toxicity study	Rat/28 days inhalation/ 0; 2.15; 2.45 mg/m^3	2.45 mg Al/m^3	0.14 mg/m^{3*}

* A conversion factor has been used to convert from aluminum to aluminum hydroxide based on molecular weight (Arcadis, 2011)

TABLE 5

CALCULATED DNEL VALUE OF ALUMINIUM TRIHYDROXIDE BASED ON INHALATION STUDY

Bioavailability / Exposure

By exposure to aluminium trihydroxide, a low uptake is assessed both by inhalation and by dermal exposure (see Table 6).

Routes of exposure	
Inhalation	The vapour pressure of aluminium trihydroxide is considered to be very low (value not given), and therefore it is assumed that exposure by inhalation will only be associated with inhalation of dust containing aluminium
Inhalation – airborne particles	Worst case is considered with 52.5 $\mu g/m^3$ in the form of airborne particles in the indoor environment, and the dust contains as an unrealistic worst case scenario 1 gram of aluminium hydroxide per gram of dust as measurement data are not available. The 52.5 $\mu g/m^3$ is based on data for diantimony trioxide
Dermal	Aluminium trihydroxide is only absorbed in limited amounts through the skin (1%)

TABLE 6

ROUTES OF EXPOSURE (DATA FROM ARCADIS, 2011)

Conclusion of screening

Based on comparison between DNEL for inhalation (0.14 mg/m3) and the concentration of aluminium trihydroxide in dust in the air (52.5 $\mu g/m^3$), the substance is assessed not to pose a high risk of health damage (RCR = 0.37) . Furthermore, the substance is absorbed to a low degree through the skin and by inhalation.

2.4.1.2 Zirconium (Zr)

Zirconium can be used as a flame retardant as ZrO_3 alone or in combination either with H_3BO_2 or $NH_4B_5O_8$. The literature also shows that $ZrOCl_2$ is used as a flame retardant, e.g. in connection with treatment of wool (Csiro, 2012).
The survey has not exactly identified the zirconium compound used in the Zirpro flame retardant.

Classification

The group of zirconium compounds is not classified according Regulation (EC) No 1272/2008 (Annex VI, part 3, Table 3.1). Zirconium dioxide and zirconium dichloride oxide are registered in the European chemicals legislation REACH. According to the "C & L Inventory" database on the ECHA website of industry self-classifications, it is mainly eye and skin irritant classifications that are registered by the companies and that zirconium dioxide may cause respiratory irritation (ECHA, 2013).

Toxicity
There are only limited data on the potential health hazards of zirconium compounds.

Zirconium and zirconium compounds have been found mutagenic in *in vitro* tests and are not classified as carcinogenic (HSDB, 2006).

Bioavailability / Exposure
Have not been able to identify data regarding absorption through the skin, but it is estimated that the substances are poorly absorbed through the skin.

Conclusion of screening
It is estimated that the substances are bound hard in the textile fibre, which is considered to mean a limited exposure, and therefore the risk of a toxicological potential is considered to be small.

2.4.1.3 Magnesium hydroxide (CAS 1309-42-8)
No specific knowledge has been obtained from the survey that magnesium hydroxide is used in products on the Danish market, but magnesium hydroxide is indicated as a flame retardant in textiles in the report on flame retardants conducted for the European Commission in 2011 (Arcadis, 2011).

Classification
The substance is not classified according to Regulation (EC) No 1272/2008 (Annex VI, part 3, Table 3.1). The substance is registered in the European chemical legislation REACH. According to the "C & L Inventory" database on the ECHA website of industry self-classifications, most of the companies have reported that the substance is not classifiable. Some companies report that the substance should be classified as eye and skin irritant (ECHA, 2013).

Toxicity
There is little information on the toxicological effects of magnesium hydroxide, but there are data on other inorganic magnesium compounds from which 'read-across' can be made.
Magnesium hydroxide has low acute toxicity. The substance may be skin and eye irritant, based on information from suppliers of the substance (ARCADIS, 2011). The substance is not mutagenic and it is assessed not to be carcinogenic (based on data for magnesium chloride hexahydrate), nor is it considered to be teratogenic (EBCR, 2011).

Type of study	Species/duration/dose	DNEL*
Inhalation – repeated dose toxicity study	human/lifetime / 250 mg/person corresponding to 3.6 mg/kg bw/day for a person of 70 kg	4.56 mg/m^{3*}

TABLE 7

CALCULATED DNEL VALUE FOR MAGNESIUM HYDROXIDE BASED ON INHALATION STUDY

Bioavailability / Exposure
After exposure to magnesium hydroxide, a low uptake is assessed both by inhalation and by dermal exposure (see Table 8).

Route of exposure	Exposure by textile in carpets and furniture
Dermal	Due to the potential irritant effect of magnesium hydroxide, prolonged contact with the substance should be avoided. If magnesium hydroxide is incorporated in the textile fibre, it is unlikely that magnesium hydroxide still exists as such and can migrate out of the matrix. It is most likely to be magnesium ions migrating out of the matrix, if any. Because of the negligible dermal absorption of magnesium (1%), and as no systemic effects are expected for magnesium cations after skin exposure, dermal exposure is considered to be negligible.
Inhalation	Flame retardants can wear out during normal use of upholstery or carpets, and some of the particles may be small enough to be stirred up in the room air and be inhaled. Gardner et al (2000) have estimated an airborne particle concentration of 1.5 µg magnesium hydroxide/m^3 in a room due to wear of the upholstery.

TABLE 8

ROUTES OF EXPOSURE (DATA FROM ARCADIS)

Conclusion of screening
Based on a screening of the adverse health effects of exposure to magnesium hydroxide the substance is assessed not to pose a major health hazard as the substance is poorly absorbed through the skin and by inhalation (as dust particles).

2.4.2 Phosphorous-based flame retardants

There is a variety of phosphorus-based flame retardants, and the survey has shown that it is often this type of flame retardant that is used in the identified product groups, but it has not been reported which type of phosphorus-based flame retardant the individual manufacturers use. As the survey has not generated any knowledge of the specific phosphorous-based flame retardants used, internet searches have been made to identify individual substances known to be used for textile / foam.

Based on data from Cefic (Cefic, 2012) and from the large European study (Arcadis, 2011) and other studies (cf. section 2.3.1), it is estimated that the most common phosphorous-based flame retardants in the products identified in this project , are the following compounds:

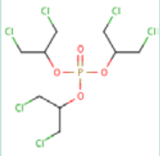
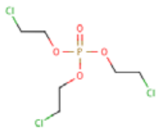
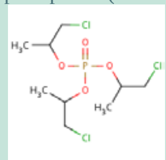
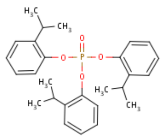
- Tris (1,3-dichloro-2-propyl)phosphate (TDCPP)
- Tris(2-chloro-1-methylethyl)phosphate (TCPP)
- Tris(2-chloroethyl) phosphate (TCEP)
- Bis(chloromethyl) trimethylenebis(bis(chloromethyl)phosphate (BTMCP or V6)
- Tris(isopropylphenyl)phosphate
- Melanin phosphate
- Bisphenol A-bis(diphenyl phosphate)

As the survey does not identify the specific phosphorous-based flame retardants in products on the Danish market, a screening of all known phosphorous-based compounds will not currently be made, only the compounds which are considered mostly used. Tables 9 and 10 show an overview of the physical-chemical properties of the substances and their harmonised classifications, classifications registered by the industry, and NOAEL/DNEL values for the substances. This information may initially provide an overview of their health damaging potential and thus give an idea of which substances to analyse in Phase 2 of the project.

Flame retardant	CAS no.	Vapour pressure	Water solubility
TDCPP	13674-87-8	5,6 x 10-6 Pa at 25°C,	18,1 ± 1,1 mg/l at 20°C
TCEP	115-96-8	0,00114 Pa at 20 °C	7820 mg/l at 20 °C
TCPP	13674-84-5	1,4 x 10-3 Pa at 25°C	1080 mg/l at 20°C
V6	38051-10-4	2,75 x 10-6 Pa at 25°C*	232 ± 4 mg/l at 20°C
Tris(isopropylphenyl) phosphate	26967-76-0	-	-
Bisphenol A-bis(diphenyl phosphate)	5945-33-5	-	-
Melanin phosphate	415836-09-9	-	-

* Based on QSAR'

TABLE 9
SELECTED PHOSPHOROUS-BASED FLAME RETARDANTS' PHYSICAL-CHEMICAL PROPERTIES. "-" INDICATES THAT NO DATA HAVE BEEN FOUND

Flame retardant	Application	CAS no.	Classification*	CLP Inventory	NOAEL / DNEL (mg/kg bw/day)	Estimated health risk by use in textile/foam for furniture
Tris (1,3-dichloro-2-propyl)phosphate (TDCPP) 	Used mainly in PUR foam for furniture, but is also used in textiles	13674-87-8	Proposal for harmonized classification: Carc.2, H351	47 registrations; mainly H302, H315, but also H351 and H411	Repeated dose toxicity/carcinogeni-city/harmful to reproduction: LOAEL: 5 mg/kg bw/day	The risk of using TDCPP is estimated to be low based on exposure scenarios when used in furniture, which also includes oral exposure (children).
Tris(2-chloroethyl) phosphate (TCEP) 	Lesser use in PUR foam for furniture.	115-96-8	H302; H351; H360F; H411	2742 registrations; mainly as harmonized classification	Repeated dose toxicity/carcinogeni-city: LOAEL 12 mg/kg bw/day Reproduction: NOAEL 5 mg/kg bw/day	The risk of using TCEP is estimated for adults to be limited, based on exposure scenarios when used in furniture. A more thorough risk assessment should be made for children for the specific use in this project.
Tris(2-chloro-1-methylethyl) phosphate (TCPP) 	Used mainly in PUR foam for furniture.	13674-84-5	-	587 registrations; mainly H302, but also H412	Repeated dose toxicity/carcinogeni-city: NOAEL 42 mg/kg bw/day Reproduction: NOAEL 79 mg/kg bw/day Here the absorption of 80% by oral exposure is taken into account	The risk of using TCPP is estimated to be low based on exposure scenarios when used in furniture, which also includes oral exposure (children).
Tris(isopropylphenyl) phosphate 	Used as coating in textile	26967-76-0	-	-	Dermal DNEL based on repeated dose toxicity: 0.08 mg/kg bw/day	Based on a low DNEL for dermal exposure, the risk of dermal exposure to the substance by contact with furniture is estimated to be unacceptably high. (New data have been submitted for REACH registration, which may result in a higher DNEL value)

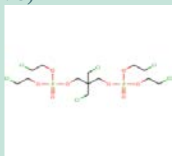
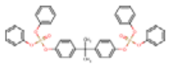
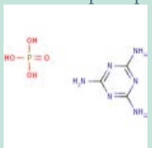
Bis(chloromethyl) Trimethylenebis(bis(chloromethyl) phosphate (BTMCP or V6) 	Used mainly in PUR foam for furniture , and as coating in textiles	38051-10-4	-	Only 6 registrations; not classified	Repeated dose toxicity: NOAEL 15 mg/kg bw/day Reproduction: NOAEL 29 mg/kg bw/day	The risk of using V6 is estimated to be low based on exposure scenarios when used in furniture (inhalation/dermal/oral exposure included).
Bisphenol A-bis(diphenyl phosphate) 	Used among others for flame retardant of teextile fibres	5945-33-5	H413	98 registrations; mainly H413	Repeated dose toxicity (28 days study in rats): $DNEL_{Dermal}$: 4.2 mg/kg bw/day $DNEL_{Oral}$: 0.6 mg/kg bw/day $DNEL_{Inhalation}$: 1.5 mg/kg bw/day	It is estimated that there is a risk from exposure to (Bisphenol A-bis(diphenyl phosphate) from furniture (dermal contact), where there is a risk coefficient of > 1. The conclusion is however, that the risk assessments has been made from few data and must be considered to be conservative.
Melanin phosphate 	Used for textile 'backcoating'	415836-09-9	-	128 registrations; not classified	Repeated dose toxicity (90 days study in rats): $DNEL_{Dermal}$: 1,12 mg/kg bw/day $DNEL_{Inhalation}$: 1,96 mg/kg bw/day	It is estimated that there is a risk from exposure to melanin phosphate from furniture (dermal contact), where there is a risk coefficient of > 1. The conclusion is however, that the risk assessments has been made from few data (extrapolation) and must be considered to be conservative.
* '-' indicates that the substance does not have a harmonized classification H302: Harmful if swallowed. H315: Causes skin irritation. H351: Suspected of causing cancer. (Carc 2)		H360: May damage fertility or the unborn child. H411: Toxic to aquatic life with long lasting effects.				H412: Harmful to aquatic life with long lasting effects. H413: May cause long lasting harmful effects to aquatic life.

TABLE 10

HARMONISED AND REGISTERED CLASSIFICATION FOR PHOSPHOROUS-BASED FLAME RETARDANTS IDENTIFIED IN THE EU AS FLAME RETARDANTS IN TEXTILES OR FURNITURE (MAY BE IN THE FOAM COMPONENT AND NOT IN THE TEXTILE). THE RISK IS ESTIMATED BASED ON DATA FROM (ARCADIS, 2011)

2.5 Exposure scenarios

As a starting point, a worst case scenario for the calculation of the risk exposure is made. If there is no risk in this scenario, you can stop and conclude that there is no risk of exposure. However, if a risk is found in the worst case scenario, the scenario must be subject to a critical review, so that something more nuanced can be said on how high the risk really is.

2.5.1 Health

The survey includes the following products: textiles for carpets, curtains, furniture (including foam for upholstery) and mattresses. Therefore, exposure scenarios have been set up for these use situations.
For exposure calculations, it is considered in which exposure scenarios to place the surveyed product groups, and thus the length of the exposure time, which the target group is potentially exposed to (Table 11).

The following routes of exposure are important by exposure to flame retardants in the identified products:

- Direct skin contact with a flame retardant product.
- Inhalation; the content of flame retardants in the indoor air can have an impact on the total exposure.
- Exposure to dust particles containing flame retardant; this can be oral exposure from hand-to-mouth contact with dust particles in the home. Young children are likely to consume a larger amount of dust particles than adults, for example when playing on the floor. Data indicate that children consume 100 mg of dust per day (EU RAR, 2009).
- Furthermore, it is estimated that young children in some cases may suck furniture, curtains and carpets. Therefore, they are estimated to be the most critical group; e.g. some of the chlorinated alkyl phosphates are water soluble enabling them to be released from the textiles, e.g. by sucking them (EU RAR, 2008).

Generally, it is difficult to find concrete data on the amount of dust released from a piece of furniture, a carpet, or a curtain. There are data to the fact that flame retardants are present in indoor air and dust in the home (e.g. Kalachova *et al*, 2012), but the specific source has not been identified. Gardner *et al.* (2000), however, have described a method for estimation of the amount of dust produced by a sofa (see Table 11).

Product groups	Exposure period (application/contact/how long)	Which/how large a part of the body is exposed
Carpets	Children may be exposed when playing on the carpet. Adults are expected to have a minimum of contact with the carpet by normal use (soles of feet), but in situations where an adult is playing with a child, there will be more contact. The dermal contact with flame retardants in the carpet is however estimated to be minimal if the flame retardant is on the back of the carpet which the survey indicates. Eating/inhaling of dust from the floor is estimated to be largest source. It has not been possible to find data on the amount of dust specifically from carpets.	Weight: 10 kg (1-2-year old child) Dermal contact: butt, half side of the leg, and forearms and palms corresponding to worst-case (half body surface) corresponding to 2400 cm^2. Contact time: 5 hours
Curtains	Dermal contact will occur when the curtains are hung up or taken down, and when taken down for washing. Besides this, there is only limited, but more frequent dermal contact with the palm associated with pulling the curtain. It is estimated that young children in individual cases may suck the curtain and thus obtain an oral exposure to water-soluble flame retardants in the textile. Eating/inhaling of dust from the indoor air is estimated to contribute to the exposure. It has not been possible to find on the amount of dust released from curtains. Furthermore, it is estimated that beautiful remains of curtains are sometimes used for other purposes, e.g. children's play (but this exposure is assessed outside the scope of this project).	Mainly adults will have contact Weight: 60 kg Palms: 430 cm^2 (hands are 860 cm^2, two palms is half of that area) Contact time: a few minutes It is estimated that toddlers may suck the curtain, whereby an oral exposure will occur. The exposure depends largely on the applied flame retardant; and whether it is embedded in the textile fibre, or it is coated onto the fabric. In addition, the water solubility of the flame retardant is of great importance for whether the substance is released by sucking on the fabric.
Furniture	The amount of hours of the day an adult is in contact with a piece of furniture varies a lot. It can be highly dependent on type of job, as an office worker will have much more contact than a gardener, for example. As worst-case is therefore used 10 hours for adults. For furniture with upholstery containing flame retardant foam, there are various data on how much of this can migrate out and become available for dermal exposure on the surface. For TDCPP exposure to flame retardants bound in PUR foam is described to be minimal (EU RAR, 2008), whereas for TCEP exposure from PUR foam was observed (EU RAR, 2009).	Children: 10 kg (2-3-year old) Adults: 60 kg 2.6 Sofa: Dermal contact: worst-case is half a body surface in contact with the sofa, corresponding to: Children: 2400 cm^2 Adults: 9000 cm^2 Contact time: 5 hours (children) - 10 hours (adults)

Product groups	Exposure period (application/contact/how long)	Which/how large a part of the body is exposed
	Measurements show that 130 µg TCEP/25 cm^2 per 24 hours (=0.217 µg/cm^2/hour) is released from upholstery containing 8 mg TCEP/cm^2. The area covered by a person sitting in an armchair covered with fabric is about 1000 cm^2 (half of both forearms and hands). The person is assumed to sit in the chair for 4-8 hours, which results in an amount of min. min 870 µg/event (= 0.217 µg/cm^2/hour * 4 hours * 1000 cm^2). Assuming that you sit in the chair 100 times a year for 4 hours, the annual total amount of TCEP migrating from the chair to the skin will be 87000 µg. This amount will result in an average exposure of ~ 3.9 µg/kg bw/day for a 60 kg person. For 1-3-year old children the same scenario will result in an average exposure of 10 µg/kg bw/day for a child of 9.1 kg. Eating/inhaling of dust from the indoor air is estimated to contribute to the exposure.	Office chair: Dermal contact: worst-case is contact with bare legs and a part of a bare back (summer period) corresponding to: Children: 380 cm^2 Adults: 1000 cm^2 Contact time: 8 hours (adults) – 4 hours (children)
Mattresses	On average, adults sleep 7-9 hours a day, while children of 1-3 years old sleep 12-14 hours[12]. During this period you will be exposed to flame retardants through dermal contact with the mattress (but only indirectly, as a sheet on top of the mattress is generally used). Eating/inhaling of dust from the indoor air is estimated to contribute to the exposure. It has not been possible to obtain data on the amount of dust that on average comes from mattresses, but there data available on the amount of TCPP released from a mattress with PUR foam to indoor air in the EU RAR (2008).	Adults: 60 kg Children: 10 kg (2-3-year old) Dermal contact: half a body surface exposed worst-case corresponding to: Children: 2400 cm^2 Adults: 9000 cm^2 Contact time: 9 hours (adults) – 14 hours (children)

TABLE 11

OVERVIEW OF RELEVANT EXPOSURE SCENARIOS FOR THE IDENTIFIED PRODUCT GROUPS: CARPETS, CURTAINS, FURNITURE AND MATTRESSES. THE SURFACE AREA IS BASED ON (NORDIC EXPOSURE GROUP, 2011)

The specific exposure assessment conducted in Phase 3 of the project will use REACH Guidance documents R.15 and R.17 to calculate the absorption of flame retardants via the relevant exposure routes (ECHA, 2012a; ECHA, 2012b).

[12] Source: http://www.netbaby.dk/show.asp?ID=3793

2.6.1 Environment

Flame retardants used as additives might evaporate from the materials in which they are used. It applies to some of the substances that they are very stable in the atmosphere (e.g. PBDE compounds), and once they are emitted to air, they will be spread over large distances, and will be allocated to soil and the water environment.

Flame retardants used reactively in the products can be emitted to the extent that there has been an incomplete reaction. The total amount released from incompletely reacted compounds is assessed in the overall picture to be negligible.

It is estimated that the main source of spreading of flame retardants to the environment will be evaporation from products[13].

For the identified product types there may be a direct contact between the flame retardant material and water. Textile washing is estimated to provide a source of flame retardants in wastewater. It is estimated, however, that larger furniture and mattresses are washed to a lesser extent, and curtains are rarely washed (estimated to be about once a year), and permanent carpeting is also rarely washed. Small rugs are washable and can thus provide flame retardants when washed. Based on the physical/chemical properties (especially halogenated) of the substances, it is believed that the flame retardants in waste water will mainly end up in the sludge.

All products containing flame retardants will ultimately be disposed of to waste incinerators or dumped in landfills. In connection with the incineration of waste, the compounds will predominantly be destroyed, but there is a possibility that a small part will pass through the combustion chamber and end up in residual products. Flame retardants in products that end up in landfill sites will ultimately be emitted from the products. The extent to which the compounds will decompose when released or spread in the air or the water environment is not known.

2.7 Applicable regulations in DK

In Denmark there is no direct requirement for flame retardants to be used in specific products (IMS, 2011; Arcadis, 2011). The EU, however, has the Product Safety Directive (General Product Safety Directive 2001/95), which has been implemented in Denmark via the Product Safety Act (ACT no. 1262 of 16/12/2009). The Product Safety Act indicates that only *safe products* can be placed on the market. It is the responsibility of the producers that their products are safe for the consumer.

Definition of safe products according to the Product Safety Act (ACT no. 1262 af 16/12/2009)

"A product with no risk or just limited and acceptable risk for the safety or health of the consumers, when the product is used in normal or predictable circumstances and within the expected life time of the product".

Although there is a definition of *safe products*, there is no completely unambiguous definition, and therefore both the EU and Denmark ensure compliance with the product safety legislation in practice with relevant safety standards. The safety standards that apply within the home textiles area are listed below. Whether manufacturers can fulfil the standards without the use of flame

[13] Source: Rapport fra Miljøstyrelsen: Bromerede flammehæmmere - massestrømsanalyse og vurdering af alternativer, 1999 (http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/udgiv/publications/1999/87-7909-416-3/html/samfat.htm)

retardants depends among others on the kind of material the product is made of and the context in which the product will be used.
The definition of safe products in the Product Safety Act also covers "chemical safety". This means that if a product contains harmful substances that pose a risk to the consumer, it can also be the Product Safety Act that makes the product not legal.

Kjeld Bülow, counsellor in the Furniture+Interior Association, stated in an article in "Ingeniøren"[14] that there are no legal requirements concerning fire safety of upholstered furniture either in Denmark or at European level. In contrast, the UK has particularly strict requirements, which requires that upholstery foam in furniture for private homes shall have added flame retardants. According to Kjeld Bülow, the Danish producers obviously have to comply with these requirements if they want to export to the UK. This is consistent with the picture that contact to the producers has shown in this project.

Kjeld Bülow points out that in the US, California has stricter fire regulations for upholstered furniture than the other states via their Technical Bulletin 117 (TB 117). In practice, this legislation TB 117 means that flame retardants are used in upholstered furniture to meet fire safety requirements, although it is not directly stated that flame retardants must be used[15]. According to Stapleton et al. (2012) there is only a slight difference between the content of flame retardants in furniture in the various states. It makes the researchers behind the study conclude that the Californian standard de facto is widespread throughout the US, as California is one of the largest markets in the US and in the world in general. California, however, in late 2013 decided to change the test requirements specified in TB 117, which means that the requirements can be complied with without the use of flame retardants. The amendment to the legislation will come into force on 1 January 2015[16].

Kjeld Bülow points out that there is no overview as to whether something similar is happening in Europe, i.e. if upholstered furniture imported to Europe in practice also meets the UK fire requirements and thus contain flame retardants.

According to Kjeld Bülow, the EU Commission, however, is under intense pressure from England regarding fire safety requirements, which may at worst lead to requirements for the use of flame retardants. In addition, Norway is also currently looking at increasing fire safety requirements[17].

The contact to the 61 selected relevant businesses in the furniture/home textile industry in this survey has shown that the Danish producers are faced with demands for flame retardant products in two situations:

1. In the case of foreign customers, i.e. sales to markets outside Denmark.
   - E.g. the U.S., the UK, France, Ireland, Sweden, Finland, and the Czech Republic have special fire safety regulations when it comes to certain types of furniture/interior design (Arcadis, 2011).
   - But the textile and carpet manufacturers in Denmark generally experience requirements, especially from the UK and the US when it comes to fire safety. Especially the UK has high demands when it comes to fire safety, and the US (especially California) has special fire safety standards for furniture (Stapleton et al., 2012).
2. In the case of products for public buildings, such as hotels or institutions.

Since Denmark is a relatively small market in terms of sales of consumer products such as furniture and other furnishing articles, this means that special furniture or furnishing are not necessarily

[14] http://ing.dk/artikel/total-uvidenhed-om-giftige-flammehaemmere-i-mobler-134601
[15] http://www.ireadlabelsforyou.com/flame-retardant-law-is-about-to-change/
[16] http://www.ireadlabelsforyou.com/flame-retardant-law-is-about-to-change/
[17] Personlig kommunikation med Kjeld Bülow, rådgiver i Møbel+Interiør Brancheforeningen, februar 2013.

produced specifically for the Danish market if there are more strict requirements in terms of fire safety in other European countries. As England is mentioned by the contacted companies as one of the countries with the strictest requirements in terms of fire protection, the English rules about fire safety are briefly described below.

According to FIRA (2011), the British do not only make demands for fireproof furniture/furnishing fabrics in public spaces, but also products for private homes. The overall rules generally state that

- the filling must be able to withstand specific ignition requirements
- the upholstery must be resistant to a lit cigarette
- the cover must be resistant to an open flame
- All furniture must be provided with a label describing the requirements that the product meets

According to Kjeld Bülow, counsellor in the Furniture+Interior Association, these stricter fire safety requirements in Britain require flame retardants to be added to upholstery foam in furniture for private homes[18]. It is indicated in the FIRA (2011) that textiles incorporating flame retardants can have a tendency to melt when exposed to flames/cigarettes and thereby be able to ignite upholstery material. Therefore, the combination of upholstery, cover, etc. shall be tested in relation to lit cigarettes and open flames to be sure that the total product (furniture) is fireproof. Optionally, it may be necessary with an extra fire retardant layer on the back of the cover - a backcoat - to form a fire-proof barrier between the cover and the upholstery.

It is further stated in the FIRA (2011), that it is not recommended to use "spray-on" flame retardants, i.e. after treatment with flame retardants, in products designed to meet the English fire protection requirements, as it is often not possible to ensure consistent fire safety of the entire product. It is recommended instead to use materials with built-in flame retardants or materials that in themselves have flame retardant properties.

2.7.1 Fire safety standards for products

In the textile sector, the following product areas have European standards for fire safety (Arcadis, 2011 – Table 8-3):

- Furniture
- Mattresses
- Textiles
- Curtains
- Carpets
- Nightwear for children (not covered by this project survey with focus on home interiors)
- Bedding (not covered by this project survey with focus on home interiors)

There are a variety of standards for fire safety in force in Denmark and Europe. Below the standards are listed, obtained by a search on Danish Standards' website. We searched for the words "flammability", "fire and textiles", "flame and textiles" and in the categories "13220.40 - materials and products' flammability and resistance to fire," "97.140 - Furniture" and "59080.30 - Textile fabrics ". This search should, according to Danish Standard, ensure a complete list of relevant standards in the area. Moreover, the standards are indicated that contain requirements for fire safety, as the contacted companies have indicated that they would be entitled to live up to in the production of furnishing fabrics for the foreign market. It should be noted that the standards generally make demands on flammability, and thus only indirectly requires the use of flame retardants.

[18] http://ing.dk/artikel/total-uvidenhed-om-giftige-flammehaemmere-i-mobler-134601

Relevant standards for textiles/ interior design

DS/EN 597-1:1995 - Furniture - Assessment of the ignitability of mattresses and upholstered bed bases - Part 1: Ignition source: Smouldering cigarette

DS/EN 597-2:1995 - Furniture - Assessment of the ignitability of mattresses and upholstered bed bases - Part 2: Ignition source: Match flame equivalent

DS/EN 1021-1:2006 - Furniture - Assessment of the ignitability of upholstered furniture - Part 1: Ignition source smouldering cigarette

DS/EN 1021-2:2006 - Furniture - Assessment of the ignitability of upholstered furniture - Part 2: Ignition source match flame equivalent

DS/EN 1058.3:1977 - Materials - Coverings and linings - Ignition temperature and surface spread of flame

DS/EN 1101:1996 - Textiles and textiles products - Burning behaviour - Curtains and drapes - Detailed procedure to determine the ignitability of vertically oriented specimens (small flame)

DS/EN 1101/A1:2005 - Textiles and textile products - Burning behaviour - Curtains and drapes - Detailed procedure to determine the ignitability of vertically oriented specimens (small flame)

DS/EN 1102:1996 - Textiles and textile products - Burning behaviour - Curtains and drapes - Detailed procedure to determine the flame spread of vertically oriented specimens

DS/EN 1103:2005 - Textiles - Fabrics for apparel - Detailed procedure to determine the burning behaviour

DS/EN 1624:2000 - Textiles and textile products - Burning behaviour of industrial and technical textiles - Procedure to determine the flame spread of vertically oriented specimens

DS/EN 1625:2000 - Textiles and textile products - Burning behaviour of industrial and technical textiles - Procedure to determine the ignitability of vertically oriented specimens

DS/ISO 4880:2003 - Burning behaviour of textiles and textile products - Vocabulary

DS/ISO 6925:1985 - Textile floor coverings - Burning behaviour - Tablet test at ambient temperature

DS/EN ISO 6940:2004 - Textile fabrics - Burning behaviour - Determination of ease of ignition of vertically oriented specimens

DS/EN ISO 6941:2003 - Textile fabrics - Burning behaviour - Measurement of flame spread properties of vertically oriented specimens

DS/EN ISO 9239-1:2010 - Reaction to fire tests for floorings - Part 1: Determination of the burning behaviour using a radiant heat source

DS/ISO 9239-2:2003 - Reaction to fire tests for floorings - Part 2: Determination of flame spread at a heat flux level of 25 kw/m2

DS/EN 10528:1996 - Textiles - Commercial laundering procedure for textile fabrics prior to flammability testing

DS/ISO 12949:2011 - Standard test method for measuring the heat release rate of low flammability mattresses and mattress sets

DS/EN ISO 12952-1:2010 - Textiles - Assessment of the ignitability of bedding items - Part 1: Ignition source: smouldering cigarette

Relevant standards for textiles/ interior design

DS/EN ISO 12952-2:2010 - Textiles - Assessment of the ignitability of bedding items - Part 2: Ignition source: match-flame equivalent

DS/EN 13501-1 + A1:2009 - Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

DS/EN 13772:2011 - Textiles and textile products – Burning behaviour – Curtains and drapes – Measurement of flame spread of vertically oriented specimens with large ignition source

DS/EN 13773:2003 - Textiles and textile products - Burning behaviour - Curtains and drapes - Classification scheme

DS/EN 14041/AC:2007 - Resilient, textile and laminate floor coverings - Essential characteristics

DS/EN 14533:2003 - Textiles and textile products - Burning behaviour of bedding items - Classification scheme

The 17 Danish textile and carpet manufacturers who have been contacted for the survey also indicate that their customers make demands to comply with other foreign standards regarding fire safety (the standards that were given via the survey are listed below). However, this is mainly for textiles exported to the respective foreign markets. How strict the requirements to fire safety in public buildings in these foreign markets are, depends on how the textiles are to be used. There will be much stricter requirements for fire safety of textiles in prisons or offshore compared to offices, schools and museums.
In general, England makes far stricter requirements on fire safety compared to Denmark and other European countries (see description above).

Relevant standards on foreign markets (described by the contacted companies)

USA:

- CAL TB117/California Technical Bulletin 117 - Requirements, Test Procedure and Apparatus for Testing the Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture

England:

- BS EN 1021-1:2006 – Furniture. Assessment of the ignitability of upholstered furniture. Part 1: Ignition source smouldering cigarette.
- BS EN 1021-2:2006 - Furniture. Assessment of the ignitability of upholstered furniture. Part 2: Ignition source match flame equivalent.
- BS 5852:2006 - Methods of test for assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources.
- ISO/BS EN 14465:2003 - Textiles. Upholstery fabrics. Specification and methods of test.
- BS 476-33:1993, ISO 9705:1993 - Fire tests on building materials and structures. Full-scale room test for surface products
- BS 7176:1995 - Specification for resistance to ignition of upholstered furniture for non-domestic seating by testing composites

Relevant standards on foreign markets (described by the contacted companies)

Germany:

- DIN 4102-1:2011 - Fire behaviour of building materials and elements Part 1: Classification of building materials Requirements and testing

Switzerland:

- SN 198 898:1987

France:

- NF P 92

Italy:

- UNI 9175

2.7.2 Building regulations

The Building Regulations of 29.8.2011 (BR10, 2011) contains the requirements for the construction industry in Denmark. The regulations are issued under the Building Act. The Building Regulations' Chapter 5.5. on "Fire and smoke spreading", paragraph. 1, describes that buildings should be constructed and fitted so that a fire can be limited. At the same time it is defined that the flooring is part of the buildings, and thus there are indirect fire safety requirements for flooring in the construction of buildings. Buildings constructed with carpets as flooring must be seen as part of the building and must comply with these requirements for fire spreading (DEA, 2012).
According to the Building Regulations, there are no specific requirements that products used in construction must be flame retardant.

Building Regulations' Chapter 5.5. on "Fire and smoke spreading", paragraph. 1 (www.bygningsreglementet.dk)

" Buildings must be constructed and arranged so that a fire can be limited to the fire unit where the fire started. Spreading of fire and smoke to other fire units must be prevented in the time required for evacuation and the effors of the fire and rescue services".

2.7.3 Legislation on specific flame retardants

In the textile sector, the following flame retardants are limited by legislation:

- TRIS (tris(2, 3-dibromopropyl)) – must not be used in textiles intended to come into contact with the skin. Limited via REACH appendix XVII.
- TEPA (tris (1-aziridinyl) phosphinoxide) – must not be used in textiles intended to come into contact with the skin. Limited via REACH appendix XVII.
- PBB (polybrominated biphenyls) – must not be used in textiles intended to come into contact with the skin. Limited via REACH appendix XVII.
- OctaBDE (octabrom diphenylether) – limit value of 0.1% in articles (products). Limited via REACH appendix XVII.
- PentaBDE (pentabromo diphenylether) – limit value of 0.001% in articles (products). Limited via the Stockholm Convention.

The flame retardants HBCD, short-chain chlorinated paraffins, TCEP, boric acid (and certain salts hereof), boron oxide and some borax compounds (sodium tetraborate decahydrate and sodium tetraborate pentahydrate) are on the EU list of candidates under REACH. This means that there is a duty of disclosure (REACH Article 33) in the supply chain, if products contain more than 0.1% of these substances. If the products are sold to consumers on the other hand, there is only a duty to disclose the content of these substances, if consumers demand this information.

2.8 Environmental and health labels in Denmark relating to treatment with flame retardants

This section outlines the requirements of different environmental and health labels used in Denmark to the use of flame retardants. As basis we have focused on the environmental and health labels outlined in the project "Survey of chemical substances in textiles"(Poulsen et al., 2011), but only focused on labels considered to be relevant to the product group. This means that ecological labels such as (GOTS, IVN, Soil Association, KRAV and Demeter) have not been reviewed, and neither have other labels such as Fairtrade, as these labels are exclusively available for pure linen (or clothes) and not home textile products. We also examine the Danish indoor environment label. The labels under review are indicated in Table 12 below.

Type of label	Relevant labels
Health labels	Oeko-Tex 100/CONFIDENCE IN TEXTILES
Environmental labels	The EU Flower The Swan Good Environmental Choice Oeko-Tex 1000/100+
Other labels	Danish Indoor Climate Labelling

TABLE 12

RELEVANT ENVIRONMENTAL AND HEALTH LABELS IN THE HOME TEXTILE AREA IN DENMARK

2.8.1 Oeko-Tex 100

The Oeko-Tex 100 label or ”CONFIDENCE IN TEXTILES” as we call it in Denmark cannot be obtained if specific flame retardants are used[19]. The specific flame retardants not allowed to use are: PBB, TRIS, TEPA, pentaBDE, octaBDE, decaBDE, HBCDD, SCCP and TCEP. However, certain flame retardants are allowed. These are specifically identified on the Oeko-Tex website by their specific trade names [20] and are also stated in Table 13 below. For example, several of Treviras’ flame retardants are allowed to use for the Oeko-Tex 100-labelled textiles.

The Oeko-Tex 100 label thus generally prohibits the use of flame retardants and also specific flame retardants, while some other flame retardants are allowed. The reason for this is unknown, but one reason could be that there has been a conflict between the general prohibition of flame retardants and the fulfillment of general fire safety requirements in some European markets.
It is described in the Oeko-Tex 100 requirements that the allowed flame retardants must meet the following requirements:

- Fibre materials with built-in flame retardants: from a human/environmental assessment by Oeko-Tex, it must be possible to use the fibres without limitations. The implications of this are not described in detail.
- Finished textiles treated with flame retardants: treatment must be harmless with respect to human health, based on a thorough human/environmental assessment by Oeko-Tex.

[19] https://www.oeko-tex.com/oekotex100_PUBLIC/content1.asp?area=hauptmenue&site=grenzwerte&cls=02
[20] https://www.oeko-tex.com/en/manufacturers/certified_products/active_chemical_products/flame_retardant_products/flame_retardant_products.html

Type of flame retardant	Commercial names	Producer
Fibre materials with flame retardant properties	Dacron® T483 ESFRON FR-Adhesive (Type N) FR-Adhesive Type X FR-Membrane (Type 11) FR-Membrane Type 23 Lenzing FR® Trevira CS Trevira CS bioactive Trevira CS/FR Polyesterrohstoff A2 Visil AP	DuPont Sabanci Polyester GmbH, Hamm (D) Woongjin Chemical Co. Ltd., Seoul (Korea) W.L. Gore & Associates GmbH, Putzbrunn (D) W.L. Gore & Associates GmbH, Putzbrunn (D) W.L. Gore & Associates GmbH, Putzbrunn (D) W.L. Gore & Associates GmbH, Putzbrunn (D) Lenzing AG, Lenzing (A) Trevira GmbH, Bobingen (D) Trevira GmbH, Bobingen (D) Trevira GmbH, Bobingen (D) Kuitu Finland Oy, Valkeakoski (FN)
Precursors for the production of flame retardant polymers	UKANOL ® FR50/1 UKANOL® ES	Schill + Seilacher Aktiengesellschaft, Böblingen (D) Schill + Seilacher Aktiengesellschaft, Böblingen (D)
Flame retardants for use on finished textile	AFLAMMIT® KWB AFLAMMIT® SAP APYROL CEP-ECO Avora® Polymer 2370 Avora® Polymer 2630 Avora® Polymer 2750 Burnblock DanAi-H ECO-FLAM PU ECO-FLAM SU Finifire Pro Flacavon ARP Flacavon WP FLAMMENTIN® MSG FLOVAN® CGN	Thor GmbH, Speyer (D) Thor GmbH, Speyer (D) CHT R. Beitlich GmbH, Tübingen (D) Invista Resins & Fibers GmbH & Co. KG (D) Invista Resins & Fibers GmbH & Co. KG (D) Invista Resins & Fibers GmbH & Co. KG (D) Burnblock ApS, Copenhagen (DK) Jiangsu Sheng Dan Ai Chemical Co., Ltd., Yangzhong (CN) NV DEVAN Chemicals, Ronse (BE) NV DEVAN Chemicals, Ronse (BE) Finifire BV, El Haarlem (NL) Schill + Seilacher, Böblingen (D) Schill + Seilacher, Böblingen (D) Thor GmbH, Speyer (D) Huntsman Textile Effects, Basel (CH)

Type of flame retardant	Commercial names	Producer
	Fyrol PCF	ICL-IP Europe BV, Amsterdam (NL)
	Pekoflam® ECO liquid	Clariant International Ltd., Muttenz (CH)
	PEKOFLAM® MSP liquid	Clariant Produkte (Schweiz) AG, Muttenz (CH)
	Pekoflam® SYN liquid	Clariant International Ltd., Muttenz (CH)
	PROBAN® POLYMER	Rhodia UK Limited, West Midlands (GB)
	PYROVATEX® CP new	Huntsman Textile Effects, Basel (CH)
	PYROVATEX® CP-LF	Huntsman Textile Effects, Basel (CH)
	RUCO-FLAM PCE	Rudolf GmbH, Geretsried (D)
	X-Guard 3-HPP-N	Chempia Co., Ltd, Ansan City (Korea)

TABLE 13

FLAME RETARDANTS ALLOWED ACCORDING TO OEKO-TEX 100 (SOURCE: OEKO-TEX 100)

2.8.2 The EU Flower

The EU Flower requires that only flame retardants that are chemically bound into the polymer fibre or onto the fibre surface (reactive flame retardants) are allowed in the textile product. The use of additive flame retardants is not allowed. Furthermore, it is required that if the used flame retardants are provided with one or more of the below H-phrases, these reactive flame retardants on application must change their chemical structures, so that they are not classifiable with any of these H-phrases. In addition, no more than 0.1% of the flame retardant must retain its original properties in the treated yarn or fabric (Commission Decision 567, 2009).

These classification requirements placed by the EU Flower means that 4 of the 9 flame retardants identified in this survey (TDCPP, TCEP, TCPP and Bisphenol A-bis(diphenyl phosphate)) would not be allowed in Flower-labelled products. The classification requirements would also mean that certain brominated flame retardants would not be allowed because of their health and environmental properties[21].

[21] http://www.mst.dk/Virksomhed_og_myndighed/Kemikalier/Fokus+paa+saerlige+stoffer/Bromerede+flammehæmmere/02150000.htm#Sådan

H-no.	H-phrase	H-no.	H-phrase
H351	Suspected of causing cancer.	**H361f**	Suspected of damaging fertility.
H350	May cause cancer.	**H361d**	Suspected of damaging the unborn child.
H350i	May cause cancer if inhaled.	**H360FD**	May damage fertility. May damage the unborne child.
H340	May cause genetic defects.	**H361fd**	Suspected of damaging fertility. Suspected of damaging the unborn child.
H341	Suspected of causing genetic defects.	**H400**	Very toxic to aquatic life.
H360 F	May damage fertility.	**H410**	Very toxic to aquatic life with long lasting effects.
H360 D	May damage the unborn child.	**H411**	Toxic to aquatic life with long lasting effects.
H360 Fd	May damage fertility. Suspected of damaging the unborn child.	**H412**	Harmful to aquatic life with long lasting effects.
H360 Df	May damage the unborn child. Suspected of damaging fertility.	**H413**	May cause long lasting harmful effects to aquatic life.

TABLE 14

REQUIREMENTS TO REACTIVE FLAME RETARDANTS IN THE FLOWER: H-PHRASES NOT ALLOWED FOR FLAME RETARDANTS

2.8.3 The Swan

The Nordic Eco label, the Swan generally follows the Flower criteria; there are a few additional criteria set up by the Swan compared to the Flower - with the exception of content of flame retardants. It should be noted that the criteria for textiles is currently in hearing (Nordisk Miljømærkning, 2012).

2.8.4 Good Environmental Choice

There are new criteria for the Swedish Good Environmental Choice label in 2012. The criteria include the following textile areas: textile fibres and textile processing, second hand textiles and redesign textiles. According to these criteria, it is not allowed to use flame retardants anywhere in the manufacturing process of the textiles. The only exception is if legislation in the selling country requires the products to be treated with flame retardants. In this case, the flame retardants must comply with the general chemical criteria set. This means that the SVHC substances are not allowed to use and flame retardants that are classified with the following H-phrases (see Table 15) are not allowed to use.

These classification requirements set by Good Environmental Choice mean that 2 of the 9 flame retardants identified in this survey (TDCPP and TCEP) would not be allowed in products labelled with Good Environmental Choice. The classification requirements would also mean that certain brominated flame retardants would not be allowed due to their health and environmental properties[22]. For example, HBCDD is classified with H361 and TBBPA is classified with H400. It should be noted that the Good Environmental Choice does not impose as strict requirements

[22] http://www.mst.dk/Virksomhed_og_myndighed/Kemikalier/Fokus+paa+saerlige+stoffer/Bromerede+flammehæmmere/02150000.htm#Sådan

regarding the classification for the environmental properties of flame retardants. This is the reason why several of the identified flame retardants in this survey are permitted by the Good Environmental Choice criteria compared with the EU Flower or the Swan criteria. TDCPP and TCEP are not allowed either according to Good Environmental Choice criteria or the EU Flower or the Swan criteria, but TCPP and bisphenol A-bis(diphenylphosphate) are allowed according to the Good Environmental Choice criteria, but not according to the EU Flower or the Swan criteria.

H-no.	H-phrase	H-no.	H-phrase
H300	Fatal if swallowed.	H330	Fatal if inhaled.
H301	Toxic if swallowed.	H310	Fatal in contact with skin.
H351	Suspected of causing cancer.	H360F	May damage fertility.
H350	May cause cancer.	H360D	May damage the unborn child.
H350i	May cause cancer if inhaled.	H361f	Suspected of damaging fertility.
H340	May cause genetic defects.	H361d	Suspected of damaging the unborn child.
H341	Suspected of causing genetic defects.	H372	Causes damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.	H373	May cause damage to organs through prolonged or repeated exposure.
EUH070	Toxic by eye contact.	EUH059	Hazardous to the ozone layer.

TABLE 15
REQUIREMENTS TO REACTIVE FLAME RETARDANTS IN GOOD ENVIRONMENTAL CHOICE: H-PHRASES NOT ALLOWED IN THE CLASSIFICATION OF FLAME RETARDANTS

2.8.5 Oeko-Tex 1000/100+

Oeko-Tex 1000 is a company brand that provides various environmental requirements for the company. If a company has both Oeko-Tex 1000, Oeko-Tex 100 ("Confidence in Textiles") the same products can be labelled with the Oeko-Tex 100 +. Oeko-Tex 1000 provides additional requirements for flame retardants (Oeko-Tex 1000, 2012), namely that the following types of flame retardants are not allowed to use (in addition to the requirements for flame retardants in Oeko-Tex 100):

- Flame retardants based on antimony or arsenic
- Brominated flame retardants
- TEPA (tris-(aziridinyl)-phosphinoxide)
- Flame retardants with chlorinated paraffins or fluorinated compounds

2.8.6 Danish Indoor Environment Labelling

Danish Indoor Environment Labelling is voluntary labelling for construction products and products' impact on the indoor environment. The Indoor Environment Label applies for the following product types relevant to this project: Textile flooring and upholstered furniture. Other household textiles such as curtains do not seem to be covered by the Danish Indoor Environment Labelling.

The Indoor Environment Label makes demands on the product in its application phase and comprises the products' impact on indoor air quality. An Indoor Environment Labelled product has undergone testing and has documentation for the release of chemicals into the air. The Indoor

Environment Label only makes demands to the product in its application phase. The demands may be an upper limit for emission and the kind of substances allowed emitting.

Currently, the types of demands set by the Indoor Environment Label are:

- Indoor environment-related time value is based on the determination of the emission of volatile organic compounds (VOC) – i.e. the time it takes before the emission from a product is at an acceptable concentration in the indoor air.
- Emission of carcinogenic substances
- Release of particles and fibres
- Indoor environment-related instructions (i.e. instructions on storage, transportation, use, cleaning, etc.)

This means that the Danish Indoor Environment Label in practice does not exclude the use of flame retardants, if they just do not emit above a certain level - that is, only if the flame retardant is volatile. The level is determined from the irritation threshold of the individual emitted substances, and must not exceed 50% of the irritation threshold of each substance. However, there are rules that carcinogenic substances must not emit from products with the Indoor Environment Label. This means that certain brominated flame retardants and the flame retardant TCEP (Tris (2-chloroethyl) phosphate) is thereby excluded in products with the Indoor Environment Label, if they evaporate from the products (The Indoor Environment Label, 2005).

2.8.7 Summary of requirements for flame retardants in certain labelling systems

The demands to the use of flame retardants in the different reviewed labelling systems appear from the table on next page.

Type of label	Demands to the use of flame retardants
Confidence in textiles (Oeko-Tex 100)	General prohibition on the use of flame retardants – however, certain flame retardants are allowed. It is specifically stated that the following flame retardants must not be used: PBB, TRIS, TEPA, pentaBDE, octaBDE, decaBDE, HBCDD, SCCP and TCEP.
The EU Flower	No use of flame retardants with certain classifications, such as CMR effects and environmental effects (the classifications are different from those in Good Environmental Choice). 4 out of the 9 flame retardants identified in this survey will not be allowed in products labelled with the Flower. These are TDCPP, TCEP, TCPP and Bisphenol A-bis(diphenyl phosphate).
The Swan	As for the Flower
Good Environmental Choice	No use of flame retardants with certain classifications, such as CMR effects, environmental effects and toxic substances (the classifications are different from those in the Flower and the Swan – and not as severe in terms of environmental classifications). 2 oout of the 9 flame retardants identified in this survey will not be allowed in products labelled with Good Environmental Choice. These are TDCPP and TCEP.
Oeko-Tex 100+	No use of the following types of flame retardants: • Flame retardants based on antimony and arsenic • Brominated flame retardants • TEPA • Flame retardants with chlorinated paraffins or fluorinated compounds
Danish Indoor Environment Label	Carcinogenic substances are not allowed to emit from products, i.e. certain types of brominated flame retardants

TABLE 16
SUMMARY OF DEMANDS TO FLAME RETARDANTS IN VARIOUS LABELLING SYSTEMS

2.9 Alternatives to flame retardants in textiles

Not many alternatives have been identified to the use of flame retardants in textiles. When contacting companies in the industry, four of the contacted companies mention that the use of wool as a textile material is a good alternative to the use of flame retardants, as wool in itself has flame retardant properties. The natural flame retardant properties of wool is due its high nitrogen and moisture contents, high ignition temperature, as well as the low heat of combustion of wool and its limited oxygen index[23]. (The oxygen index and the nitrogen content are important for the degree to which the material is able to maintain a flame, once it catches fire).

An internet search gave the following alternatives to the use of flame retardants in textile products:

- Use of wool that has a certain natural flame retardant effect.
- Use of ”barriere fabrics” or wrapping of foam/upholstery (Ansi, 2012).
- Change the design, using non-combustible materials instead of textiles (e.g. use of metal blinds instead of curtains).
- Use of fire alarm instead of flame retardant materials.

[23] http://www.csiro.au/files/files/p9z9.pdf

Substitution of health hazardous flame retardants with less health hazardous substances:

- Pre-treatment of the products with burnblock, included in Oeko-tex's list of approved active chemical products. Burnblock consists of sodium benzoate and citric acid, among others, and acts to prevent oxygen from reaching the treated product, thus preventing ignition of the product (Burnblock, 2012).
- The substances TDCPP, TCPP and V6 have similar use patterns and chemical similarity. The three substances are predominantly used in various types of polyurethane foam applications in the EU (> 97.5% of TCPP, > 85% of TDCPP and > 75% of V6). Chlorinated alkyl phosphate esters (particularly TCPP) were identified as possible substitutes to pentabromodiphenylether (pentaBDE) in the risk reduction strategy for this substance (EU, 2001). But it has since become clear from discussions with the industry that these chemicals are not direct substitutes for pentaBDE in the EU, and that changes in the TCPP consumption is more associated with the decline in TCEP, and an increase in the market for polyurethane (PUR) generally (EU RAR, 2008).

3. Selection of products

3.1 Background

The purpose of this project was to identify the flame retardants in household textiles, which influence the most on our health and environment. The survey received a very good response from suppliers to the Danish market, which does not use flame retardants or use the flame retardants which are accepted in the Oeko-Tex 100 labelled articles. About half of the contacted companies did not respond to our inquiries, and the industry that responded believes that there are products on the Danish market, which includes, for example, chlorinated and brominated flame retardants. As for furniture, chlorinated and brominated flame retardants are expected to occur particularly in cheap imports from the Orient. According to the response from the industry, the picture is reversed for carpets where the industry says that cheap rugs do not contain flame retardants, because they are expensive to add.
Strict British fire safety regulations mean that it should be impossible to ignite furniture and household textiles by a lit cigarette or a match. Therefore, it is estimated that products sold in Denmark, which are also sold to the UK market, may contain flame retardants.

3.2 Strategy

In order to concentrate resources where the problematic flame retardants pose the highest exposure to the average Dane, it was decided that the strategy would be to buy products that could potentially contain problematic flame retardants, while the products that potentially pose the highest risk of exposure were prioritised.

All products with flame retardants can contribute to the concentration of flame retardants in indoor air/dust. As flame retardants in addition to furniture and home textiles also occur in electrical installations, clothing and building materials, the flame retardants that occur in individual households can come from many different sources. Some of these substances may evaporate from lighted and heated appliances and inhaled by humans. How easy a flame retardant is released from the product during use depends on whether the substance is chemically bound in the material or more free-flowing in the material[24]. Furthermore, the expected rate of evaporation to indoor air/dust also depends on how large a surface the product has in relation to the air, and how the product is used (for example, it could be imagined that flame retardants in a mattress used to jump in will release higher concentrations than a mattress you do not use). Potentially, all the identified product groups may release flame retardants to the indoor air and dust, but based on the types of flame retardants (inorganic) seen in carpets, these are assessed to be less interesting to focus on due to their low toxicity potential. The curtains may potentially release flame retardants to indoor air and dust, but the survey indicates that the flame retarded curtains are usually flame retarded with flame retardants built into the textile fibre minimising the release from the fabric. It was therefore decided in cooperation with the EPA to focus on home textiles and foam materials, which you may come into dermal contact with.

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24 http://www.mst.dk/Virksomhed_og_myndighed/Kemikalier/Fokus+paa+saerlige+stoffer/Bromerede+flammeh%C3%A6mmere/

Based on the estimated exposure, the largest dermal exposure to flame retardants is expected to occur when using furniture or mattresses containing flame retardants either in the fabric or to a lesser extent from foam parts or both.
The carpets are predominantly added flame retardants on the backside, and therefore exposure is assessed to be less like the survey suggests, that it is mainly the inorganic flame retardants used for carpets. These are toxicologically less problematic than the phosphorus-based ones found in furniture.
For curtains exposure is assessed to be low, as a result of dermal contact with a hand in connection with pulling on and off. Furthermore, the industry indicates that the Danish-made curtains, if they are fire retardant, primarily contains built in Oeko-Tex 100-labelled phosphorus-based flame retardants. For this reason it was chosen not to focus on the curtains in the analysis phase.

The strategy for the kind of flame retardants we sought was therefore:

- To identify the products that may contain bromine and/or chlorine flame retardants. By comparing information from the industry with products on shop websites, products can be located for which there is no further information.
- To prioritise the flame retardants that must not occur in the eco-labeled articles (Oeko-Tex 100, the Swan, and the EU-Flower).

The strategy for the kind of products we sought was therefore:

- To focus on mattresses and particularly on furniture.
- To find the range of products supplied identical to the Danish and other European markets (for example both the UK and Denmark) to catch the products which must meet the high fire safety requirements of e.g. the UK.
- To prioritise products which are not ecolabelled (Oeko-Tex 100, the Swan, and the EU-Flower).
- To prioritise furniture containing foam and textiles of synthetic materials (polyester and other synthetic materials) and a few articles of cotton.
- Through the survey, the industry reported that wool often does not need to be treated with a flame retardant, and therefore the analysis phase does not focus on textiles of wool.
- Carpets are downgraded because the industry indicates that fire retardants are typically added in the foam on the backside of the carpet, and exposure through dermal contact, therefore, is considered to be significantly less than the exposure by dermal contact with furniture.
- Curtains are also downgraded as a result of a small dermal exposure and the fact that the curtains are primarily expected to contain built in Oeko-Tex 100-labelled phosphorus-based flame retardants, which are released from the fabric to a limited extent.

Therefore an internet search was carried out to find stores, and thus furniture and mattresses sold both in Denmark and the UK. Specific products from these stores were prioritised when purchasing products.

3.3 The shopping list

The following search strategy was used to find relevant products for the project analysis program:

- search for products/articles that can be purchased both in the UK and Denmark
- search for products/articles for which we had a putative suspicion that they may be imported from non-EU countries, and therefore may contain flame retardants - including cheap products/articles
- search for products/articles incorporating textiles of polyester and other synthetic materials as well as a few products of cotton
- Furthermore, it is known from previous studies and the literature that there may be halogenated flame retardants in foam materials in furniture. Therefore a number of mattresses, chairs and poufs with upholstery have been included.

3.4 Selection of products

Based on of the above, the following products were purchased for analysis of the content of flame retardants:

- 3 office chairs (called KS1 to KS3 in the report)
- 8 mattresses (called M1 to M8 in the report)
- 3 chairs/armchairs (called S1 ti S3 in the report)
- 1 rug (called P1 in the report)

4. Analyses

As described in the previous section, a total of 15 products were selected for analysis of content of flame retardants. The 15 products consisted of:

- 3 office chairs (KS1 to KS3)
- 8 mattresses (M1 to M8)
- 3 chairs/armchairs (S1 to S3)
- 1 rug (P1)

The following analyses were made on the 15 products:

- XRF-screening
- GCMS-screening of selected subsamples
- Quantitative analyses of selected flame retardants observed by the GCMS-screening

The first step in the analyses was an XRF screening. XRF is an X-ray screening, i.e. an element analysis making it possible to make a first guess on a content of flame retardant in the product, and the type (brominated, chlorinated, phosphorus-based, etc.). Each of the 15 products was divided into a number of subsamples equal to the number of different material layers, which the products consisted of. The products consisted of 1 to 11 layers. The layers were numbered from the top, i.e. layer 1 is the layer that consumers touch. Rug and mattresses are however reversible. These layers are described in detail below in Table 17.

Product	Description of the individual layers of the product
Office chair KS1	Layer 1: Red textile, Layer 2: Pink foam, Layer 3: Foam granules of several colours
Office chair KS2	Layer 1: Black textile, Layer 2: White foam, Layer 3: White foam
Office chair KS3	Layer 1: Gray textile, Layer 2: Light gray foam, Layer 3: Gray foam, Layer 4: Gray foam
Mattress M1	Layer 1: Hvid fiberdug, Lag 2: Hvidt tekstil, Lag 3: Hvid fiberdug, Lag 4: Hvidt skum
Mattress M2	Layer 1: White textile, Layer 2: White wadding, Layer 3: White fiber cloth, Layer 4: White foam
Mattress M3	Layer 1: Blue textile, Layer 2: White foam
Mattress M4	Layer 1: Blue textile with light rear, Layer 2: White foam
Mattress M5	Layer 1: Light textile, Layer 2: White foam, Layer 3: White fiber cloth
Mattress M6	Layer 1: White textile sewn together with layer 2, Layer 2: White wadding,

Product	Description of the individual layers of the product
	Layer 3: White foam
Mattress M7	Layer 1: Bluish foam
Mattress M8	Layer 1: White and gray textile, Layer 2: White foam
Rug P1	Layer 1: White longhaired fleece, Layer 2: White textile back of the fleece, Layer 3: Brown fleece outside, Layer 4: Brown backing
Chair S1	Layer 1: Gray textile glued on a light textile backing, Layer 2: White textile, Layer 3: Yellow foam, Layer 4: Light green foam
Chair S2	Layer 1: Gray/black textile, Layer 2: White wadding, Layer 3: White foam, thin, Layer 4: White foam, thick, Layer 5: Foam granule several colours, Layer 6: Thin smooth black textile, Layer 7: Black textile fibre cloth, Layer 8: Bottom strap
ChairS3	Layer 1: Gray textile, Layer 2: Thin layer of gray foam, Layer 3: White wadding, Layer 4: Foam granule several colours, Layer 5: Black textile fibre cloth, Layer 6: Green strap, Layer 7: Foam granule several colour, Layer 8: Thick gray foam, Layer 9: Cardboard, Layer 10: Green strap, Layer 11: Black textile fibre cloth

TABLE 17
DESCRIPTION OF THE INDIVIDUAL LAYERS OF THE 15 PRODUCTS PURCHASED FOR ANALYSES

Based on the XRF screening, 13 subsamples were selected for which a GCMS-screening was made for a possible identification of any flame retardants. Subsequently, based on the GCMS-screening, four subsamples were selected, for which the content of flame retardants was identified. For these subsamples a quantitative analysis was performed to determine the content of the specific flame retardants. Finally, headspace analysis of two products was made to evaluate the emission of the flame retardants from the products.

The four methods of analysis (XRF screening, GCMS screening, quantitative analysis and headspace analysis) and the results of the three analyses are described below.

4.1 XRF-screening

4.1.1 Analytical method – XRF-screening

Screening by XRF is carried out with an X-LAB 2000 instrument from Spectro GmbH operated using a software called Spectro X-LAB, with a supplier developed analytical method called TurboQuant.

Three different XRF spectra are recorded from each sample. These spectra are based on different types of secondary targets. One with molybdenum as a secondary target used for the determination of the elements in the areas Cr - Zr and Pr - Bi, one with Al2O3 as a Barkla target used for the determination of the elements in the area Y - Ce, and one with HOPG as Bragg target used for determination of the elements in the area Na - V.

Based on calibration against a number of reference materials of various types, the content of the specified elements in the samples from Na – U can be determined by means of TurboQuant. The method also allows measurements of the elements in materials containing significant amounts of the light elements that are not among the specific elements by XRF analysis. It is thus possible to see the content of e.g. chlorine (Cl) and phosphorus (P).

The tested samples were taken from the materials in the furniture / mattresses. All products were cut up and the different layers were counted and described (see Table 17). As the x-ray screening is a surface screening, it is necessary to X-ray analyse all layers individually to get an overview of the content of elements in each layer. In total, 59 X-ray analyses of the 15 products were made. The products consisted of between 1 and 11 layers per product.

Larger pieces of all the materials were taken from each product, which was then cut out to the size of 35 mm x 35 mm. In some cases it was not possible to take a single sample, which could make a massive sample of the desired size. In those cases several similar samples were laid on top of each other to achieve anything that remotely could constitute a massive test.

The estimated overall detection limits of the performed screenings are given in Table 18, but as shown by XRF results in Appendix 1, the detection limit differs for each element. The detection limit is between 0.0002% (cadmium) and 0.5% (for sodium), i.e. between 2 and 5000 ppm.

Element	Detection limit (%)	Element	Detection limit (%)
Na	0.5	Sr	0.005
Mg	0.1	Y	0.005
Al	0.05	Zr	0.001
Si	0.05	Nb	0.0005
P	0.02	Mo	0.0005
S	0.01	Ag	0.0005
Cl	0.01	Cd	0.0002
K	0.005	In	0.0005
Ca	0.005	Sn	0.0002
Ti	0.002	Sb	0.0005
V	0.002	Te	0.001
Cr	0.001	I	0.001
Mn	0.001	Cs	0.001
Fe	0.005	Ba	0.002
Co	0.002	La	0.003
Ni	0.001	Ce	0.005
Cu	0.001	W	0.002
Zn	0.001	Hg	0.002
Ga	0.001	Tl	0.002
Ge	0.001	Pb	0.002
As	0.001	Bi	0.002
Se	0.001	Th	0.003
Br	0.002	U	0.003
Rb	0.005		

TABLE 18
DETECTION LIMITS IN PERCENTAGE BY WEIGHT FOR THE ELEMENTS BY USE OF XRF-SCREENING

4.1.2 Analytical results – XRF-screening

The analytical results for all 59 subsamples are presented in Appendix 1. A selection of results is presented in the figures on the following pages. Focus is on the presentation of the elements that are part of the flame retardants identified in this survey, i.e. the elements Al, P, Cl, Ti, Br and Zr. Results for these elements are presented for the individual elements to provide an overview of the difference in levels, and also individually for the 15 analysed products.

4.1.2.1 Analytical results presented per element

The following figures illustrate the measured content in the 59 subsamples, Al, Ti, P, Cl, Br, and Zr respectively. The units of Al, P, Cl and Ti are given in percentage by weight, whereas the units for Br and Zr are given in ppm (μg/g), as Br and Zr are not identified in just as large amounts (maximum 0.039%).

Initially, Al and Ti, P and Cl, and Br and Zr are presented for all 59 subsamples in three different figures. In these figures, it is hard to read all the details, and therefore the results for all six elements are indicated in 2 x 4 different figures subsequently. One figure for each product group (office chairs (KS), mattresses (M), armchairs (S) and rug (P)), which in turn are divided in one figure for Al, Ti, P and Cl, respectively, with content reported in percentage by weight, and in one figure for Br, and Zr, respectively, with content reported in ppm.

<u>*Analytical results for all 59 subsamples*</u>

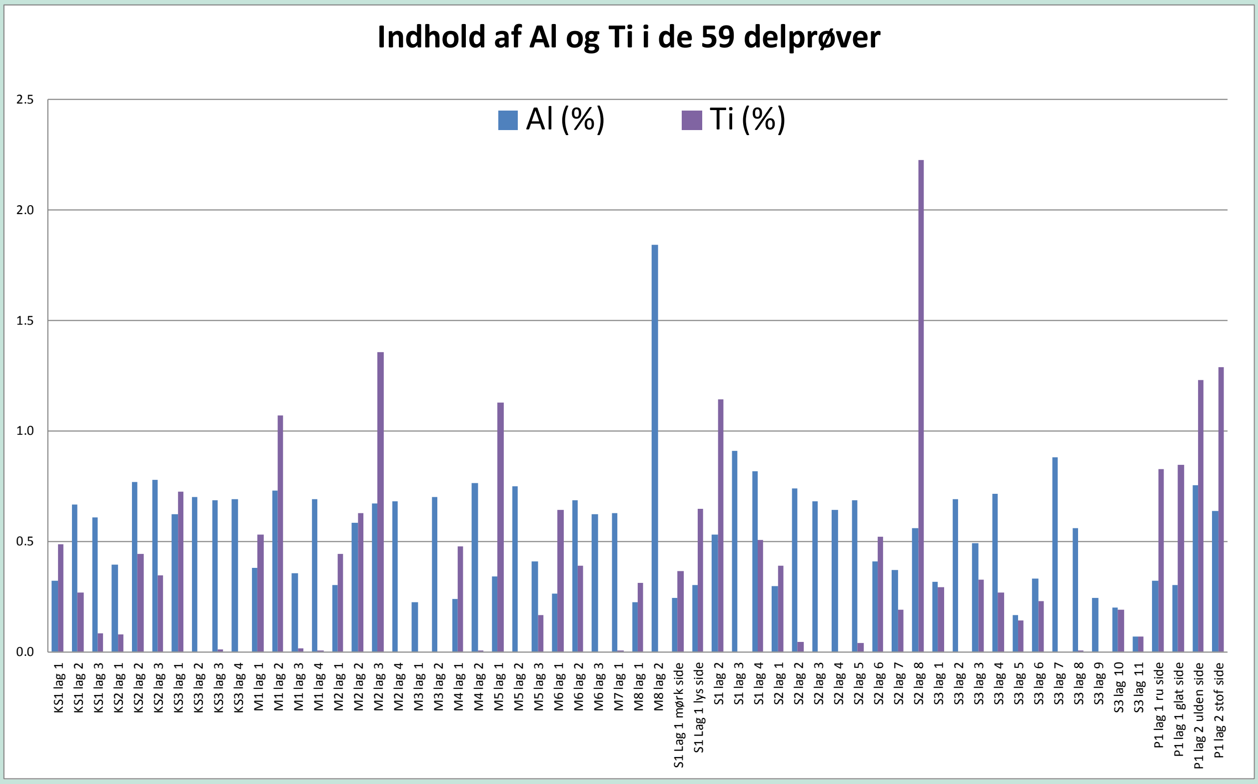


FIGURE 1
CONTENT OF ALUMINIUM AND TITANIUM IN THE 59 SUBSAMPLES

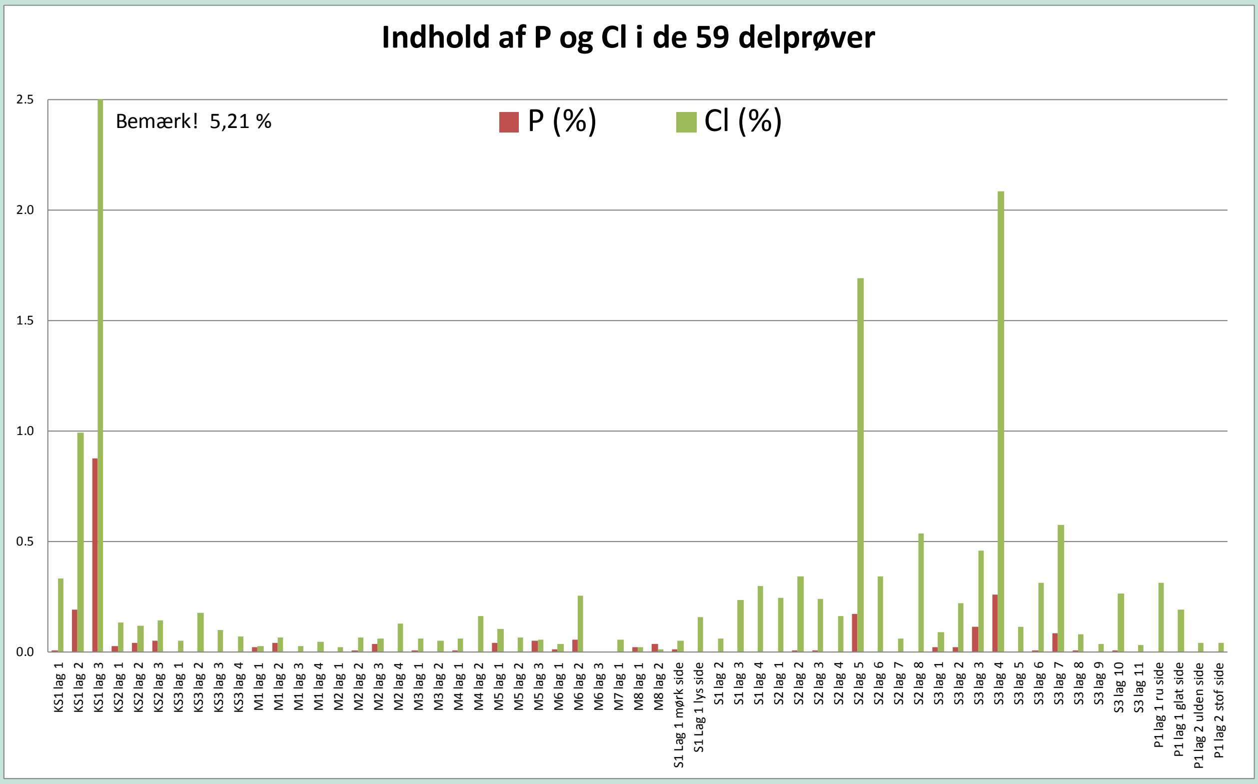


FIGURE 2
CONTENT OF PHOSPHOROUS AND OG CHLORINE IN THE 59 SUBSAMPLES

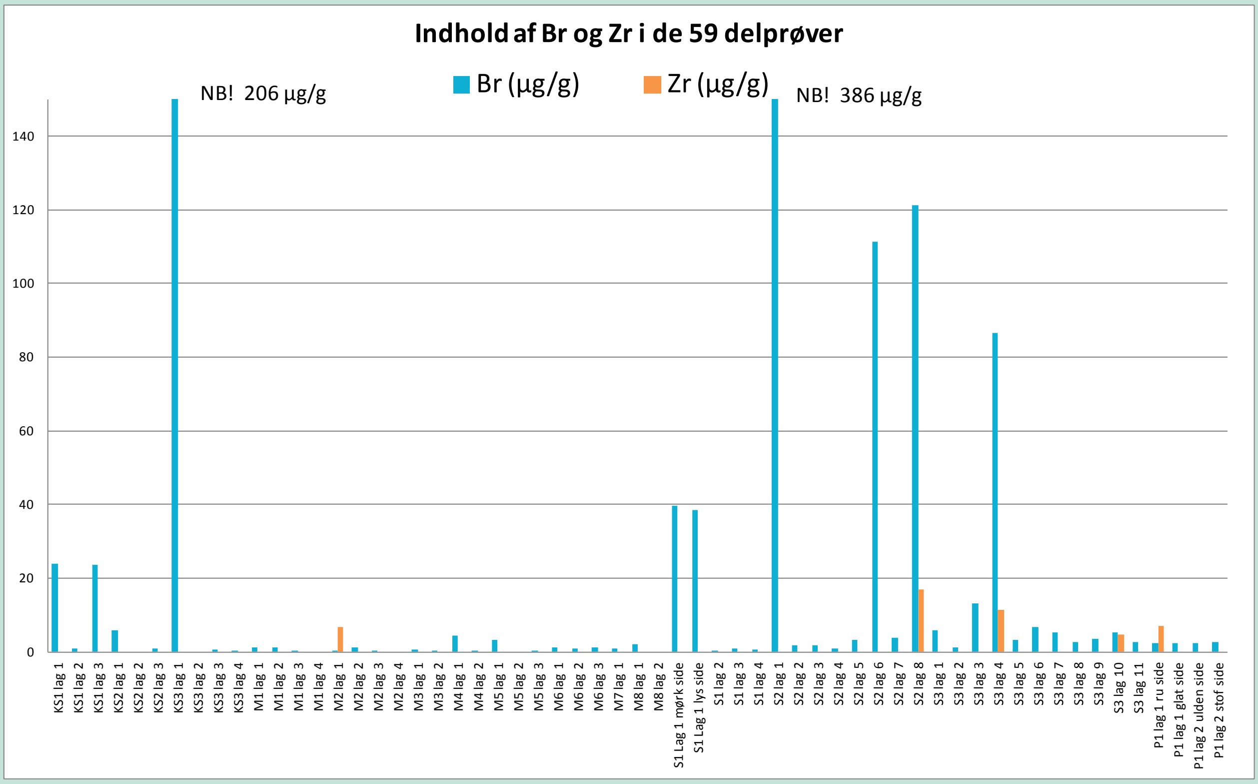


FIGURE 3
CONTENT OF BROMINE AND ZIRCONIUM IN THE 59 SUBSAMPLES

Analytical results in the four selected types of products

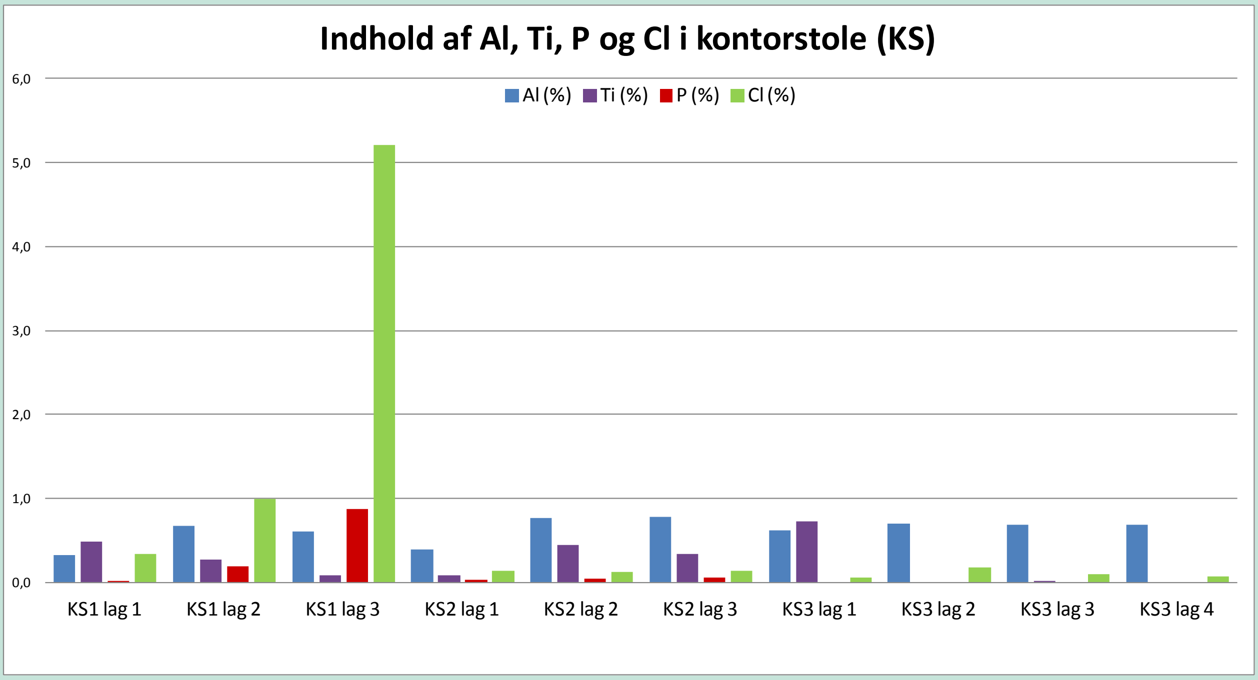


FIGURE 4
CONTENT OF AL, TI, P AND CL IN OFFICE CHAIRS - MEASURED IN PERCENTAGE BY WEIGHT

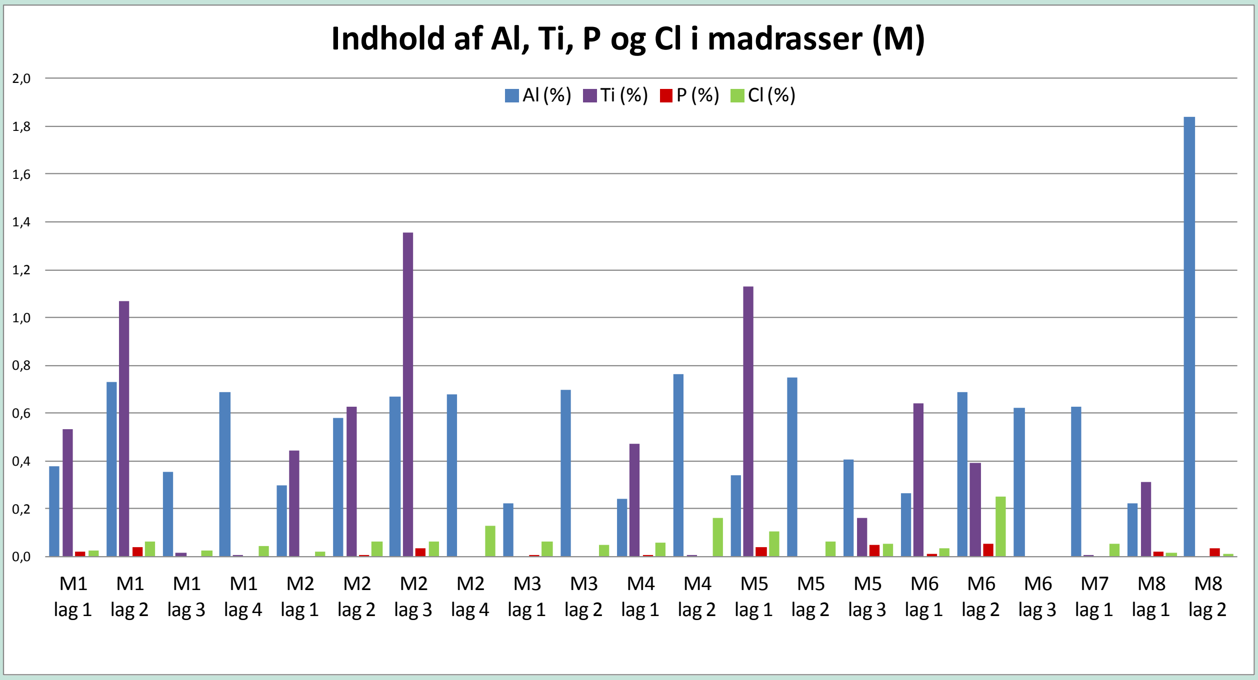


FIGURE 5
CONTENT OF AL, TI, P AND CL IN MATTRESSES - MEASURED IN PERCENTAGE BY WEIGHT

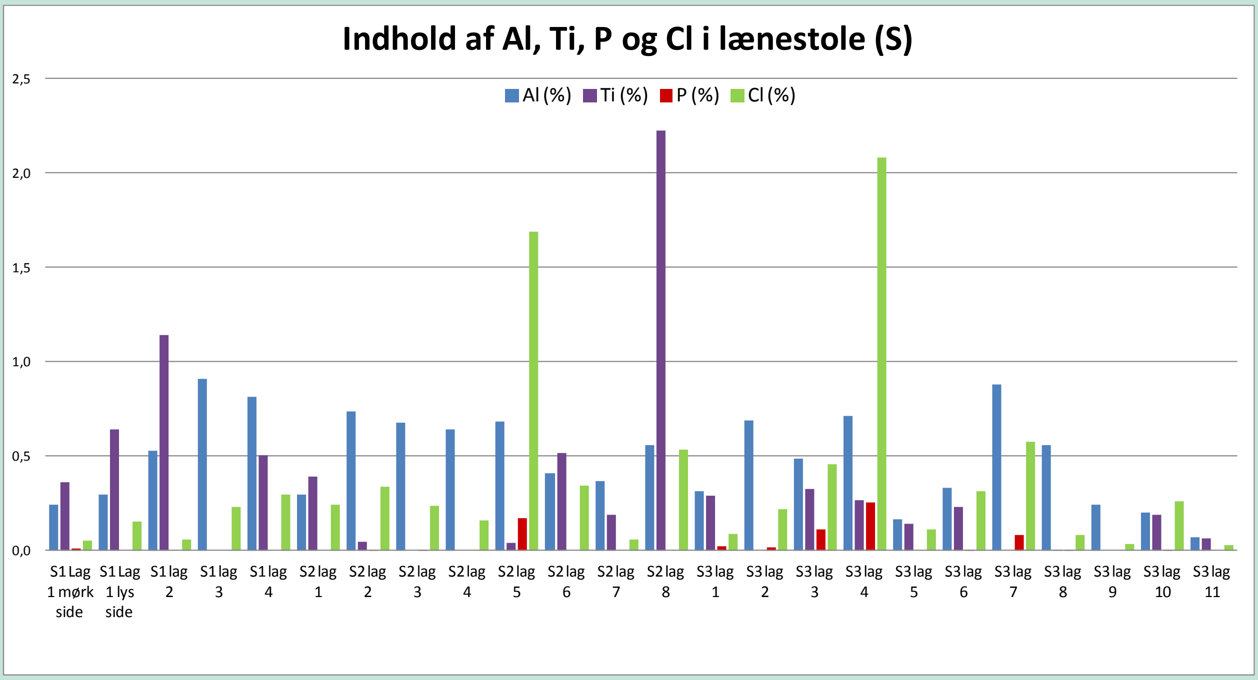


FIGURE 6
CONTENT OF AL, TI, P AND CL IN ARMCHAIRS - MEASURED IN PERCENTAGE BY WEIGHT

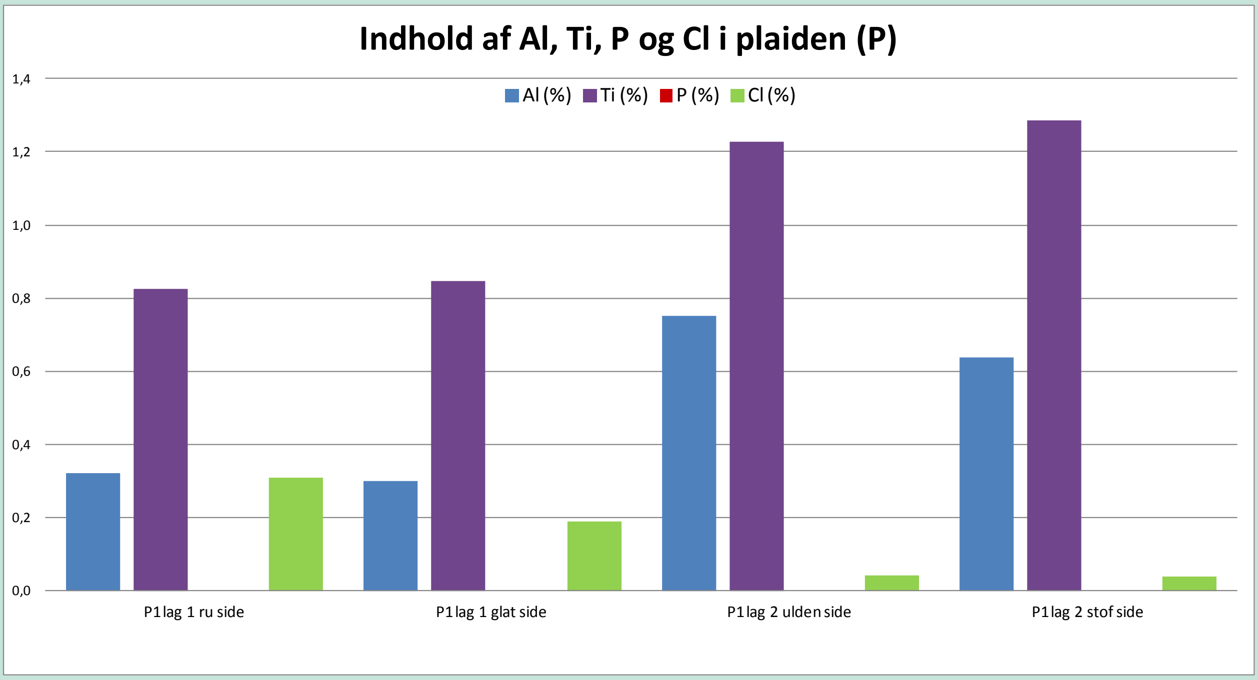


FIGURE 7
CONTENT OF AL, TI, P AND CL IN THE RUG - MEASURED IN PERCENTAGE BY WEIGHT

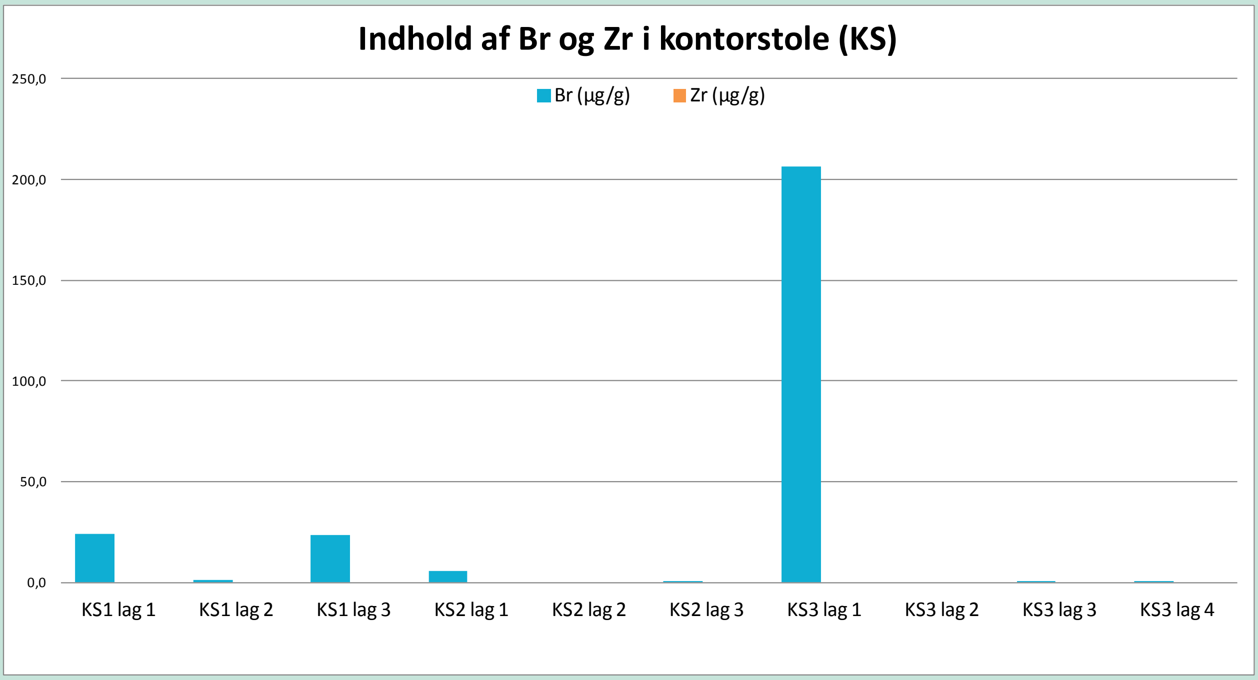


FIGURE 8
CONTENT OF BR AND ZR IN OFFICE CHAIRS – MEASURED IN PPM (MICROG/G)

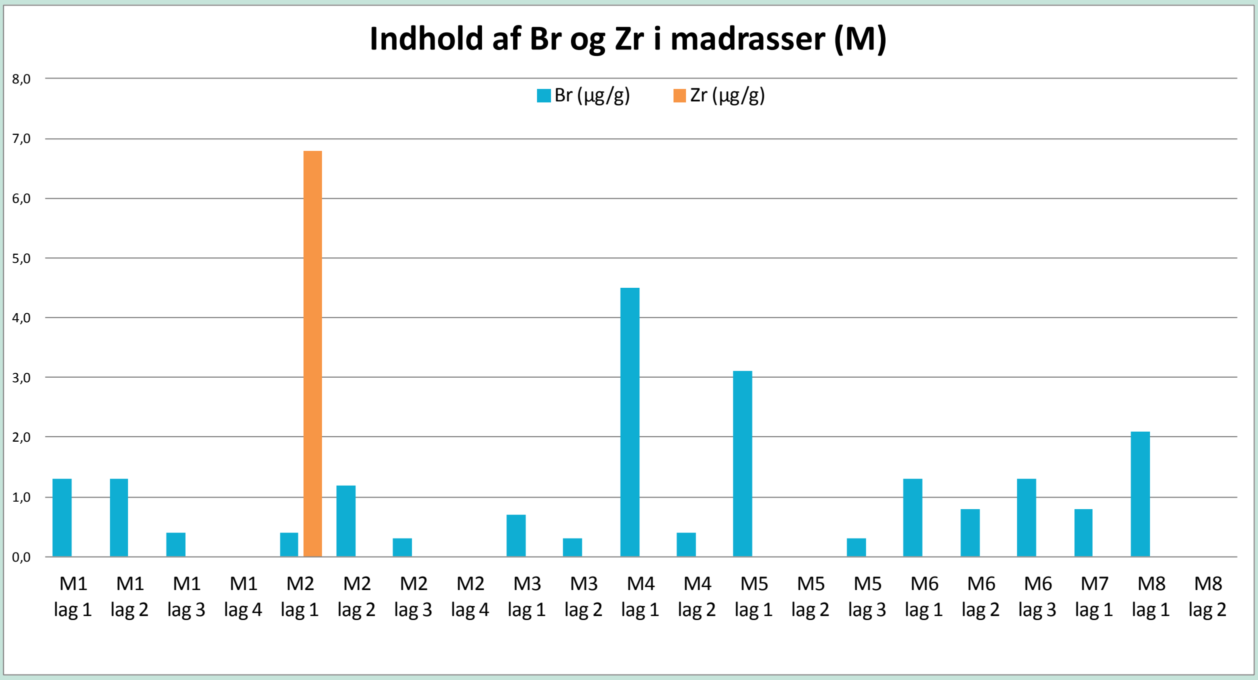


FIGURE 9
CONTENT OF BR AND ZR IN MATTRESSES – MEASURED IN PPM (MICROG/G)

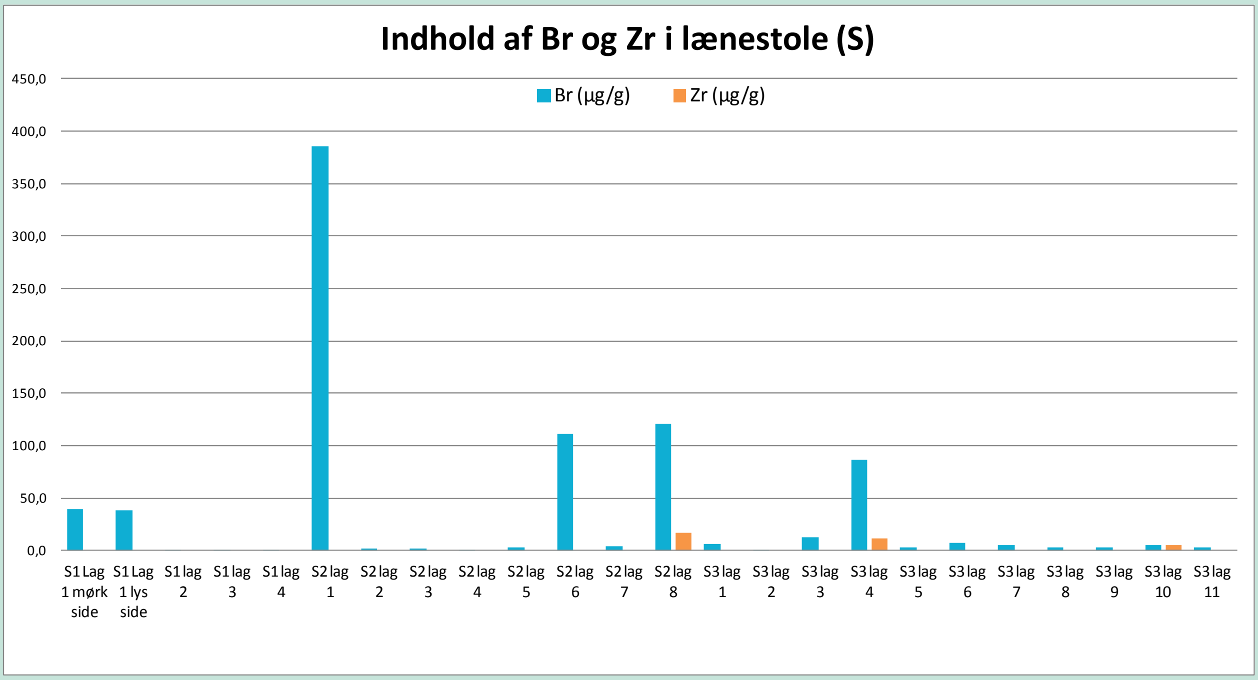


FIGURE 10
CONTENT OF BR AND ZR IN ARMCHAIRS – MEASURED IN PPM (MICROG/G)

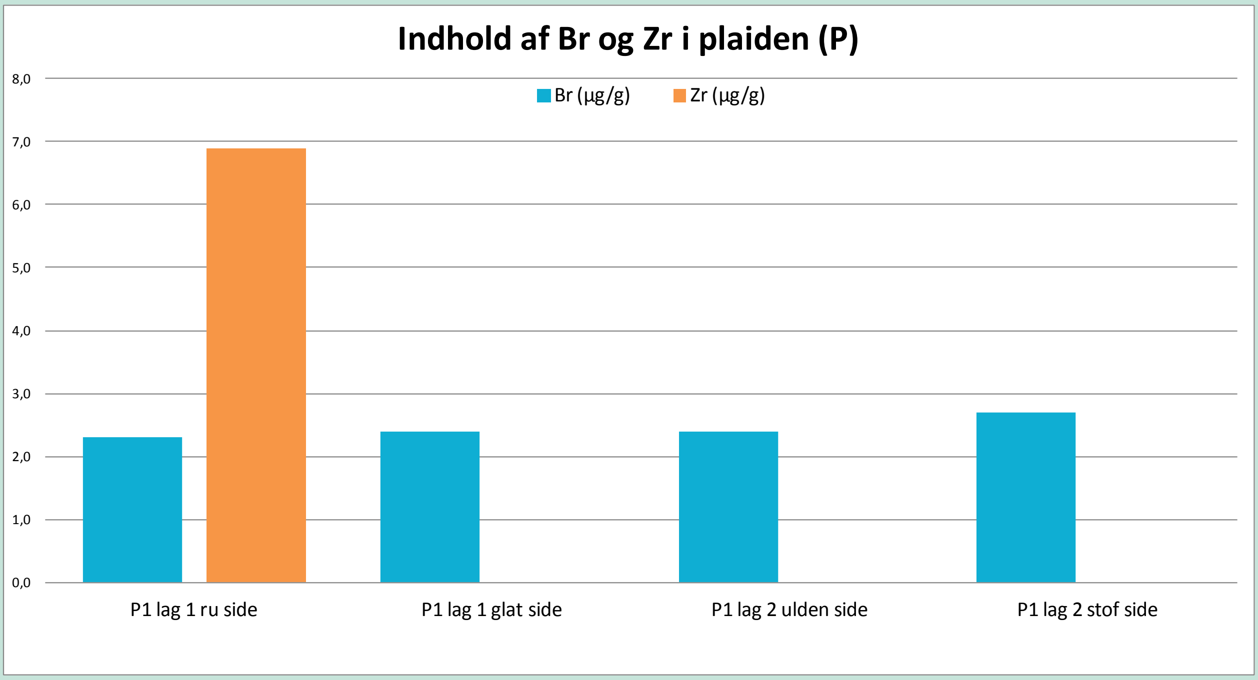


FIGURE 11
CONTENT OF BR AND ZR IN THE RUG – MEASURED IN PPM (MICROG/G)

4.1.2.2 Discussion of XRF-results

It appears from Figure 1 to Figure 7, that **aluminium (Al) and titanium (Ti)** are found in concentrations of up to 1.84% and 2.23%, respectively, which might indicate a possible content of aluminum-based or titanium-based flame retardants. According to information obtained from the survey, aluminium hydroxide, for example, is used in concentrations of approx. 3% (as AlOH3), but this was primarily indicated as the concentration level used in carpets. Aluminium has been identified in all samples, but only M8 (layer 2) stands out from the crowd in terms of aluminium content, which may be $Al(OH)_3$. However, it seems that Al and Si go together (content wise), i.e. a higher Al content results in a higher Si content, which may be because they are fillers and not fire retardants, or to the use of silicone in the production. And this picture also applies for M8 (layer 2).

The survey did not identify the levels of titanium-based flame retardants used, but the survey shows that titanium may occur as flame retardants in the form of titanium salts or titanium hexafluoride. The X-ray analyses clearly show that the products S2 (layer 8), P1 (layer 2), S1 (layer 2), M2 (layer 3) and M1 (layer 2) stand out with content rates above 1%. However, there may be other sources of presence of titanium in the products than the use of titanium-containing flame retardants. For example, titanium dioxide (bright white dye with good covering capacity) is used in a wide range of products, such as paint, paper and plastics.

Flame retardants based on aluminium and titanium are not an environmental and health issue based on the screening of the survey, and therefore the focus is not on these flame retardants in the further analyses.

From Figure 2 to Figure 7 it is seen that generally there is not a high content of either **phosphorus (P) or chlorine (Cl)** in the 59 samples, with the exception of a few subsamples with a higher content: These are the products KS1 (layer 3 and layer 2), S3 (layers 3 and 4) and S2 (layer 5), where there is a relatively high phosphorus and chlorine content - and proportionally it seems that concentrations of phosphorus and chlorine follow similar curves:

- In KS1 (layer 3), the content of chlorine is 5.21% and the phosphorus content is 0.99%.
- In KS1 (layer 2), the content of chlorine is 0.99% and the phosphorus content is 0.19%.
- In S3 (layer 3), the content of chlorine is 0.46% and the phosphorus content is 0.11%.
- In S3 (layer 4), the content of chlorine is 2.08% and the phosphorus content is 0.26%.
- In S2 (layer 5), the content of chlorine is 1.69% and the phosphorus content is 0.17%.

These observations might indicate content of flame retardants consisting of both chlorine and phosphorus, such as TCEP, TCPP or TDCPP. Data from the survey shows that the chlorine/ phosphorus flame retardants can be used in concentrations of between 0.01% and 1.5 %, i.e. the above content rates could indicate content of chlorine/phosphorus-based flame retardants.

Chlorine alone is seen in a number of subsamples in concentrations of between 0.1% and 0.6%. These are the products S2 (layer 8), S3 (layer 7), KS1 (layer 1), KS2 (layers 1, 2 and 3), KS3 (layer 2), M2 (layer 4), M4 (layer 2), M5 (layer 1), S1 (layer 1 light side, layer 3 and layer 4, S2 (layers 1, 2, 3, 4 and 6) and P1 (layer 1 rough and smooth side). Phosphorus does not seem to occur alone (i.e. without a content of chlorine as well).
There may be other sources of chlorine than flame retardants. Chlorine is used in particular for bleaching.

Figure 3 to Figure 11 show that generally there is not a high content of **zirconium (Zr)** in the tested products. A content of zirconium above the detection limit was only measured in five products. The maximum level is measured to be 17 ppm (or 0.0017%) in the subsample S2 (layer 8). Therefore it is unlikely that we should find flame retardants based on zirconium in any of the tested products.

For **bromine (Br)**, however, a few products stand out. However, the levels of bromine are generally low in relation to the stated values (of 0.1-28%) of bromine in flame retardants in plastics[25] (corresponding information for textiles has not been identified). The small amounts of bromine therefore hardly suggest a content of brominated flame retardants, even if there is no immediate other sources of content of bromine than from brominated flame retardants:

- S2 (layer 1) with a bromine content of 386 ppm (or 0.0386%).
- S2 (layer 8) with a bromine content of 121 ppm.
- S2 (layer 6) with a bromine content of 111 ppm.
- KS3 (layer 1) with a bromine content of 206 ppm.
- S3 (layer 4) with a bromine content of 86 ppm.
- S1 (layer 1 dark side) with a bromine content of 40 ppm.
- S1 (layer 1 light side) with a bromine content of 39 ppm.
- KS1 (layer 1) with a bromine content of 24 ppm.
- KS1 (layer 3) with a bromine content of 24 ppm.

Antimony (Sb), which is used together with brominated flame retardants, only occurs in low concentrations (maximum measured concentration is 88 ppm). There seems to be a correlation between the concentration of bromine and antimony in the products and product parts.

[25] http://en.wikipedia.org/wiki/Brominated_flame_retardant

4.1.2.3 Analytical results presented per product

The following 15 figures present the content of these 6 elements in the different layers in the 15 analysed products. Levels indicated by (concentration) 0.00% either means that the content of the element was below the detection limit of the particular element or the content was below 0.00% (i.e. below 50 ppm, as values above 50 ppm would be rounded up to 0.01% in the figures). Please note that the scale of the different figures has been adapted to the levels identified in the various products. All values are given in percentage by weight. Photos from the cut-up products are also presented for all 15 products, making it possible to see the individual layers in the products. Layer 1 is the outer layer.

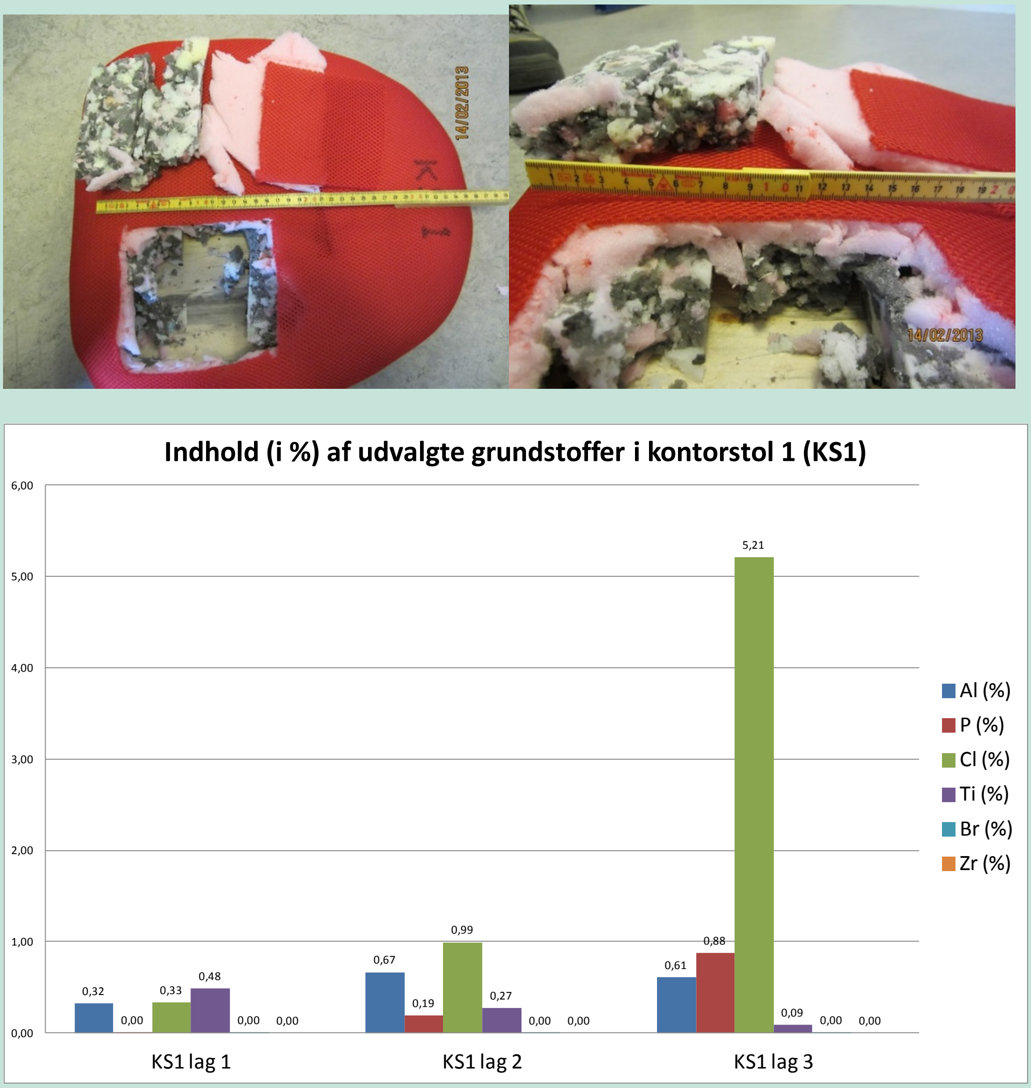


FIGURE 12
OFFICE CHAIR KS1: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

The cover KS1 (layer 1) has one of the higher contents of bromine identified in the 59 subsamples (see Figure 3 for comparison with the other products). The pink foam in KS1 (layer 2) has one of the higher contents of Cl/P and the foam granules in KS1 (layer 3) have an even higher content of Cl/P. The ratio of CI and P is much the same in the two layers (2 and 3), which might indicate a content of a Cl/P flame retardant.

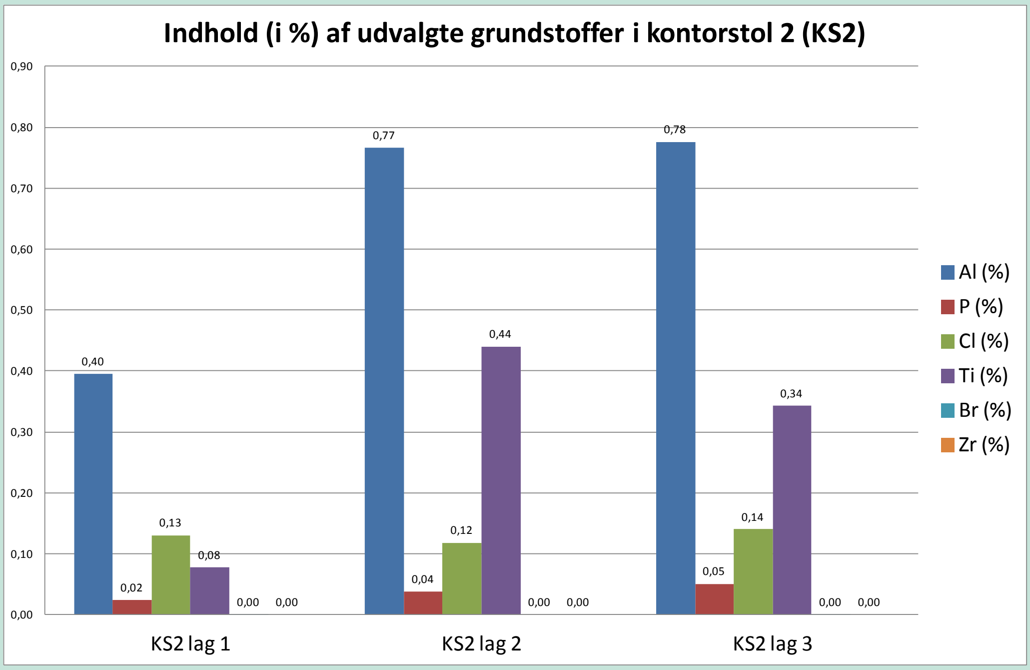


FIGURE 13
OFFICE CHAIR KS2: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In KS2, primarily aluminium and titanium are found in the highest concentrations. The content of Cl, P, and Br is relatively low compared with other products.

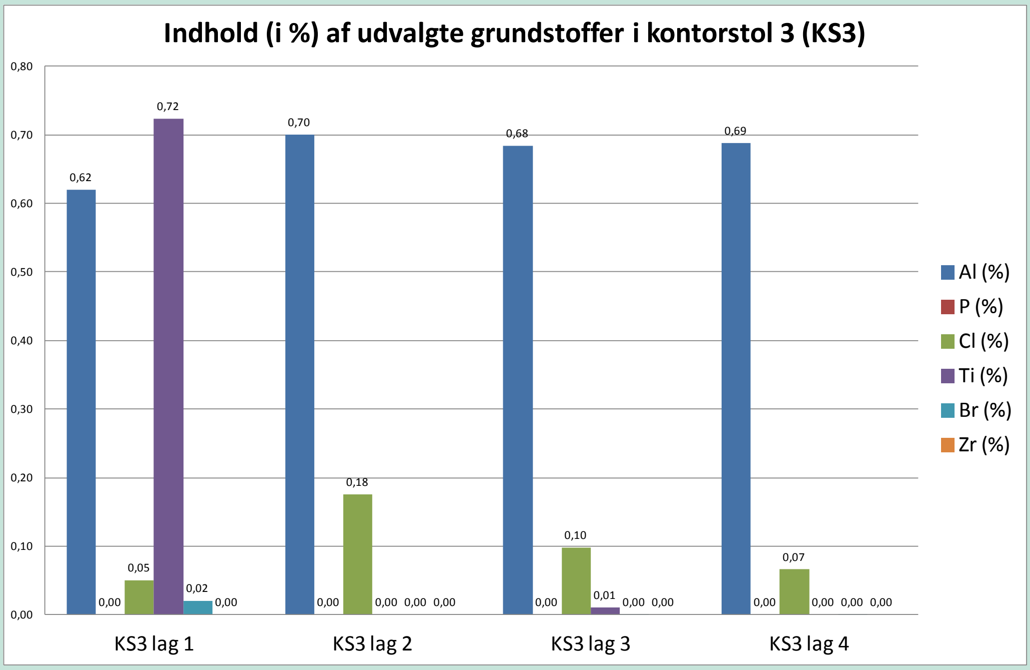


FIGURE 14
OFFICE CHAIR KS3: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In KS3, primarily aluminium and titanium are found in the highest concentrations. The content of Cl and P is relatively low compared with other products. The content of bromine in the cover from KS3 (layer 1) is the highest content identified in the 59 subsamples.

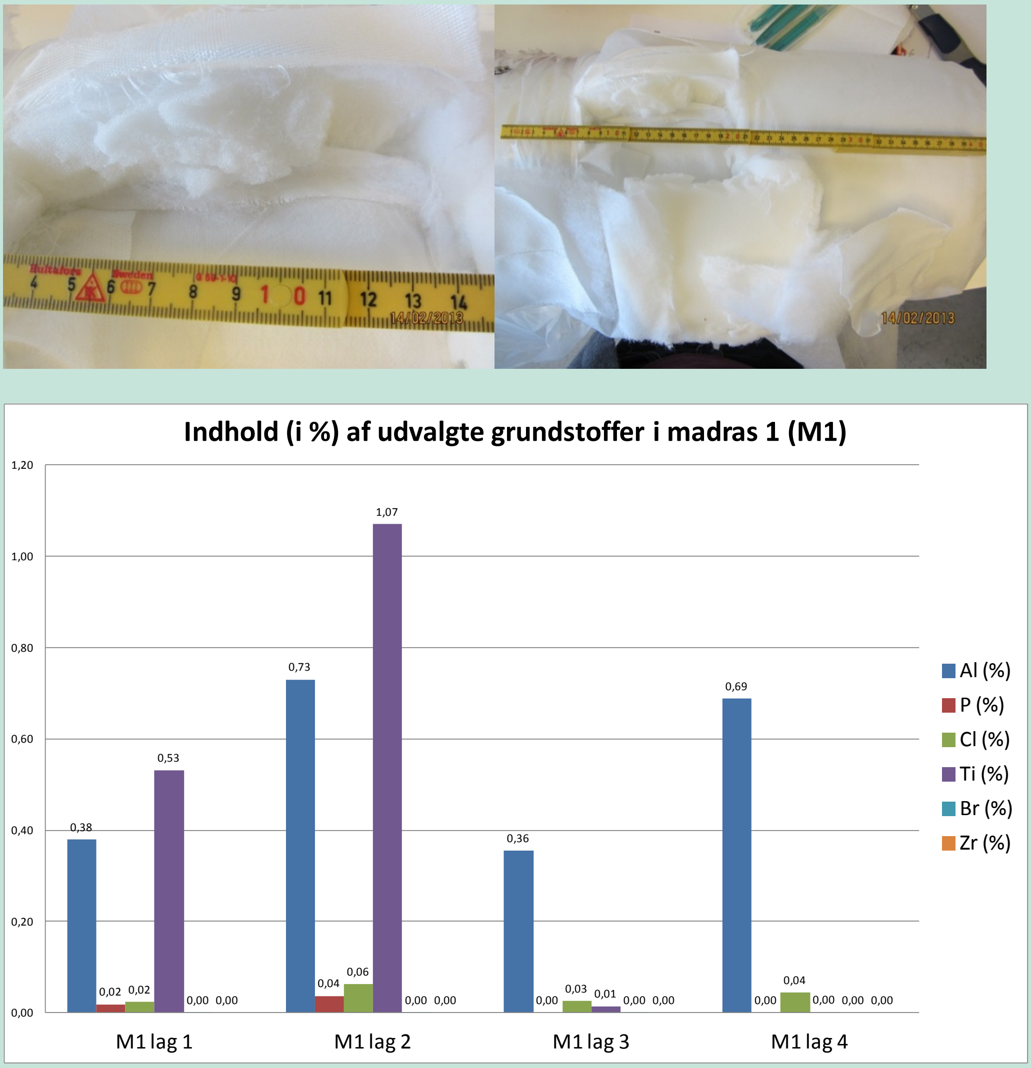


FIGURE 15
MATTRESS M1: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In M1, primarily aluminium is found in the highest concentrations. Titanium is also found in high concentrations, but only in layers 1 and 2. The content of Cl, P and Br is relatively low compared with other products.

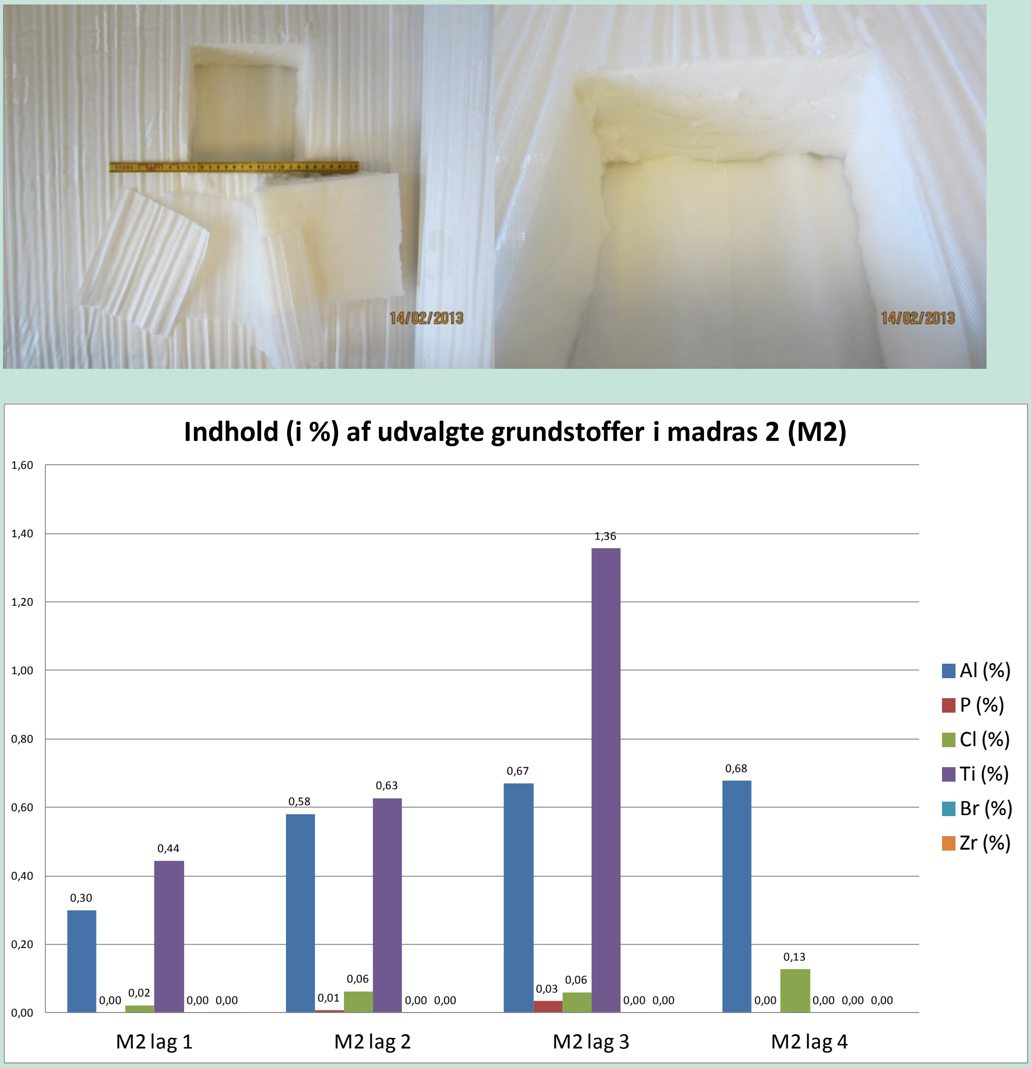
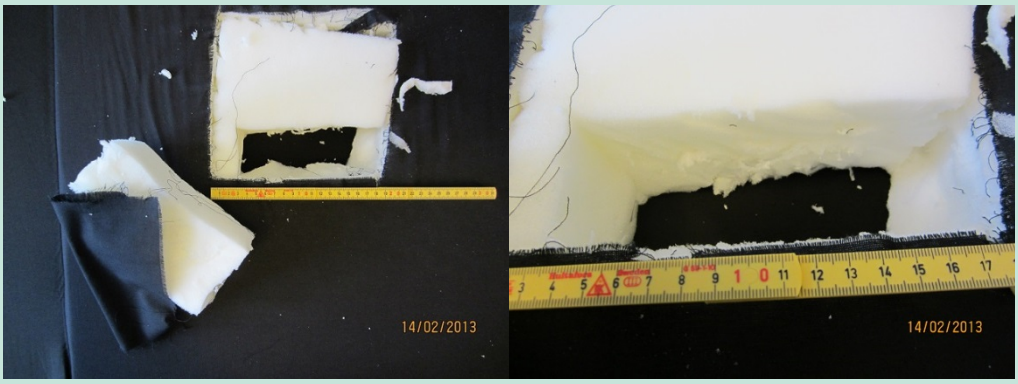


FIGURE 16
MATTRESS M2: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In M2, primarily aluminium and titanium are found in the highest concentrations. The content of Cl, P and Br is relatively low compared with other products. The distribution between the layers is however different from M1.



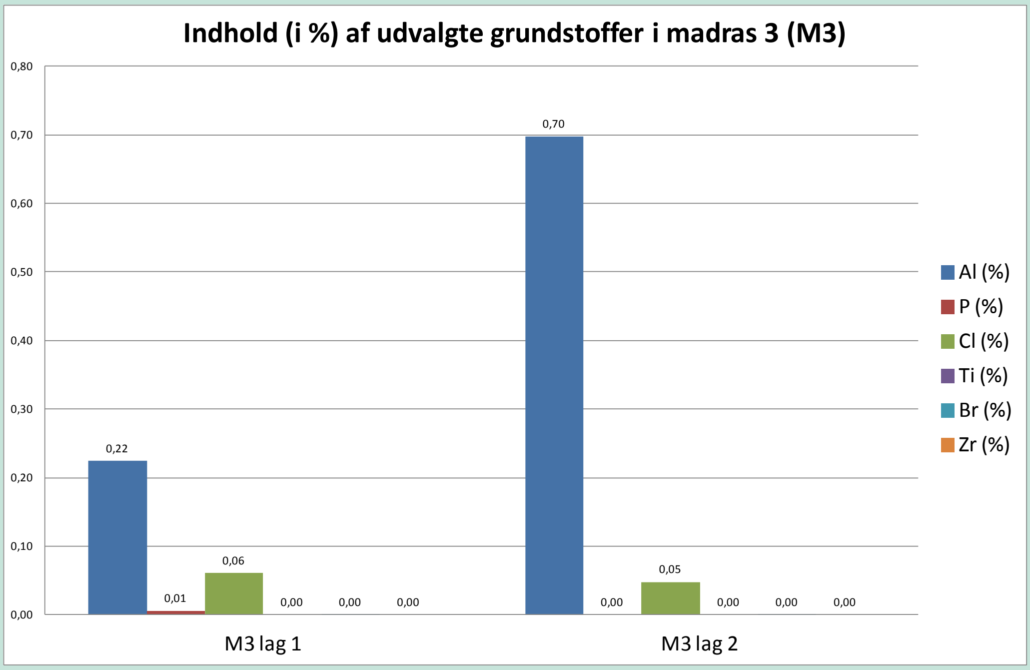


FIGURE 17
MATTRESS M3: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In M3, primarily aluminium is found in the highest concentrations. The content of Ti, Cl, P and Br is relatively low compared with other products.

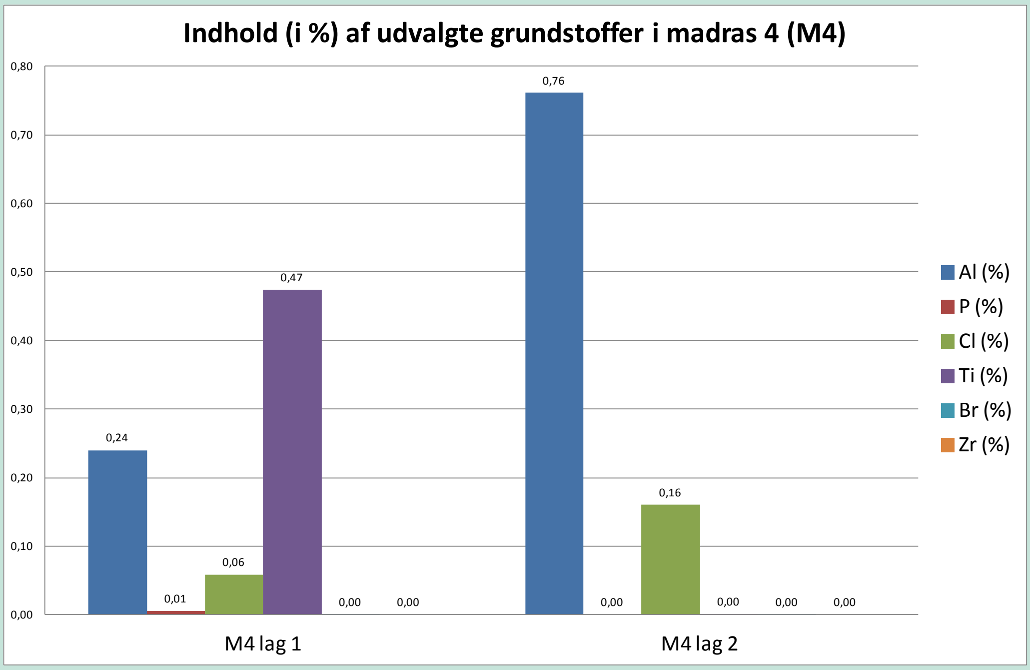


FIGURE 18
MATTRESS M4: : PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In M4, primarily aluminium and titanium are found in the highest concentrations. The content of Cl, P and Br is relatively low compared with other products.

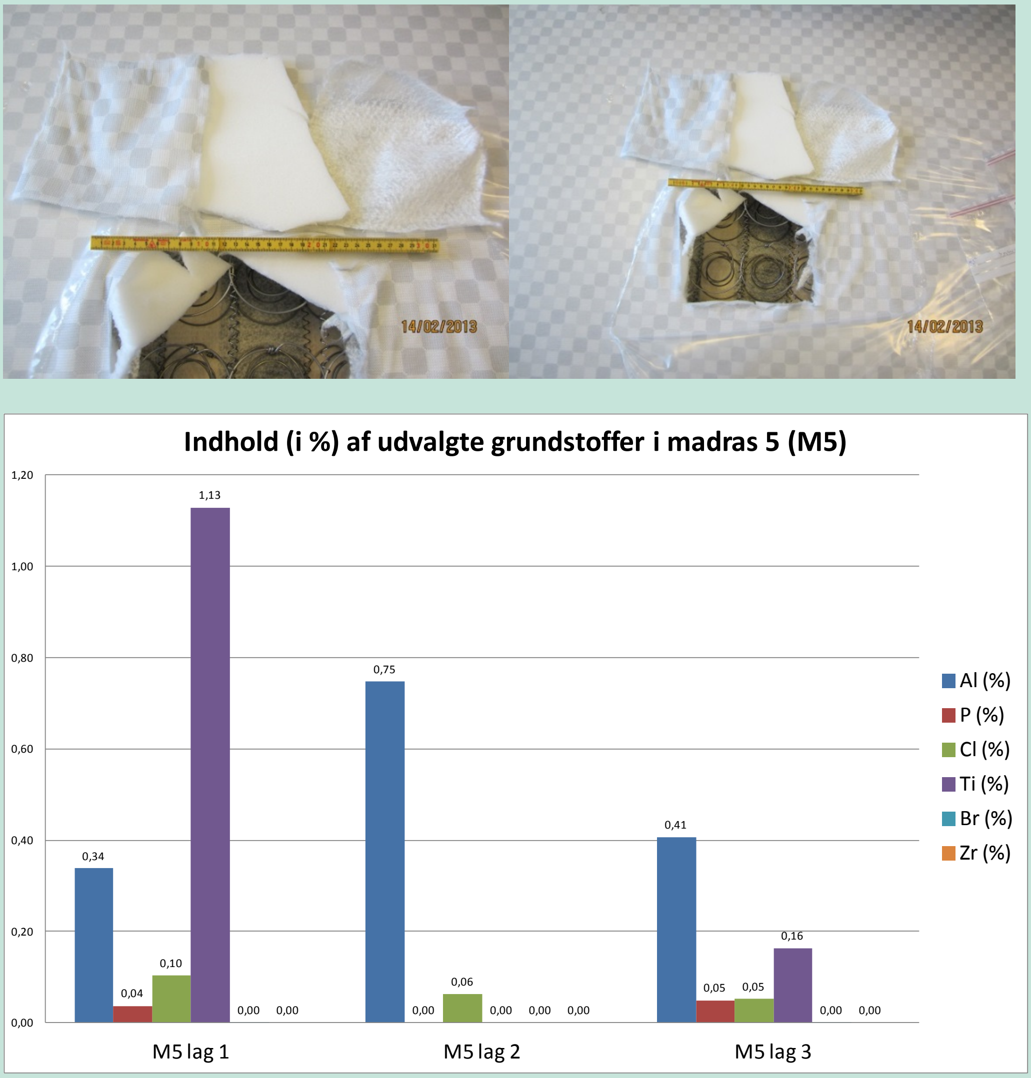
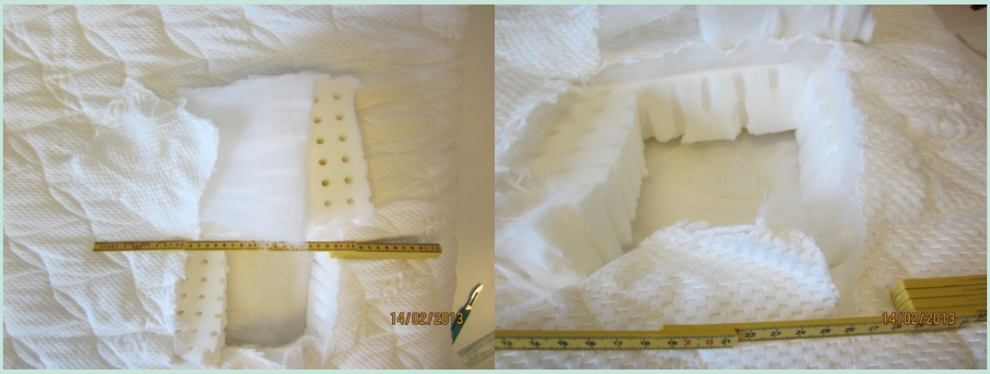


FIGURE 19
MATTRESS M5: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In M5, primarily aluminium and titanium are found in the highest concentrations. The content of Cl, P and Br is relatively low compared with other products.



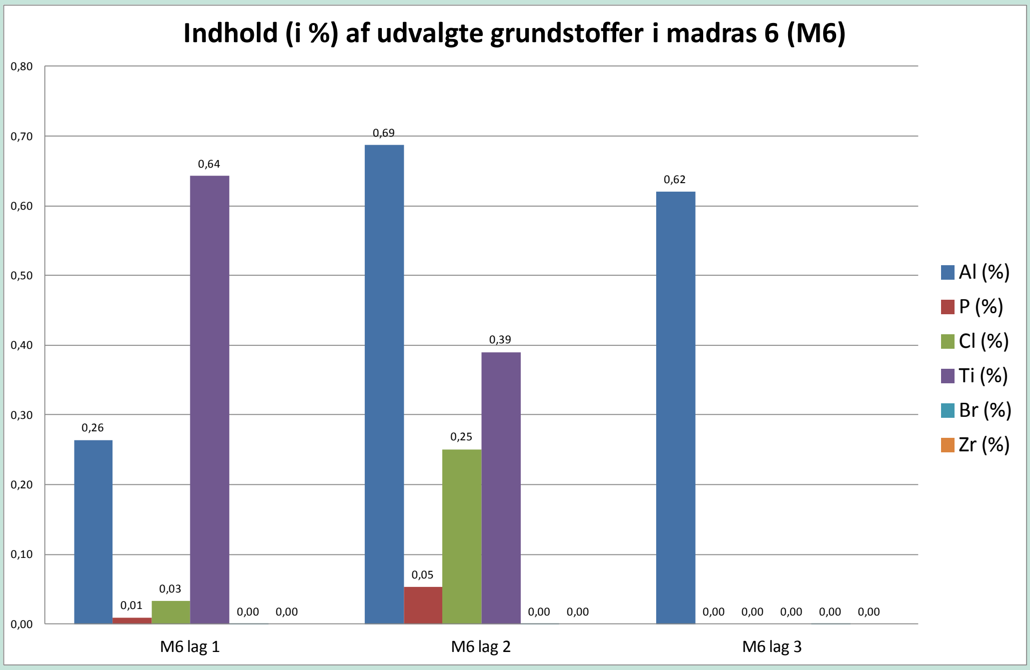


FIGURE 20
MATTRESS M6: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In M6, primarily aluminium and titanium are found in the highest concentrations. However, for the white wadding in M6 (layer 2), there is a content of Cl/P. The content of Br is relatively low compared with other products.

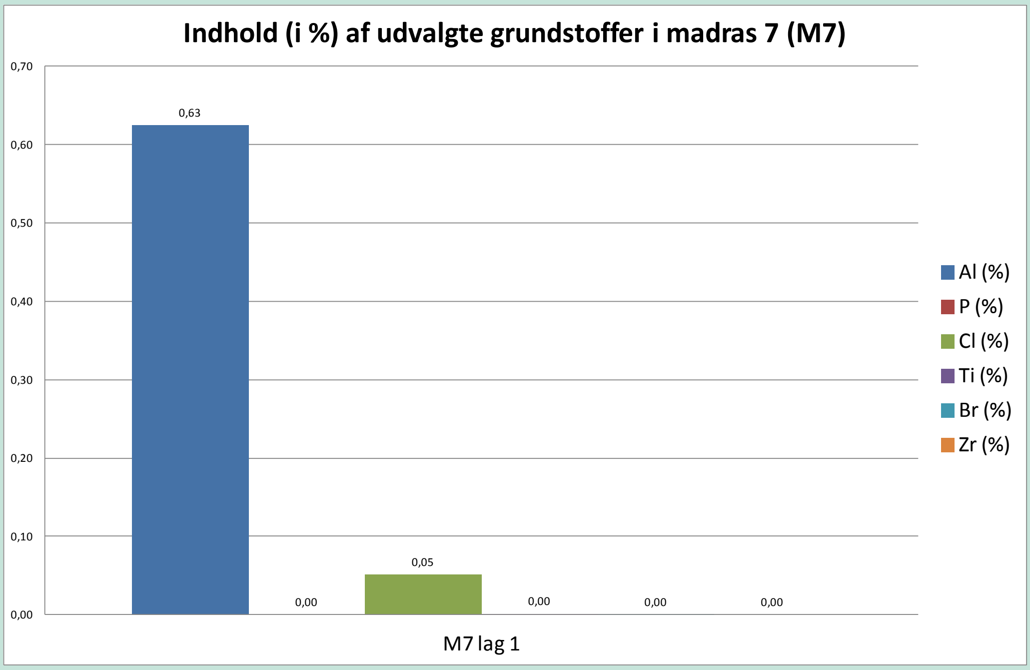


FIGURE 21
MATTRESS M7: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In M7, primarily aluminium is found in the highest concentrations. The content of Ti, Cl, P and Br is relatively low compared with other products.

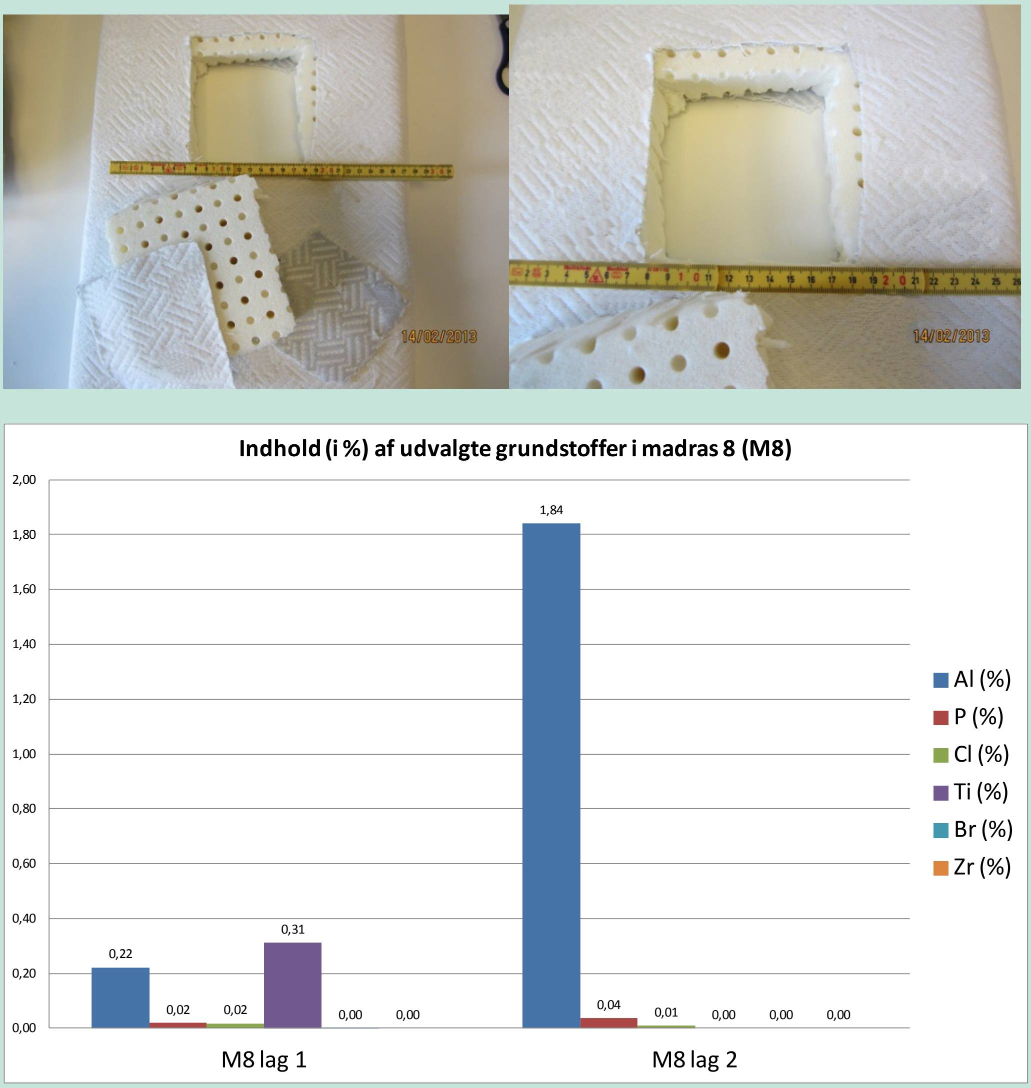


FIGURE 22
MATTRESS M8: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In M8, primarily aluminium and titanium are found in the highest concentrations. The content of Cl, P and Br is relatively low compared with other products.

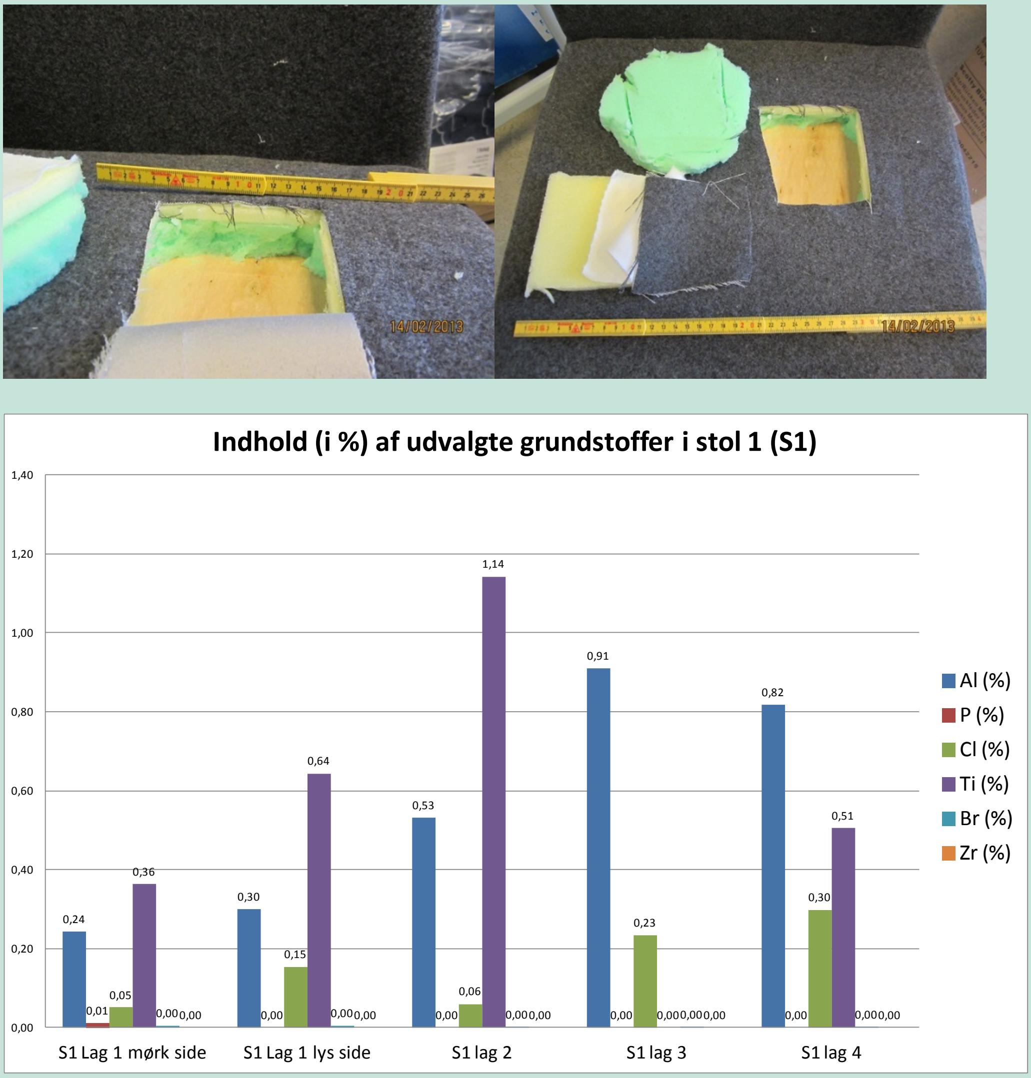


FIGURE 23
CHAIR S1: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In S1, primarily aluminium and titanium are found in the highest concentrations. The content of Cl and P is relatively low compared with other products. However, the content of bromine in the cover in S1 (layer 1 dark side and light side) is the highest content measured in the 59 subsamples.

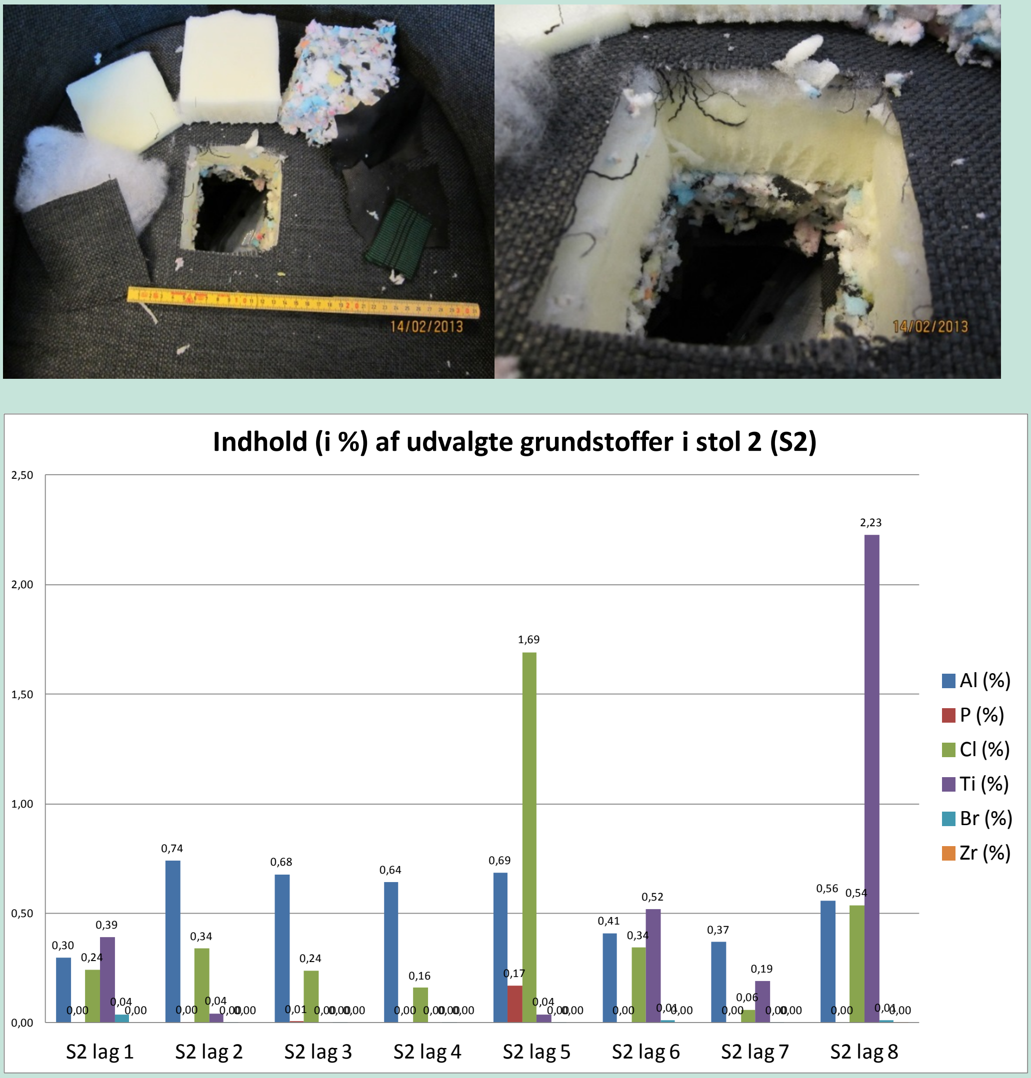


FIGURE 24
CHAIR S2: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In S2, primarily aluminium and titanium are found in the highest concentrations. However, the content of chlorine in the foam granules in S2 (layer 5) is relatively high. In the same layer, phosphorous has been found, but not in the same Cl/P ratio as is typically seen in other subsamples. The cover in S2 (layer 1) has the highest identified content of bromine. Similarly, the thin smooth black fabric in S2 (layer 6) and the bottom strap (layer 8) have higher levels of bromine, and both of these layers also contain chlorine.

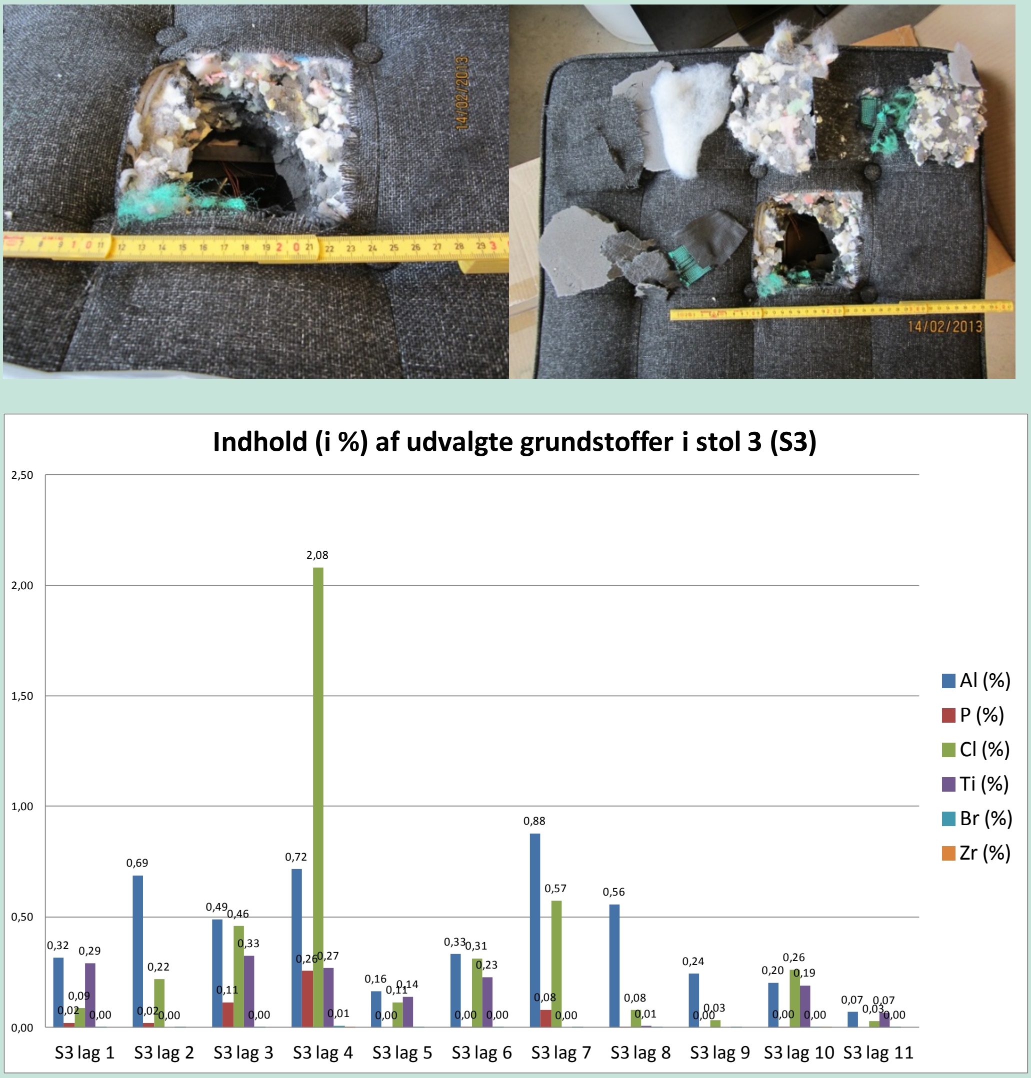


FIGURE 25
CHAIR S3: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In S3, primarily aluminium is found in the highest concentrations. However, the content of chlorine in the foam granules in S3 (layer 4) is relatively high (approx. 2.1%), but not in the same Cl/P ratio as is typically seen in other subsamples. In the same layer (layer 4) one of the higher contents of bromine is also seen. Both Cl and P (in roughly the same ratio as in other subtests) are seen in the wadding in S3 (layer 3) and in the foam granules in S3 (layer 7).

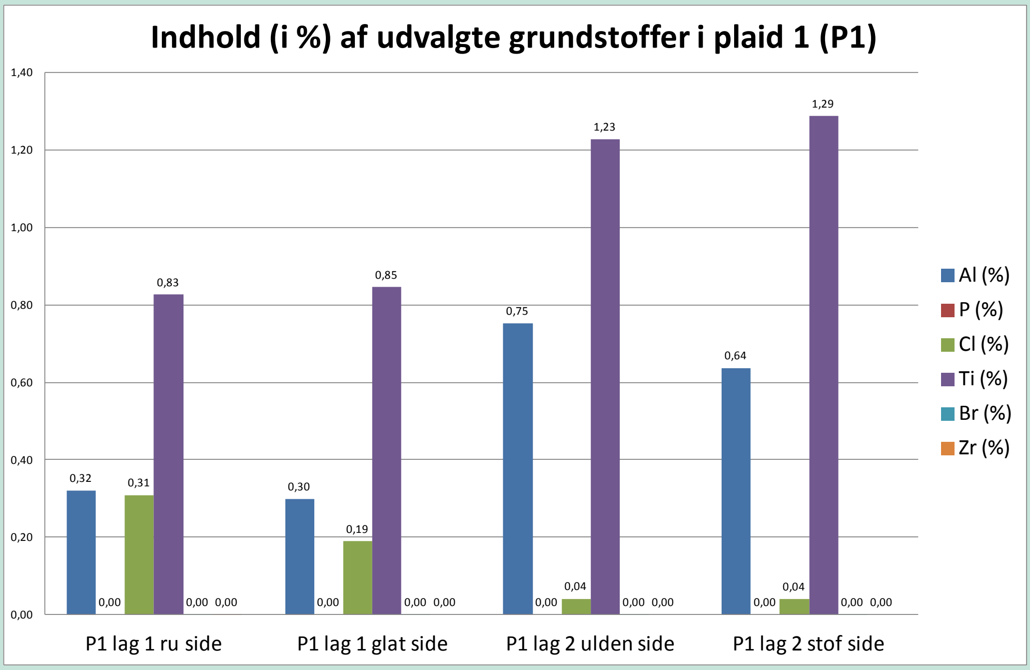


FIGURE 26
RUG P1: PHOTOS AND CONTENT OF SELECTED ELEMENTS MEASURED BY XRF-SCREENING

In P1, primarily aluminium and titanium are found in the highest concentrations. The content of P and Br is relatively low compared with other products. A slightly higher content of Cl in layer 1 is seen compared with other products.

4.1.2.4 Selection of products for GCMS-screening

Based on Figure 1 to Figure 26, a total of 13 subsamples were selected for GCMS screening. This GCMS screening was performed as a single determination and the purpose of this was exclusively to identify the flame retardants to be subsequently quantified by a quantitative analysis. This analytical step was used to make sure that the identified levels of the elements were actually due to a content of flame retardants.

By GCMS-screening, the resulting peaks are compared with the NIST library. The NIST library is a computer program that identifies where in the spectrogram the peak of the individual substance comes out by chemical analysis. The library covers a long range of substances, but not all. That is, there is an opportunity to identify/recognize substances that are in the NIST library and substances you have in the reference file (i.e. substances with purchased, analysed standards and therefore added as supplement to the NIST library). Generally, chemical tests cannot identify something you do not have references to, but The NIST covers many of the chlorinated flame retardants and some brominated flame retardants (tetrabromo bisphenol A, hexabromo cyclododecane, hexabromo benzene, decabromo diphenyl ether, and a wide range of biphenyls and diphenyl ethers – but not all. Furthermore, it is possible to see the following phosphorus-based flame retardants:

- Tris (1,3-dichloro-2-propyl)phosphate (TDCPP/TDCP) – CAS 13674-87-8
- Tris(2-chloro-1-methylethyl)phosphate (TCPP) – CAS 13674-84-5
- Tris(2-chloroethyl)phosphate (TCEP) – CAS 115-96-8
- Triphosphate (2,3-dibromopropyl) (TRIS) – CAS 126-72-7
- Triorthocresyl phosphate (TOCP) – CAS 78-30-8

The following subsamples were selected for the following GCMS-screening:

3. KS1 (layer 1) the cover – due to content of Br
4. KS1 (layer 2) pink foam – due to content of Cl and P
5. KS1 (layer 3) foam granules – due to content of Cl and P
6. KS3 (layer 1) the cover – due to content of Br
7. M6 (layer 2) white wadding – due to content of Cl and P
8. S1 (layer 1) the cover – due to content of Br
9. S2 (layer 1) the cover – due to content of Br
10. S2 (layer 5) foam granules – due to content of Cl and a little P
11. S2 (layer 6) thin, smooth, black fabric – due to content of Br
12. S2 (layer 8) bottom strap – due to content of Br and Cl
13. S3 (layer 3) wadding – due to content of Cl
14. S3 (layer 4) foam granules – due to content of Cl, P and Br
15. S3 (layer 7) foam granules (visually like layer 4) due to content of Cl

4.2 GCMS-screening

4.2.1 Analytical methos – GCMS-screening

The test preparation for GCMS-screening took place in the following way: 0.5 to 2 g was extracted with 20 ml of acetone:hexane 2:8 in ultrasound for ½ hour. The extract was transferred to vials for GCMS analysis. Concurrently, solutions of TOCP, TRIS, TCEP, TCPP and TDCPP were run for identification.

4.2.2 Analytical results – GCMS-screening

TCPP and TDCCP were only found with small amounts of other isomers of the same substances. Normally, content of both flame retardants in the same samples is seen.

None of the other phosphorous-containing flame retardants were observed.

There were no signs of content of other chlorinated or brominated flame retardants. The screening was even repeated with an optimised method for brominated flame retardants to be sure that the samples did not contain brominated flame retardants.

Levels of TCPP and TDCPP in the samples are indicated as approximate values below. It should be noted that there is great uncertainty on the values, as it is solely a screening, and the concentrations in the extracts were well above the calibration solutions.

Subsample	Type of material	Approximate content of TCPP	Approximate content of TDCPP
KS1 (layer 3)	Foam granules	> 0.1% (medium)	> 1% (high)
S2 (layer 5)	Foam granules	> 0.01% (low)	> 0.1% (medium)
S2 (layer 8)	Bottom		> 0.01% (low)
S3 (layer 4)	Foam granules	> 0.1% (medium)	> 1% (high)
S3 (layer 7)	Foam granules	> 0.1% (medium)	> 1% (high)

TABLE 19
RESULTS FROM GCMS-SCREENING. ONLY RESULTS OF THE SUBSAMPLES THAT IDENTIFIED CONTENT OF FLAME RETARDANTS ARE SHOWN.

Other peaks than TCPP and TDCPP were only observed in two of the samples:
- S2 layer 8 – a mineral oil
- S2 layer 5 – BHT, a carboxylic acid and something that is probably a foaming agent from the manufacture of the foam (azobisisobutyronitrile)

The screening chromatograms for all 13 subsamples are listed in Appendix 4. From these it appears that no other flame retardants were observed than the described TDCP and TDCPP.

4.3 Quantitative analysis
Based on the GCMS-screening, it was decided in cooperation with the EPA to make quantitative analyses of TDCPP and TDCP on 4 subsamples:
- KS1 (layer 3)
- S2 (layer 5)
- S3 (layer 4)
- S3 (layer 7)

4.3.1 Analytical method – quantitative analysis
The test preparation for quantitative analysis took place in the following way: 0.5 was extracted with 20 ml of acetone:hexane 2:8 in ultrasound for ½ hour. Then the samples stood overnight and were extracted again by ultrasound. As the screening had shown very high levels in four of the selected samples, the extracts were diluted typically 10-20 times before GCMS analysis. Duplicate analyses were performed.

The samples were analysed by GCMS on a Perkin Elmer Clarus 560 GCMS System with Single Ion Monitoring (SIM).

External standards made of the pure substances were used:

- Tris(1,3-dichloro-2-propyl)phosphate (TDCPP/TDCP)– CAS 13674-87-8 quantified by ion 191 m/z.
- Tris(2-chloro-1-methylethyl)phosphate (TCPP) – CAS 13674-84-5 quantified by ion 125 m/z.

The calibration was linear between 5 and 50 µg/ml.

The chromatographic conditions were:

- Column: Perkin Elmer Elite 5MS 30 m * 0,25 mm i.d. with 0.25 µm stationary phase
- Injection: 1 µl splitless, at 325 °C
- Carrier gas: Helium 26 psi
- Oven: 65 °C 2 min, 12 °C/min to 180 °C, 8 °C/min to 320 °C, hold 10 min.

4.3.2 Analytical results – quantitative analysis

The quantitative analyses gave the following results (see Table 20). The uncertainty is about 60% relative. As the granules are clearly made of different foam, the content of flame retardants in the subsamples is expected to vary, thereby contributing to the uncertainty.

Subsample	Type of material	TCPP			TDCPP		
		ppm	%	µg/cm²	ppm	%	µg/cm²
KS1 (layer 3)	Foam granules	4601	0.46	920	9043	0.9	1800
S2 (layer 5)	Foam granules	687	0.07	140	1348	0.13	260
S3 (layer 4)	Foam granules	4397	0.44	880	6115	0.61	1220
S3 (layer 7)	Foam granules	3414	0.34	680	5679	0.57	1140

TABLE 20
RESULTS OF THE QUANTITATIVE ANALYSES OF CONTENT OF TCPP AND TDCPP (STATED IN PERCENTAGE BY WEIGHT AND MIKROGRAM/CM2)

4.4 Headspace analyses - degassing

To examine the amount of degassing of TCPP and TDCPP from the purchased chairs, headspace analyses were made of the two products with the highest content of TCPP and TDCPP, i.e. KS1 (layer 3) and S3, where layer 4 and layer 7 in S3 were pooled for a total sample. This means that there is indeed a degassing attempt from two foam samples in two different chairs.

4.4.1 Analytical method– headspace analyses

In 10 ml headspace vials, with an actual volume of 11.3 ml, subsamples were weighed of KS1 layer 3, and S3 layer 4 + layer 7. An area of approx. 1 cm² seen from the seat was pursued. 0.2 g of foam corresponds to approx. 0.8 mg TCPP and 1-2 mg TDCPP in the vials.

Sample	Dimensions (cm x cm x cm)	Surface area in the seat (cm^2)	Weight (g)
KS1 layer 3. A	1.2 x 1.2 x 3.5	1.44	0.2294
KS1 layer 3. B	1.0 x 1.1 x 3.5	1.1	0.1877
S3 layer 4. A **S3 layer 7. A**	0.6 x 1.1 x 3.0 0.5 x 0.9 x 2.5	0.66 0.45	0.0938 0.0952
S3 layer 4. B **S3 layer 7. B**	0.5 x 0.9 x 3.0 0.6 x 1.1 x 2.5	0.45 0.66	0.0531 0.1185

TABLE 21
DETAILS OF THE CHOSEN SAMPLES FOR HEADSPACE ANALYSES

Other vials were dosed with (added) 0.5, 1, 2, 4 and 5 µg TCPP and TDCPP (a total of 10 vials) for calibration. Furthermore, there were empty vials for the detection of possible blank value from the fibre.

The vials were conditioned at 60 °C for 2 days prior to analysis to ensure balance in the gas phase.

Headspace in the vials were analysed by SPME technique with a 7 µm PDMS SPME fibre (Supelco 57303). The vials were acclimatised at 30 °C for 5 minutes, then extracted for 15 minutes, after which the fibre was transferred to the injector, where the collected gas was evaporated at 325 °C for analysis on a 30 m *0.25 mm i.d. column with 0.25 µm with single ion detection of ions 99, 125 and 191, which are both present in TCPP and TDCPP. Carrier gas helium with a constant pressure of 26 psig. Oven program: 60 °C 2 min, 12 °C/ min to 180 °C, then 8 °C/min to 320 °C, hold 1 min. In the used Perkin Elmer Clarus 550 GC MS system with swafer, TCPP has a retention time of 17.9 min and TDCPP of 24.5 min.

4.4.2 Analytical results – headspace analyses

When analysed at 30 °C, neither TCPP nor TDCPP were detected in the samples. TCPP could be measured in the calibration vials with increasing signal for increasing amount.

As there was no detectable signal for TDCPP for the calibration vials (although an introductory test using a high concentration had shown traces), a longer extraction time was attempted (45 min) and the other parameters unchanged, but there was still no detectable signal. Finally, extraction at 50 °C was tried with 30 min acclimatisation and 15 min extraction. TDCPP still could not be detected neither in the calibration vials nor in the foam samples, but now TCPP could also be detected for the foam samples. A TCPP calibration vial with 1 µg gave a signal that was 125 times higher than the corresponding vial at 30 °C. This shows that the vapour pressure increases significantly by the temperature increase.

In view of the vapour pressure for TCPP, there should have been the same signal in all five calibration vials. The vapour pressure at 25 °C for TCPP is in ECHA draft reports of May 2008 set to 0.0014 Pa, and TDCPP to 0.0000056 Pa (these are the values weighted as "valid without restriction"). With 0.0014 Pa in 11.3 ml, there will be 0.2 ng TCPP in total in the gas phase and the rest of the dosed TCPP (0.5 to 5 micrograms) should therefore be in the liquid phase.

Contrary to expectations, the signal for TCPP was slowly increasing with the amount in the vial. The observed signals for TCPP in the calibration vials show that there is a substantial concentration on the fibre. Therefore, the signal cannot with any certainty be converted to a gas phase concentration.

This means that best approximation of an actual concentration in a chair will be to use the vapour pressure where the vapour pressure specified by ECHA corresponds to concentrations of 187 µg/m^3 for TCPP and 1 µg/m^3 for TDCPP. Because TCPP is seen in the foam samples at 50 °C and not at 30 °C as in the calibration vials, there is evidence that TCPP binds to the foam or to TDCPP, in which it is a contaminant, so the equilibrium pressure of the foam may be much lower than in the pure chemical. This means that the use of the vapour pressure is likely to give a worst case scenario.

5. Toxicological assessment

The following section deals with risk assessment for the two detected phosphorus-based flame retardants found in products on the Danish market.

5.1.1 Method for calculating the tolerable level of exposure, DNEL

To calculate DNEL values (Derived No Effect Level) guidelines from REACH are used stating how to calculate a DNEL value based on a critical dose (NOAEL, no observed effect level or LOAEL. lowest observed effect level) and relevant assessment factors (AF). The assessment factors to be used will depend on the kind of study the doses are based on. From this, the effect specific DNEL value will be calculated (ECHA 2010).

The effect specific DNEL value is determined using the following formula:

$$Effect\ specificDNEL = \frac{NOAEL}{AF_1 \cdot AF_2 \cdot \ldots \cdot AF_n} = \frac{NOAEL}{AF\ sum}$$

In some cases where a NOAEL cannot be determined, a LOAEL value is used instead of a NOAEL value, and adjustment is made with an assessment factor of 3-10 for extrapolation from LOAEL to NOAEL. The assessment factors are determined according to the principles of the REACH guidelines as specified in Table 22.

Parameter	Value	Assessment factor used
Interspecies	Allometric scaling Adjustment for differences in body weight and thus in metabolism between animals and humans	4 for rats 7 for mice 2.4 for rabbit
Interspecies	Other differences between animals and humans	2.5
Intraspecies	Differences between individuals	10
Dose-response	LOAEL to NOAEL (if LOAEL is used because NOAEL has not been determined)	3-10 (depending on the severity of the effects)
Duration of the study	From subchronic to chronic exposure	2

TABLE 22
ASSESSMENT FACTORS (AF) USED TO CALCULATE DNEL

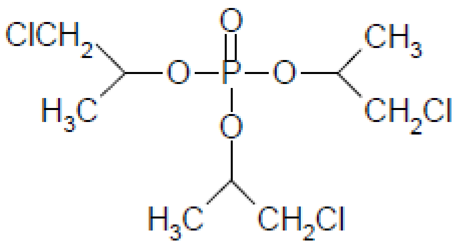
Furthermore, additional assessment factors may be used depending on the starting point of the NOAEL value, using additional factors if the study was of short duration, if particularly serious effects occur or other aspects of, for example the dose-response curve.

5.2 Toxicological assessment

Generally, it applies to the two substances that two European consumer organisations ANEC and BEUC in a statement (ANEC / BEUC, 2012) in 2012 proposed a ban on TCPP and TDCPP in toys as they regard these substances as being similar to TCEP, which is subject to the authentication scheme under REACH, as a result of the harmonised EU classification as reprotoxic 1B, H360F (May damage fertility).

5.2.1 Health and environmental assessment of TCPP

5.2.1.1 Physical-chemical properties

Name	Tris(2-chloro-1-methylethyl)phosphate
CAS no	13674-84-5
Molecular formula	C9H18Cl3O4P
Structure	
Vapour pressure	1.4×10^{-3} Pa at 25 °C
Log P (octanol/water)	2.68±0.36
Henry's Law constant	3.96×10^{-4} Pa m^3/mol at 25 °C

Harmonised classification	no EU-harmonised classification of the substance

5.2.1.2 Health

EU's Risk Assessment Report from 2008 (EU RAR, 2008a) contains a full and updated review of the available toxicological data, while the report also states calculations regarding exposure levels for the population including consumers and workers.

TCPP is absorbed rapidly and extensively (approx. 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 2000 mg/kg body weight according to a classification as Acute Tox. 4, H302.

Studies have shown moderate degrees of skin and eye irritation, but there is no data on respiratory irritation. Based on studies, TCPP is considered not to be allergenic in contact with skin.

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.

TCPP was not found to be genotoxic/mutagenic, neither in *in vitro* nor in *in vivo* animal studies. By contrast, QSAR model analyses have predicted that the substance might be mutagenic, but taking into account the animal data and the conclusion of the EU risk assessment report, there seems to be no basis for assessing the substance as genotoxic.

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 the 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 derived 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 where 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 occur in *in vivo* studies, and this may be associated with the decrease in uterine weight. Thus, further evidence/studies will be needed to clarify the potential for endocrine disrupting effects of the substance (EU RAR, 2008a).

Analogy conclusion to TCEP in relation to reproduction toxicity (as for carcinogenicity) is considered less reliable, as no effect has been found on uterus for TCEP, while TCEP also strongly affects the male reproductive system, which is not found for TCPP.

Calculation of DNEL
The NOAEL/LOAEL values used for further risk assessment are a NOAEL of 52 mg/kg body weight/day determined in a 90-days study in rats and a LOAEL of 99 mg/kg body weight/day from a 2-generation study in rats, respectively. These levels correspond to an internal dose of 41.6 and 79.2 mg/kg body weight/day, respectively, taking into account a 80% absorption of TCPP by oral exposure. Therefore DNEL can be calculated to:

$$Effect\ specificDNEL = \frac{41,6}{4 \cdot 2,5 \cdot 10 \cdot 2 \cdot 3} = \frac{41,6}{600} = 0,07\, mg\,/\,kg\ bodyweight\,/\,day$$

$$Effect\ specificDNEL = \frac{79,2}{4 \cdot 2,5 \cdot 10 \cdot 10} = \frac{79,2}{1000} = 0,08\, mg\,/\,kg\ bodyweight\,/\,day$$

The two calculated DNEL values are on the same level, and it is therefore estimated that the lowest value of 0.07 based on liver effects in a 90-days study should be carried forward for use in the risk assessment.
(Above can be seen that an assessment factor of 10 is used for LOAEL, for NOAEL extrapolation, for the 2-generation study, as influence on the offspring is considered more serious than influence on the liver in the 90-days study, and therefore, an assessment factor of 3 has been applied for LOAEL for NOAEL extrapolation).

5.2.1.3 Environment

A number of ecotoxicological data for TCPP are available, i.a. regarding acute toxicity in fish and acute and chronic toxicity in invertebrates and algae. Furthermore, there are toxicity studies with terrestrial organisms and microorganisms. Table 23 shows values found in different studies with aquatic organisms, where EC50 is the concentration with an effect (L=Lethal) on 50% of the test organisms in acute tests, and NOEC (No Observable Effect Concentration) is the calculated no effect concentration from chronic studies.

Study	Effect	Concentration [mg/l]
Aquatic toxicity: fish	LC_{50} (96h)	51
Aquatic toxicity: invertebrates	EC_{50} (48h)	131
Aquatic toxicity: algae	EC_{50} (72h)	82
Chronic toxicity: invertebrates	NOEC (21d)	32
Chronic toxicity: algae	NOEC/EC_{10} (72h)	13/42

TABLE 23
AQUATIC TOXICITY BY EXPOSURE TO TCPP (EU RAR, 2008A)

Based on the lowest observed NOEC of 32 mg/l from a chronic reproduction study in daphnia, and the use of an assessment factor of 50, an expected no effect concentration (PNEC) for the water environment ($PNEC_{freshwater}$) of 0.64 mg/l has been calculated. A corresponding $PNEC_{marine}$ of 0.064 mg/l has been calculated using an assessment factor of 500.

A study of toxicity in microorganisms resulted in an IC_{50} of 784 mg/l (EU RAR, 2008). Based on this study, an expected no effect concentration for microorganisms $PNEC_{microorganisms}$ of 0.784 mg/l can be calculated using an assessment factor of 100.

The results of toxicity studies in terrestrial organisms are shown in Table 24.

Study	Effect	Concentration [mg/l]
Toxicity to earthworm	LC_{50} (14d)	33 mg/kg dry weight
Chronic toxicity to earthworm	NOEC (56d)	18 mg/kg dry weight
Toxicity to higher plants	NOEC	17 mg/kg dry weight
Toxicity to terrestrial microorganisms (read across TDCP)	NOEC (28d)	128 mg/kg wet weight

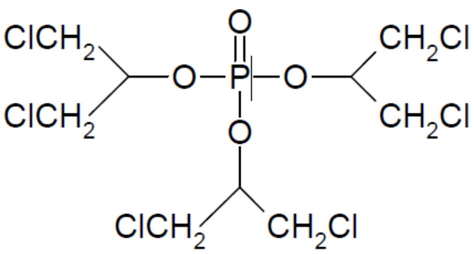
TABLE 24
TERRESTRIAL TOXICITY BY EXPOSURE TO TCPP (EU RAR, 2008A)

The expected no effect concentration ($PNEC_{soil}$) for terrestrial organisms is 1.7 mg/kg soil (dry weight) corresponding to 1.5 mg/kg soil (wet weight) when using a conversion factor of 10 on the lowest observed chronic NOEC = 17 mg/kg soil.

As regards the PBT assessment, TCPP can be considered to fulfil the criteria as persistent (P) or potentially very persistent (vP) because the substance is not readily biodegradable. The available information on bioaccumulation (measured BCF (fish) of 0.8-4.6) shows that TCPP does not fulfil the criteria for bioaccumulation (B) (BCF > 2000). The criteria for toxicity (T) is not fulfilled either, as the chronic toxicity (NOEC/ EC_{10}) is > 0.01 mg/l. Thus, TCPP can be considered to be a PBT substance (EU RAR, 2008a).

5.2.2 Health and environmental assessment of TDCPP

5.2.2.1 Physical-chemical properties

Name	**Tris(2-chloro-1-(chloromethyl)ethyl)phosphate**
CAS no	13674-87-8
Molecular formula	C9H15Cl6O4P
Structure	
Vapour pressure	5.6 x 10^{-6} Pa at 25 °C
Log P (octanol/water)	3,69
Henry's Law constant	1.24 x 10^{-4} Pa.m^3/mol
Harmonised classification	Carc. 2, H451

5.2.2.2 Health

TDCPP is absorbed rapidly and extensively (approx. 100% of the dose) following oral administration and is widely distributed in the organs of the body. An *in vitro* study in human skin showed a 15% dermal absorption when exposed to ‘pure’ TDCPP, and 30% dermal absorption when exposed to TDCPP in foam. TCPP is extensively metabolised in the body, and the metabolites are excreted mainly via urine, but also via faeces and the expiratory air (EU RAR, 2008b).

The acute toxicity is low as most of the oral and dermal LD_{50} values are above 2000 mg/kg body weight. An LC50 value of > 5.22 mg/l has been found in an inhalation study in rats indicating low acute toxicity by inhalation (EU RAR, 2008b).

Studies have shown moderate degrees of skin and eye irritation, but there is no data on respiratory irritation, but based on data from an acute inhalation study, TDCPP is estimated not to be irritating to the respiratory system. Based on studies, TDCPP is considered not to be allergenic in contact with skin (EU RAR, 2008b).

There is no evidence to suggest that TDCPP is mutagenic in *in vitro* studies, but *in vivo* micronucleus studies in mice have been found negative. These results are further supported by negative results in *in vitro* and *in vivo* unscheduled DNA synthesis studies (EU RAR, 2008b). The conclusion in EU’s risk assessment report presents no reason to assess the substance as genotoxic.

A 2-year cancer study in rats was conducted in which groups of 60 male and female rats were fed diets containing TDCPP at doses of 0, 5, 20 and 80 mg/kg bw/day. Significantly higher mortality was observed in the high dose group of males. An effect on body weight was observed in the high dose groups of both males and females with a 20% reduction of body weight in this group at study termination compared with the control group. The absolute and relative kidney, liver and thyroidal weights were increased in the medium and high dose groups. A LOAEL of 5 mg/kg body weight can be determined based on the findings of renal hyperplasia (increased cell growth) in all exposed groups. Hyperplasia of the renal tubule epithelium is considered a pre-neoplastic lesion which may lead to adenoma and from there to carcinoma. Kidney tumours were observed after 24 months in the medium and high dose groups (EU RAR, 2008b).
In an epidemiological study performed in a factory producing TDCPP, no effects were observed, indicating that TDCPP should have a carcinogenic effect in humans (EU RAR, 2008b).

In relation to effects on the offspring, a study in rats has been carried out with dosing of pregnant rats. It was observed that a dose of 400 mg/kg bodyweight/day significantly increases the number of resorptions in the uterus of the animals compared to controls. In this high-dose group, there was also evidence of delayed bone growth of the foetuses/offspring. These effects were accompanied by significant toxic effects in the dams at this dose. There was no evidence of embryo toxicity in the absence of toxic effects in the dams. The NOAEL for the offspring was 100 mg/kg bw/day, based on increased resorption and reduced viability index of the foetuses at a dose of 400 mg/kg body weight/day (EU RAR, 2008b).

A 12-week male fertility study in rabbits has been carried out at dose levels of 2, 20 or 200 mg/kg body weight/day administered orally. Parameters such as mating, fertility, semen analysis and male reproductive organs were unaffected by exposure to TDCPP at all dose levels (EU RAR, 2008b).

In the 2-year cancer study described above effects was observed on the male reproductive organs. The effects were mainly observed in animals at 24 months, and can therefore be considered to be secondary to the natural aging process of rats rather than a specific effect on the male reproductive system. In addition, an increased incidence of Leydig cell tumours was observed in the medium and high dose groups after 12 and 24 months, indicating that the observed effects on the male reproductive system may be secondary effects to the carcinogenic effect in rats. EU’s risk assessment report therefore concludes that there is no viable evidence that TDCPP has an effect on male fertility.

Calculation of DNEL

The 2-year cancer study is used to determine a DNEL for use in the risk assessment where a LOAEL of 5 mg/kg bw/day was established. 100% absorption of TDCPP is anticipated by oral exposure of the animals, so that the internal dose is equal to the values found.

Chronic exposure:

$$Effect\ specificDNEL = \frac{5}{4 \cdot 2{,}5 \cdot 10 \cdot 10} = \frac{5}{1000} = 0{,}005\, mg\,/\,kg\ bodyweight\,/\,day$$

A DNEL of 0.005 mg/kg bw/day found in a cancer study is used in the risk assessment. (An assessment factor of 10 is used for LOAEL for NOAEL extrapolation, as renal hyperplasia must be considered a serious effect).

5.2.2.3 Environment

A number of ecotoxicological data for TDCPP are available, i.a. regarding acute toxicity in fish and acute and chronic toxicity in aquatic invertebrates and algae. Furthermore, there are toxicity studies with terrestrial organisms and microorganisms. The lowest observed aquatic NOEC for TDCPP is 0.5 mg/l found in a 21-days study in Daphnia (EU RAR, 2008b).

Table 25 shows values found in different studies with aquatic organisms.

Study	Effect	Concentration [mg/l]
Aquatic toxicity: fish	LC_{50} (96h)	1.1
Aquatic toxicity: invertebrates	EC_{50} (48h)	3.8
Aquatic toxicity: algae	EC_{50} (72h)	4.6
Chronic toxicity: invertebrates	NOEC (21d)	0.5
Chronic toxicity: algae	NOEC/EC_{10} (72h)	1.2 / 2.3

TABLE 25
AQUATIC TOXICITY BY EXPOSURE TO TDCPP (EU RAR, 2008B)

Based on a NOEC of 0.5 mg/l from a chronic reproduction study in daphnia, and the use of an assessment factor of 50, a $PNEC_{aquatic}$ of 0.01 mg/l has been calculated. A corresponding $PNEC_{marine}$ of 0.001 mg/l has been calculated using an assessment factor of 500.

A toxicity study in microorganisms resulted in a limiting concentration of 1000 mg/l (EU RAR, 2008b).
A realistic $PNEC_{microorganisms}$ based on a limiting concentration of 1000 mg/l can be calculated, and a PNEC ≥ 100 mg/l can be calculated using a conversion factor of 10.

The results of toxicity studies in terrestrial organisms are shown in Table 26.

Study	Effect	Concentration [mg/l]
Toxicity to earthworms	LC_{50} (14d)	26 dry weight
Chronic toxicity to earthworms	NOEC (57d)	3.3 dry weight
Chronic toxicity to higher plants	NOEC	19.3 dry weight
Toxicity to terrestrial microorganisms	NOEC (28d)	128 wet weight

TABLE 26
TERRESTRIAL TOXICITY BY EXPOSURE TO TDCPP (EU RAR, 2008B)

The availability of a data set, comprising acceptable results from three chronic studies with species from at least three trophic levels means that it is possible to derive a $PNEC_{soil}$ from test data using a conversion factor of 10 for the lowest chronic NOEC. This results in a $PNEC_{soil}$ of 3.3/10 = 0.33 mg/kg soil dry weight corresponding to 0.29 mg/kg soil wet weight.

As regards the PBT assessment, TDCPP can be considered to fulfil the criteria as persistent (P) or potentially very persistent (vP). The available information on bioaccumulation (measured BCF (fish) at 31-59) shows that TDCPP does not meet the criteria for bioaccumulation (B). The criteria for toxicity (T) are not met either. Thus, TDCPP cannot be considered as a PBT substance.

6. Exposure assessment

The following sections describe how exposure by inhalation, oral contact and skin contact is calculated in relation to exposure to flame retardants in home interiors.

6.1 Method for calculating exposure from indoor environment

To assess the exposure to the selected substances via the indoor environment, the general equations described in the REACH guidance ”Guidance on information requirements and chemical safety assessment” are used.

Total exposure indoor environment = Exposure via dust + exposure via air

The exposure via air is assumed to be absorbed 100%, i.e. the inhaled quantity is equal to the internal dose.

6.1.1 Exposure via dust

The exposure via dust for each substance x is calculated as the daily intake of dust multiplied by the fraction of the substance x in dust divided by the body weight (BW) of a child and an adult, respectively.

$$D(subst.\ x)_{DUST} = \frac{Intake_{DUST} \cdot f(subst.\ x)_{DUST} \cdot f(subst.\ x)_{ORAL}}{BW}$$

Where

D(substance x)$_{DUST}$	Intake daily dose of substance x	mg/kg bw/day
Indtake$_{DUST}$	The daily intake of dust	kg/day
f(substance x)$_{DUST}$	Concentration of substance x in	mg/kg
f(substance x)$_{ORAL}$	Orale absorption of substance x	%
BW	Body weight (bw)	kg

Other parameters used for the calculations of dust and air, are the following:

- intake of dust, i.e. the assumed amount of dust per day consumed by children and adults, respectively
- Body weight (bw) of children and adults

- respirable fraction of the inhaled substance
- duration, i.e. the period of time children and adults, respectively, are exposed to substances via the indoor air
- the respiration volume of children and adults, respectively, i.e. the quantity of air inhaled every day for the population group in question

These parameters are discussed in detail below.

Intake of dust

An RIVM (National Institute for Public Health and the Environment, Holland) report entitled ”Exposure to chemicals via house dust” from 2008 concludes that a conservative, but realistic estimate of intake of dust in adults is 50 mg/day (Oomen et al., 2008). This report also lists a number of studies related to the intake of dust in adults. These studies indicate values ranging from 0.56 mg/day to 100 mg/day. However, most of the studies presented a value of about 50 mg/day, and therefore Oomen et al. (2008) chose to use this value in their assessments. One of the listed studies was USEPA (1997) which specifically listed a value of 50 mg/day.

D’Hollander et al. (2010) choose to use an average value of 7 mg/day intake of dust for adults and a 95% percentile value of 20 mg/day for adults.

Based on the above information, this project has chosen to set the value for the intake of dust in adults to 50 mg/day. This value is also used in the Environmental Protection Agency (2012) on pregnant consumers’ exposure to suspected endocrine disruptors.

Young children on the other hand have a higher daily intake of dust as they play/crawl on the floor daily. Ali et al. (2012) use an average intake of dust of 50 mg/day for young children and a maximum intake of dust of 200 mg/day. In the Environmental Protection Agency (2009) on 2-year-old children's exposure to chemical substances, a value of 50 mg/day was selected for summer scenario where children are outdoors more and a value of 100 mg/day was selected for winter scenario where the children are staying indoors more. These values originate from USEPA (1997). Based on the above information, this project has chosen to set the value for the intake of dust for children to 100 mg/day.

As indicated in the chapter below on oral absorption rates, an oral absorption rate of 1 is generally used, i.e. 100% corresponding to the fact that the total ingested amount of TDCPP is also absorbed into the body. 0.8 is used for TCPP, i.e. 80% based on data from the literature.

Respirable fraction of the inhaled substance

It is generally assumed that the respirable fraction of the inhaled substances is 1, i.e. 100% corresponding to the fact that the total inhaled amount of the substance is also absorbed in the body.

Duration (indoors stay)

A common Dane spends on average between 80 and 90% of their time indoors (EPA 2007). This corresponds to between 19.2 and 21.6 hours a day. These figures cover the entire week and also apply to indoors stay in the work situation.

An average value is used in calculations, i.e. a value of 20 hours is used for indoors stay. We have deliberately not made a distinction between indoors stay at home and at work. Many of the presented data show that there is little difference between the concentrations of the substances in private homes and in offices where measurements have been made. Therefore, we have in the calculations chosen to use the maximum measured mean and maximum values whether it is data from private homes or data that may represent a work situation. The calculated values will thus represent indoors stay for both home and work/daycare center.

Respiration volume
According to the REACH guidance "Guidance on information requirements and chemical safety assessment", chapter R.15 "Consumer exposure estimation" (ECHA 2012), adults inhale 18 m^3 air per day, whereas children (2-3 years) inhale 7 m^3 per day. These values have been used in the calculations.

This means that adults inhale indoor air for 20 hours – 24 hours per day x 18 m^3 air per day = 15 m^3 air while staying indoors, either at work or at home, whereas children (2-3 years) inhale 5.83 m^3 indoor air per day.

6.1.2 Exposure via indoor air

The exposure is calculated according to "Equation 15-2" from the REACH guidance, chapter R.15 "Consumer exposure estimation" (ECHA 2012):

$$D(subst.\ x)_{inh} = \frac{F_{resp} \cdot C_{inh} \cdot IH_{air} \cdot T_{contact}}{BW} \cdot n$$

Where

D(substance x)$_{inh}$	Inhaled daily dose of substance x	mg/kg bw/day
F_{resp}	Inhaled substance, i.e. respirable fraction (decimal fraction between 0-1)	
C_{inh}	Concentration of substance in room air	mg/m^3
$T_{contact}$	Duration of exposure per occurrence	days
IH_{air}	The person's respiration volume	m^3/day
n	Number of exposures (occurrences)	per day
BW	Body weight (bw)	kg

For dust, the content of the different substances is indicated as a fraction, i.e. the amount of substance in µg or ng per gram dust. For indoor air, the content of the different substances is indicated as a concentration, i.e. the amount of substance in µg or ng per m^3 air.

6.2 Method for calculating dermal exposure

Skin exposure occurs by direct contact with products containing flame retardants, for example when sitting on a chair where textiles or foam are flame retardant. This project has only found flame retardants in the foam part of two chairs and an office chair, so in this case it is only indirect contact with flame retardants, because the foam is wrapped in fabric, with which you have direct contact.

In EU risk assessment reports for both TCPP and TDCPP it is assessed, based on the lack of data, that dermal exposure to flame retardants in the foam part of furniture will form a very slight exposure for both children and adults, and as a maximum will be equal to the exposure you receive by inhalation. The EU risk assessment reports for the two substances have therefore assumed in the risk assessment as a worst case that dermal exposure is equal to the exposure you receive by inhalation.

In contrast, in the EU risk assessment report on TCEP, the dermal exposure has been calculated by exposure to the substance in the foam part of an armchair (see Section 2.5.1). Assuming that the migration of flame retardants from foam parts in furniture has the same level for the substances TCEP, TCPP and TDCPP, the migration found in the study with TCEP can be transferred to the analytical results found in this project. It is considered to be a reasonable assumption to compare the three substances, because they all have water solubility at the same level, and are estimated to migrate when the person sitting in the chair sweats.
The scenario specified in Section 2.5.1 will therefore be transferred to TCPP and TDCPP in the risk assessment. And the possible skin absorption is calculated according to the formula "Equation 15-7" from REACH guidance, Chapter R.15 "Consumer exposure estimation" (ECHA 2012). A factor F_{abs} is added, which is the fraction of each substance that may be absorbed through the skin. Thus, the calculated D_{der} will constitute the actual amount of absorbable substance per kg bw per day.

$$D_{der} = \frac{Q_{prod} \cdot Fc_{migr} \cdot F_{abs} \cdot F_{contact} \cdot T_{contact}}{BW} \cdot n$$

Where

D_{der}	Dermal daily dose (amount of absorbed chemical substance)	µg/kg bw/day
Q_{prod}	Amount of substance in the product	µg/cm²
Fc_{migr}	Fraction of migrating substance per time unit of the product	% per hour
F_{abs}	Fraction of applicated substance absorbed through skin (decimal fraction between o and 1)	
$F_{contact}$	Fraction of contact area (to take into account that the product is only partly in contact with the skin).	cm²
$T_{contact}$	Duration of exposure per occurrence	hours
n	Number of exposures (occurrences)	per day
BW	Body weight (bw)	kg

TCPP and TDCPP's dermal absorption values of 40% and 30%, respectively, were taken into account.

6.3 Method for calculating oral exposure

It is estimated that oral exposure to interior design containing flame retardants is found in very limited degree for adults, and therefore the potential exposure is considered to be negligible. For young children, however, the hand to mouth transfer could be a significant source of exposure in connection with dust containing flame retardants. This part, however, is included separately in Section 6.1.1.

6.4 Exposure via the indoor environment

Our indoor environment is identified as one of the main sources of exposure to chemical substances. Indoor air may contain significantly higher concentrations than outdoor air, and the most important route of exposure in the indoor environment for non-volatile compounds appears to be house dust (Rudel et al. 2003).

It was therefore decided in cooperation with the EPA to carry out a literature search for studies describing the occurrence of TCPP and TDCPP in the indoor environment, as these two flame retardants were identified by the analyses of the purchased furniture.

A general search was therefore made for reports and articles concerning the incidence of TCPP and TDCPP in the indoor environment. The focus is on studies from private homes, but studies from workplaces (offices) and cars are also included to provide an indication of the general levels, although the focus of this project is interior design and not vehicles. Studies are presented from all over the world (not just Europe), since there in general does not exist a lot of studies about the prevalence of TCPP and TDCPP in the indoor environment. Most studies of TCPP and TDCPP in the indoor environment are more recent studies (from 2012-2013). Most of the studies about the presence of flame retardants in the indoor environment deal with the occurrence of these in dust. Only a few studies of TCPP and TDCPP in indoor air have been identified. These two flame retardants generally have a low vapour pressure, which means that it is small amounts that will occur in the indoor air.

Ali et al. (2012), who summarises a number of studies of flame retardants in dust, indicate that after the global restrictions on PBDE (including penta-, octa- and deca-BDE) there has been a demand for alternative flame retardants, such as organophosphate flame retardants (e.g. TCPP and TDCPP) and new types of brominated flame retardants. According to this summary on a number of studies of flame retardants in dust, it becomes clear that the organophosphates are found in much higher concentrations than the new brominated flame retardants (about 10-100 times larger). A review article by Betts (2013) confirms that TDCPP according to the industry has long been one of the major flame retardants used in polyurethane foam stuffing in furniture and cars.
Neither TCPP nor TDCPP are chemically bonded to the foam filling in the furniture, which means that these flame retardants can be released to the indoor environment and may accumulate in the dust (Betts, 2013). A new US study (Carignan et al., 2013) shows that there is a relationship between a degradation product of TDCPP in the urine and the content of TDCPP in the dust at the workplace (offices). Likewise, Stapleton et al. (2013) in a study on flame retardants on children's hands indicate that there is something to suggest a correlation between the concentration of TDCPP and TCPP in house dust in homes and the concentration of these flame retardants from the hands of young children living in the homes where the flame retardants have been measured in the dust. This means that there is some evidence that dust is a significant route of exposure for these flame retardants, and that the TDCPP we are exposed to in the office or at home (for example through content in the dust) enter the body. According to Carignan et al. (2013), the sources that contribute to the exposure are not exactly known, but the use of flame retardant polyurethane foam in furniture and office furniture is indicated as a probable cause (Carignan et al., 2013).

By including the exposure of TCPP and TDCPP in the indoor environment in the exposure calculations, a picture is obtained of the flame inhibited furniture's long term effects on humans. Flame inhibited furniture is not the only sources of TCPP and TDCPP in the home, as these flame retardants are also used in other products in the home, but several sources indicate that especially TDCPP is commonly used in furniture foam (i.a. Stapleton et al., 2012).

Below, a number of studies of the content of TCPP and TDCPP in the indoor environment is discussed, and below tables give an overview of data presented in the sources.

6.4.1 Concentrations of TCPP and TDCPP in dust

A number of studies of TCPP and TDCPP in dust in the indoor environment have been identified. Minimum and maximum values (margins), median (50% percentile) and/or the average are presented, if stated in the studies.

The overall picture is that primarily recent studies (published in 2012 and 2013) specify the content of the flame retardants TCPP and TDCPP in dust in homes, in offices or in cars. This is due to the fact that previously (pre-2004) primarily PBDEs have been used as flame retardants in furniture. With the phasing out/limitation of PBDEs worldwide (limited e.g. in Japan and the EU, and phased out in the US), the new alternative flame retardants such as TCPP and TDCPP are being used instead. These flame retardants, and other alternative flame retardants, therefore begin to emerge in the dust in our homes. The new alternative flame retardants seen in house dust are alternative brominated flame retardants and organophosphates (TDCPP and TCPP are two commonly used organophosphates). However, it appears to be primarily TDCPP and TCPP (as seen in furniture in this Danish study) and other organophosphates such as TCEP and TBEP seen in dust (Dodson et al., 2012; Brommer et al., 2012; Ali et al., 2012).

According to Dodson, et al. (2012) the concentration of organophosphates (including TCPP and TDCPP) in dust is highest in Japan. This is because, according to Dodson et al. (2012), that Japan was one of the first countries to phase out/limit the use of PBDEs. The concentration of the alternative flame retardants (such as TCPP and TDCPP) in the dust is higher here because they have been used longer than in the rest of the world according to Dodson et al. (2012). It appears that the US (or especially California) has the second highest concentrations of TCPP and TDCPP in dust. This is because (according to Dodson et al. (2012)) that California has the strictest fire safety requirements for furniture in the world, and therefore the use of these flame retardants is high in the US (especially in California). It is indicated that the concentration of TCPP and TDCPP in dust in Europe is generally lower than in Japan and the US. However, there have been a few studies with high concentrations of TCPP and TDCPP in dust in Europe (at or above the levels recorded in the US), but this is not the general picture of the relatively few studies that exist in this area.

Source	Concentration measured in indoor environment dust	Comments
Garcia et al., 2007 **(reported in Ali et al., 2012)**	**TCPP in the home:** Average: 3.8 µg/g **TDCPP in the home:** Average: 0.12 µg/g	This study is shortly referred to in Ali et al. (2012). Concentrations of organophosphates have been measured in 8 homes in **Spain**. It was not indicated when the samples had been taken. Only average values are indicated – not minimum and maximum values.
Stapleton et al., 2009	**TCPP in the home:** Average: 0.572 µg/g Margins: < 0.14 – 5.49 µg/g **TDCPP in the home:** Average: 1.89 µg/g Margins: < 0.09 – 56.09 µg/g	Concentrations of flame retardants have been measured in 26 foam samples from furniture all over the US. Furthermore, concentrations of TCPP and TDCPP have been measured in 50 dust samples from private homes in **Boston, Massachusetts, USA** from 2002 to 2007. TDCPP was identified in 96% of all dust samples, whereas TCPP was only seen in 24% of all dust samples. But the article states that the analyses may be incorrect, and therefore may have resulted in fewer results for TCPP in the dust. The authors indicate that the identified concentrations are in the scale as seen earlier for PBDE in dust.
Bergh et al., 2010 **(reported in Ali et al., 2012)**	**TCPP in the home:** Average: 1.6 µg/g **TDCPP in the home:** Average: **10.0 µg/g** **TCPP in kindergartens:** Average: 3.1 µg/g **TDCPP in kindergartens:** Average: 9.1 µg/g **TCPP in offices:** Average: **19.0 µg/g**	This study is shortly referred to in Ali et al. (2012). Concentrations of organophosphates have been measured in 10 homes in **Sweden**. Furthermore, organophosphates have been measured in 10 kindergartens and in 10 workplaces in Sweden. It was not indicated when the samples had been taken. Only average values are indicated – not minimum and maximum values.

Source	Concentration measured in indoor environment dust	Comments
	TDCPP in offices: Average: **17.0 µg/g**	
Kanazawa et al., 2010 **(reported in Ali et al., 2012)**	**TCPP in the home**: Average: 18.7 µg/g **TDCPP in the home**: Average: 4.0 µg/g	This study is shortly referred to in Ali et al. (2012). Concentrations of organophosphates have been measured in 41 homes in **Japan**. It was not indicated when the samples had been taken. Only average values are indicated – not minimum and maximum values.
Van den Eede et al., 2011	**TCPP in the home**: Average: 4.82 µg/g Margins: 0.19 – 73.7 µg/g **TCPP in shops**: Average: 5.16 µg/g Margins: 0.58 – 24.4 µg/g **TDCPP in the home**: Average: 0.57 µg/g Margins: < 0.08 – 6.64 µg/g **TDCPP in shops**: Average: 4.61 µg/g Margins: < 0.08 – 56.2 µg/g	Concentrations of several organophosphates (including TDCPP and TCPP) have been measured in dust in 33 homes in **Belgium**. Furthermore, concentrations of organophosphates have been measured in 15 different shops in Belgium (shops selling electronics, mattresses, furniture - pharmacies, second hand shop, carpenter, analytical laboratory). It was not indicated when the samples had been taken. The measured concentrations are compared with other studies, and the conclusion is that the Belgian study measures values in line with a Spanish study, but lower values than measured in Japan. US studies are both higher and lower depending on the substance. The measured concentrations in the shops were generally higher than the measured concentrations in the homes.
Ali et al., 2012	**TCPP in the home**: Median: 0.35 µg/g **TDCPP in the home**: Median: 0.23 µg/g	Levels measured in dust samples from 34 different homes throughout **New Zealand** (both rural and urban areas). It was not indicated when the samples had been taken. TCPP and TDCPP have also been measured in dust vacuumed from the top of 16 mattresses in different homes. The measured values of TCPP and TDCPP from the mattresses were around. 70% and 50% of the values measured in the house dust.

Source	Concentration measured in indoor environment dust	Comments
		The article points out that the measured levels of TCPP and TDCPP are remarkably lower in New Zealand than in other parts of the world (compared to studies in the US, Sweden and Japan). It is reported that this may be due to the use of other flame retardants in furniture in New Zealand compared to the rest of the world, but it should also be noted that this study is the first study of contents in dust in homes from New Zealand, so it is not necessarily representative of New Zealand in general.
Dodson et al., 2012	**2006:** **TCPP in the home:** Median: 2.1 µg/g Margins: 0.34 – 120 µg/g **TDCPP in the home:** Median: 2.8 µg/g Margins: 0.73 – 24.0 µg/g **2011:** **TCPP in the home:** Median: 2.2 µg/g Margins: 0.49 – **140 µg/g** **TDCPP in the home:** Median: 2.1 µg/g Margins: 0.92 – 44.0 µg/g	Dust samples have been collected from 16 different homes both in 2006 and in 2011 (the same homes) in northern **California (San Francisco Bay Area), USA**. The content of 49 different flame retardants in total has been measured, including TCPP and TDCPP. The study shows that organophosphates (including TCPP and TDCPP) are the flame retardants most commonly found in dust in American homes and in the highest concentrations. It is reported that the concentrations of organophosphates in California are among the highest concentrations reported worldwide. This is consistent with California's strict fire requirements for furniture among others. Higher concentrations of organophosphates are only seen in Japanese homes. According to the authors, this is due to the fact that the phasing out of PBDE occurred earlier in Japan than in the rest of the world (USA and Europe). It is reported that for homes that purchased new furniture since the first measurement (i.e. 2006-2011) TCPP concentrations have increased. A significant increase in the TDCPP concentration (2006-2011) was seen in a home where major renovation / refurnishing had taken place.
Brommer et al., 2012	**TCPP in the home:** Average: 0.74 µg/g Margins: 0.37 – 0.96 µg/g **TCPP in offices:** Average: 3.0 µg/g Margins: 0.18 – 9.4 µg/g	Concentrations of TCPP and TDCPP have been measured in 12 cars and in 10 offices in the same building in **Germany**. Furthermore, measurements were made in 6 places in a single home in Germany. The samples were taken in end 2010/start 2011. The article points out that only a small number of measurements have been carried out in this study. But in spite of the small number of measurements, it was concluded that the flame retardants organophosphate ethers (including TCPP and TDCPP) are found in German cars and offices, and in concentrations significantly higher than the previously used PBDEs, which are

Source	Concentration measured in indoor environment dust	Comments
	<u>TCPP in cars</u>: Average: 3.1 µg/g Margins: 1.4 – 4.3 µg/g **<u>TDCPP in the home</u>:** Average: < 0.08 µg/g Margins: < 0.08 – 0.11 µg/g **<u>TDCPP in offices</u>:** Average: 0.15 µg/g Margins: <0.08 – 0.29 µg/g **<u>TDCPP in cars</u>:** Average: 130 µg/g Margins: <0.08 – 620 µg/g	now limited in use (via REACH and RoHS). The studies show that the content of TDCPP is significantly higher in cars than in offices.
Carignan et al., 2013	**<u>TDCPP in the home</u>:** <u>Living rooms</u>: Average: 4.21 µg/g Margins: 0.56 – 30.6 µg/g <u>Bed rooms</u>: Average: 1.40 µg/g Margins: 0.27 – 18.2 µg/g **<u>TDCPP in offices</u>:** Average: 6.06 µg/g Margins: 0.6 – **72.0 µg/g** **<u>TDCPP in cars</u>:** Average: 12.5 µg/g Margins: <0.03 – 326 µg/g	Concentrations of TDCPP in dust in offices (30), in cars (20) and in homes (60) have been measured in **Boston, Massachusetts, USA**. In the homes, the measuring was carried out in bed rooms (29) and in living rooms (31). The samples were taken in 2009. TDCPP was found in 99% of all 110 measurements. Generally, the highest concentrations were measured in cars. The second highest concentration of TDCPP was found in offices. The homes had the lowest concentrations of TDCPP, and the concentration was lowest in bed rooms rather than living rooms.
Meeker et al., 2013	**<u>TDCPP in the home</u>:** Median: 1.62 µg/g Margins: < 0.02 – 56.08 µg/g	Concentrations of TDCPP in dust have been measured in 45 homes in **Massachusetts, USA**, and a decomposition product of TDCPP has been measured in the urine of men living in these homes. It was not indicated when the samples had been taken.

Source	Concentration measured in indoor environment dust	Comments
		The article concludes that house dust seems to be a significant source of exposure to TDCPP. But it is also indicated that other environments (such as office environments) should be taken into consideration when looking at the total exposure to TDCPP.
Stapleton et al., 2013	**TCPP in the home**: Average: 3.32 µg/g Margins: < 0.02 – 67.8 µg/g **TDCPP in the home**: Average: 2.73 µg/g Margins: 0.62 – 13.11 µg/g	Concentrations of TCPP and TDCPP in dust have been measured in 30 homes in the US. It is not indicated exactly where in the US, but probably in Massachusetts or North Carolina. The levels in dust have been compared with concentrations from the hands of children. The study took place in 2012. TCPP and TDCPP are the two organophosphate flame retardants found in the highest levels. TCPP and TDCPP were identified in 97 and 100% of the dust samples, respectively, There is some indication that there is a correlation between the concentration of flame retardants in house dust and the concentration of flame retardants found on the hands of young children. Therefore, the conclusion is that house dust is significant route of exposure for flame retardants.

TABLE 27
OVERVIEW OF CONTENT OF TCPP AND TDCPP IN DUST IN THE INDOOR ENVIRONMENT. THE STUDIES MARKED WITH GREEN BACKGOUND AND NUMBERS IN BALD ILLUSTRATE THE VALUES USED IN THE EXPOSURE CALCULATIONS. THE MARGINS ILLUSTRATE MINIMUM AND MAXIMUM VALUES MEASURED.

Based on the concentrations identified for TCPP and TDCPP in dust, two values for each flame retardant were selected for the exposure calculations. These are average values (or median if the average value is not specified) and maximum values. In both cases, worst case values are selected, i.e. the highest identified average values and the highest identified maximum values. An exposure calculation based on the maximum value could say something about the health risk in the worst case, i.e. maximum measured concentration. An exposure calculation based on the average value would be more realistic for a high average exposure consideration. The question is, however, whether to use values exclusively from homes, or from work places and cars as well, and whether to exclusively choose European values, or values from the US and Japan as well.

The average and maximum values do not vary very much between the different parts of the world (New Zealand, Japan, USA and Europe) - seen from the values reported in Table 27. The values appear from Table 28 below. As a maximum, the difference is a factor of 50 between the average values of New Zealand (lowest) and Japan (highest). Comparing the average values from the US, Europe and Japan, the difference is only about a factor of 2.5-5.5 between Japan (highest) and the US/Europe, depending on the substance. Generally, there is not much difference in levels between Europe and the US.

Furthermore, it appears that there is a difference of about a factor of 10 in levels measured in the homes compared to the levels measured in cars. The levels measured in cars are generally the highest, but not many cars have been measured for these two flame retardants.

Substance	Type of value	Japan	New Zealand	USA	Europe
TCPP	Highest average	18.7 µg/g (H)	0.35 µg/g (H)	3.32 µg/g (H)	4.82 µg/g (H) **19.0 µg/g (K)** 3.1 µg/g (B)
TCPP	Highest value	Not indicated	Not indicated	**140 µg/g (H)**	73.7 µg/g (H) 24.4 µg/g (K) 4.3 µg/g (B)
TDCPP	Highest average	4.0 µg/g (H)	0.23 µg/g (H)	4.21 µg/g (H) 6.06 µg/g (K) 12.5 µg/g (B)	10.0 µg/g (H) **17.0 µg/g (K)** 130 µg/g (B)
TDCPP	Highest value	Not indicated	Not indicated	56.09 µg/g (H) **72 µg/g (K)** 326 µg/g (B)	6.64 µg/g (H) 56.2 µg/g (K) 620 µg/g (B)

TABLE 28
HIGHEST AVERAGE VALUES AND MAXIMUM VALUES LISTED IN TABLE 27 DIVIDED ON CONTINENTS (H= THE HOME, K=OFFICES OR PUBLIC BUILDINGS, AND B= CARS)

As previously mentioned, Dodson et al. (2012) indicate that the levels of TCPP and TDCPP in Japan are generally higher than in the rest of the world, because Japan sooner phased out/limited the use of PBDEs and started using alternative flame retardants such as TCPP and TDCPP. The concentrations in Japan may be an indication of a more widespread use of these flame retardants or a picture of where the concentrations in the US and Europe may be going, when the use of TCPP and TDCPP is disseminated more (old furniture with old, now phased out, flame retardants is replaced). This is however not known.

For the exposure calculations it was decided to use the highest values (average and maximum values) found in homes or in offices, whether it is in American, Japanese or European studies. The reason for this is to assume absolute worst case. We chose however not to use the levels in the cars - despite the fact that these are generally somewhat higher (a factor of 8-10 for TDCPP). This is because this project only focuses on interior design and not on means of transport. The actual contribution can be slightly larger than calculated in this report, but at the same time, the residence time in cars is much less than the residence time indoors in general.

The chosen values are bald in Table 28 and bald with green background in Table 27.

6.4.1.1 Exposure calculations for intake of TCPP and TDCPP via dust

The daily intake of TCPP and TDCPP via dust is calculated as described in Section 6.1.1 "Exposure via dust". Data for the calculations and the calculated daily intake of TCPP and TDCPP via dust are indicated in Table 29 below.

Substance	Scenario	Intake of dust (g/day)	Dust conc. observed (µg/g)	BW (kg)	f_{ORAL}	Daily intake (µg/kg bw/day)
TCPP	Children – average	0.1	19	10	0.8	0.152
TCPP	Adults – average	0.05	19	60	0.8	0.013
TCPP	Children – max	0.1	140	10	0.8	1.120
TCPP	Adults – max	0.05	140	60	0.8	0.093
TDCPP	Children – average	0.1	17	10	1	0.170
TDCPP	Adults – average	0.05	17	60	1	0.014
TDCPP	Children – max	0.1	72	10	1	0.720
TDCPP	Adults – max	0.05	72	60	1	0.060

TABLE 29
DAILY INTAKE OF TCPP AND TDCPP VIA DUST CALCULATED FOR CHILDREN AND ADULTS, AND FOR AVERAGE CONCENTRATIONS AND MAXIMUM CONCENTRATIONS

For comparison, Stapleton et al. (2013) calculate an average intake of TCPP of 0.331 µg/day and a 95% percentile intake of TCPP of 3.66 µg/day corresponding to 0.033 and 0.366 g/kg bw/day, respectively. The corresponding values for TDCPP are 0.273 µg/g (average) and 1.043 µg/g (95% percentile) corresponding to 0.027 and 0.104 µg/kg bw/day, respectively. These figures are calculated based on the values actually measured in rags used for wiping children's hands. It appears that the values for the daily intake of TCPP and TDCPP calculated in Stapleton et al. (2013) are about a factor of 3-7 lower than the above calculated worst case values.

6.4.2 Concentrations of TCPP and TDCPP in indoor air

Only a few studies of TCPP and TDCPP in indoor air have been identified. Maximum values are presented, because these values are primarily indicated in the studies. The values used in the exposure calculations are indicated in bald.

Source	Concentration measured in indoor air	Comments
Staaf and Ostman, 2005 **(reported in Van der Veen & de Boer, 2012)**	**TCPP in office (computer hall):** Max: 1.08 µg/m^3	The article is a compilation of previous studies. The measured maximum value for content of TCPP in indoor air is indicated. It is not indicated when the sample had been taken or in which country, but the article is written by Swedes.
Marklund et al., 2005	**TCPP in public building:** Margins: 0.014 – 1.1 µg/m^3 **TCPP in homes:** Margins: 0.007 – 0.21 µg/m^3 **TDCPP in public building:** Margins: 0.002 - **0,15 µg/m^3** **TDCPP in homes:** Max: not detected	Marklund has made his own measurements of TDCPP in indoor air in two homes and in 17 public buildings in Sweden. Measurements from previous studies are also described.
European Union Risk Assessment Report, 2008	**TCPP:** Max: **3.8 µg/m^3**	In the EU RAR for TCPP, air concentrations for TCPP over three different mattresses with content of TCPP have been measured. Please note that these are worst case measurements, as a small sample volume and larger amounts of foam from the mattresses have been used. The air concentration is measured after 1, 2, 3, 5, and 6.5 days, respectively. The air concentration generally peaks at 3 days, after which the concentration drops again. The indicated value covers a calculated value in a standard room in a home, based on measurements after 6.5 days.

TABLE 30
OVERVIEW OF CONTENT OF TCPP AND TDCPP IN INDOOR AIR. THE STUDIES MARKED WITH GREEN BACKGROUND AND FIGURES IN BALD ILLUSTRATE THE VALUES USED IN THE EXPOSURE CALCULATIONS. THE MARGINS ILLUSTATE MINIMUM AND MAXIMUM VALUES MEASURED.

These measured values for the content of TCPP and TDCPP in indoor air can be compared with the calculated maximum theoretical concentrations of TCPP and TDCPP which may be present in the air based on the vapour pressures of the substances. These are indicated in Section 4.4 "Headspace analyses – degassing" as 187 µg/m^3 for TCPP and 1 µg/m^3 for TDCPP. It appears that the measured values in indoor air for both TCPP and TDCPP are significantly lower, 1.1 µg/m^3 for TCPP and 0.15 µg/m^3 for TDCPP. In the EU RAR for TCPP, worst-case measurements/calculations have been made for the content of TCPP in indoor air by measuring a small sample volume of samples from mattresses and convert this to a concentration in a bedroom. This provides a somewhat higher concentration (3 times higher) than the concentration actually measured in indoor air.

In the EU RAR for TDCPP, the same calculated concentration has been used as for TCPP of 3.8 µg/m3 for TDCPP (although it is indicated that this will be an overestimation), but according to the vapour pressure for TDCPP, this should not be theoretically possible. Therefore, in this report we use the highest measured level of TDCPP of 0.15 µg/m^3.

6.4.3 Exposure calculations for exposure to TCPP and TDCPP via inhalation

The daily inhalation of TCPP and TDCPP via indoor air is calculated as described in Section 6.1.2. Data for the calculations and the calculated daily inhalation of TCPP and TDCPP via indoor air are indicated in Table 31 below. Calculations are exclusively made on the maximum values, as no identified average values can be found in the literature.

Substance	Scenario	Amount of air inhaled (m^3/day)	Air conc. observed (µg/m^3)	BW (kg)	f_{RESP}	Daily intake (µg/kg bw/day)
TCPP	Children – max	5.83	3.8	10	1	2.217
TCPP	Adults – max	15	3.8	60	1	0.950
TDCPP	Children – max	5.83	0.15	10	1	0.088
TDCPP	Adults – max	15	0.15	60	1	0.038

TABLE 31
DAILY INHALATION OF TCPP AND TDCPP VIA INDOOR AIR CALCULATED FOR CHILDREN AND ADULTS FOR MAXIMUM CONCENTRATIONS

6.5 Exposure calculations for exposure to TDCPP and TCPP via dermal contact

Migration of TCEP has been measured from upholstery of an armchair (EU RAR, 2008) corresponding to 0.217 µg/cm^2/hour from upholstery containing 8 mg TCEP/cm^2 (see Section 2.5.1). This migration corresponds to a migration of 0.003% TCEP from the upholstery per hour ((0.217 µg/cm^2/hour / 8000 µg/cm^2)*100 = 0.003% per hour). By assuming that the migration of TCPP and TDCPP has the same level as TCEP, there will also be a migration of 0.003% per hour of the two substances, which can be transferred to the analytical results found in this study. In another study, prepared by the Environmental Protection Agency, the migration of TCEP is measured from a Lamaze Cube consisting of foam, plastic, and a textile layer around it (MST, 2005). Here a significantly higher migration is found, as all the TCEP contained in the cube was released in 24 hours resulting in a migration of 4.2% per hour. It is not immediately possible to compare and identify any methodological differences in the two analyses, but it has been evaluated to be most relevant to use the migration measured in upholstery from an armchair in this exposure assessment, as this migration imitates the scenario in this study in the best way.

TCPP and TDCPP have been measured in foam parts from two chairs in this project. As a worst case scenario, the dermal exposure is calculated for the chair with the highest measured content in one of the top foam layers, office chair no. 3 (3 layers of foam). Overall higher levels of TCPP and TDCPP were quantified in a chair, but about half of the detected substance was detected in 7 layers in the chair (see Table 20) from which it is assumed that the migration will be significantly slower than from the 3 layers in the office chair. 4601 ppm TCPP and 9043 ppm TDCPP were quantified in this chair corresponding to levels of 920 µg/cm² and 1800 µg/cm² (see Table 20).
The daily amount of time used in the chair is assumed to be 8 hours for adults corresponding to a working day, because the highest content was found in an office. For children a shorter period is assumed, because it is unrealistic to assume that a child of 2-3 years will sit in a chair for that long. The time is therefore set to half, i.e. 4 hours, which is also considered a worst case scenario.

For adults, the skin area in contact with the chair is assumed to be 1000 cm² while a smaller area of 380 cm² is assumed for children (the assumption is a person wearing very short pants with a part of the thighs and a part of a bare back in the contact with the chair). During the summer, it is realistic to assume that there might be direct contact between the seat of the chair and the back of the leg, and possibly some of the forearm with the arm support. During the winter, this area would probably be overestimated, because there will be no direct contact between the thigh and the chair, but only indirect contact via the clothes.

The body weights of children and adults are set to 10 and 60 kg, respectively. The dermal absorption of TCPP and TDCPP of 30 and 40%, respectively, is taken into account.

Substance	Target group	Amount available for migration[1] (µg/cm²)	Migrated amount (µg/cm²/hour)[2]	Time (hours/day)	Area (cm²)	Daily dermal exposure (µg/kg bw/day)[3]
TCPP	Children	920	0.028	4	380	1.68
TCPP	Adults	920	0.028	8	1000	1.47
TCPP	Children	1800	0.054	4	380	2.46
TCPP	Adults	1800	0.054	8	1000	2.16

[1] The amount available for migration corresponds to the quantitative values measured in µg/cm²
[2] This is calculated as follows:
$1800\ \frac{\mu g}{cm^2} \times 0{,}00003\ per\ hour = 0.054\ \frac{\mu g}{cm^2}\ per\ hour$, where 0.00003 corresponds to the migration percentage found for TCEP
[3] This is calculated as follows:

$$\frac{0.054\ \frac{\mu g}{cm^2}\ per\ hour\ \times 4\ hours/day\ \times 380\ cm^2}{10\ kg} \times 0.30\ (dermal\ abs.) = 2.4624 \frac{ug}{kg}/dag$$

TABLE 32
CALCULTATION OF DAILY DERMAL EXPOSURE TO THE SUBSTANCES TCPP AND TDCPP

7. Risk assessment

The purpose is to clarify whether the use of flame retardants in interior design causes persons or environment to be exposed to the substances in hazardous doses. Two flame retardants found in products on the Danish market will be risk assessed in the following sections.

7.1 Method for risk assessment - health

The method for risk assessment to be used in the project is described below. The method is based on the REACH Guidance Documents.

7.1.1 Method for calculating risk

According to the REACH guidance for risk assessment (ECHA 2012), the health risk is assessed in each case according to the following formula calculating a risk characterisation ratio (RCR) using the derived no effect level (DNEL):

$$RCR = \frac{Exposure\ (D_{total})}{DNEL}$$

If RCR > 1 (i.e. the exposure is larger than DNEL), it is an unacceptable risk. If RCR < 1, the exposure is not considered to pose an unacceptable risk.

For a single substance, addition of exposure values for different routes of exposure, followed by division by DNEL, will correspond to RCR being calculated for different routes of exposure and then added:

$$RCR = \frac{Exposure\ (D_{total})}{DNEL} = \frac{D_{inh}}{DNEL} + \frac{D_{der}}{DNEL} + \frac{D_{oral}}{DNEL} =$$

$$RCR = RCR_{inh} + RCR_{der} + RCR_{oral}$$

For the purpose of comparing the contribution of different sources of exposure to a total RCR for a substance, we have in this project made calculations of RCR from different routes of exposure, and these RCR values have for each flame retardant been added to an RCR_{total}.

7.2 Method for risk assessment – environment

The environmental risk (R) can be expressed by calculating the ratio between the predicted environmental concentration (PEC) and the predicted no effect concentration (PNEC):

$$R = \frac{PEC}{PNEC}$$

Where
R > 1 indicates that environmental risk cannot be excluded, whereas R < 1 indicates that no risk is predicted.
PEC is the result of an exposure calculation based on emission rates, environmental transport, as well as information on the distribution of the substance in the environment and degradation.

PNEC is calculated from the results of acute and chronic studies (EC50/NOEC/EC10-values) in which the lowest value is divided by an assessment factor. The assessment factor is intended to compensate for uncertainty in the extrapolation of results from laboratory studies, with relatively few species, to a PNEC representing an environment (e.g. freshwater or marine areas) with a versatile range of taxonomic groups and organisms. The value of the used assessment factor depends on the number of available studies, the number of taxonomic groups covered by the studies, and the availability of chronic studies (ECHA, 2008).

7.3 Health

The daily exposure calculated in section 6 is related to the DNEL values to assess whether there is a health risk. If RCR > 1 (i.e. exposure is larger than DNEL), it is an unacceptable increase in risk.

The daily exposure is calculated as exposure from intake, inhalation and dermal absorption. The daily exposure from intake, inhalation and dermal absorption, and the total daily exposure and the corresponding RCR values are presented in the tables below.

Substance	Scenario	Daily exposure (µg/kg bw/day)	DNEL	RCR
TCPP	Children – average intake	0.152	70	0.0022
TCPP	Adults – average intake	0.013	70	0.0002
TCPP	Children – max intake	1.120	70	0.0160
TCPP	Adults – max indtag	0.093	70	0.0013
TDCPP	Children – average intake	0.170	5	0.0340
TDCPP	Adults – average intake	0.014	5	0.0028
TDCPP	Children – max intake	0.720	5	0.1440
TDCPP	Adults – max intake	0.060	5	0.0120

TABLE 33
DAILY EXPOSURE VIA INTAKE OF DUST FOR TCPP AND TDCPP, AND CALCULATED RCR VALUES

Substance	Scenario	Daily exposure (μg/kg bw/day)	DNEL	RCR
TCPP	Children	2.2167	70	0.0317
TCPP	Adults	0.95	70	0.0136
TDCPP	Children	0.0875	5	0.0175
TDCPP	Adults	0.0375	5	0.0075

TABLE 34
DAILY EXPOSURE VIA INHALATION FOR TCPP AND TDCPP, AND CALCULATED RCR VALUES

Substance	Scenario	Daily exposure (μg/kg bw/day)	DNEL	RCR
TCPP	Children	1.68	70	0.024
TCPP	Adults	1.47	70	0.021
TDCPP	Children	2.46	5	0.49
TDCPP	Adults	2.16	5	0.43

TABLE 35
DAILY EXPOSURE VIA DERMAL ABSORPTION FOR TCPP AND TDCPP, AND CALCULATED RCR VALUES

The total exposure and the resulting calculated RCR values are indicated in Table 36 (maximum values for dust intake) and in Table 37 (average values for dust intake).

Substance	Scenario	Daily total exposure (μg/kg bw/dag)	DNEL	RCR
TCPP	Children	5.015	70	0.07
TCPP	Adults	2.515	70	0.04
TDCPP	Children	3.270	5	0.65
TDCPP	Adults	2.258	5	0.45

TABLE 36
THE TOTAL DAILY EXPOSURE FOR CHILDREN AND ADULTS FOR TCPP AND TDCPP, AND CALCULATED RCR VALUES. HERE THE CALCULATIONS INCLUDING THE MAXIMUM CONCENTRATIONS ARE FOUND FOR TCPP AND TDCPP IN DUST

Substance	Scenario	Daily total exposure (µg/kg bw/dag)	DNEL	RCR
TCPP	Children	4.047	70	0.06
TCPP	Adults	2.435	70	0.03
TDCPP	Children	2.720	5	0.54
TDCPP	Adults	2.212	5	0.44

TABLE 37
THE TOTAL DAILY EXPOSURE FOR CHILDREN AND ADULTS FOR TCPP AND TDCPP, AND CALCULATED RCR VALUES. HERE THE CALCULATIONS INCLUDING THE AVERAGE CONCENTRATIONS ARE FOUND FOR TCPP AND TDCPP IN DUST

Table 38 indicates all calculated RCR values, but exclusively for the maximum values (i.e. the maximum values for dust).

Substance	Scenario	RCR_{DUST}	RCR_{INHAL}	RCR_{DERMAL}	RCR_{TOTAL}
TCPP	Children	0.0160	0.0317	0.024	0.07
TCPP	Adults	0.0013	0.0136	0.021	0.04
TDCPP	Children	0.1440	0.0175	0.493	0.65
TDCPP	Adults	0.0120	0.0075	0.432	0.45

TABLE 38
THE SINGLE CONTRIBUTIONS TO THE TOTAL RCR FOR CHILDREN AND ADULTS EXPOSED TO TCPP AND TDCPP. HERE THE CALCULATIONS INCLUDING THE MAXIMUM CONCENTRATIONS ARE FOUND FOR TCPP AND TDCPP IN DUST

The largest contribution to the total RCR comes from dermal exposure, except for children's exposure to TCPP (where inhalation at worst case concentration in air was found to be higher), and for adults dermal exposure to both substances contributes with more than 50% of the total contribution to RCR. The general rule is that for TCPP, the contribution from the three routes of exposure is more evenly shared between the routes of exposure than for TDCPP, where the dermal exposure is the most important route (see Table 38).

It should be noted that dermal exposure is the most uncertain assessment and may be the calculation which is based on the absolute worst case conditions. Firstly, migration is not known neither for TCPP nor TDCPP, and the same migration is assumed as for TCEP. This is of course an assumption, but they are similar chemical substances. On the other hand, the migration for TCEP is a migration measured from the upholstery of an armchair, and it is not known whether the construction of this armchair corresponds to the construction of the office chair (KS1) used for worst case calculations in this report. In the office chair (KS1) TCPP and TDCPP were only measured in layer 3, and the first two layers consist of a fabric layer (outer (layer 1)) and another foam layer (layer 2). It is thus absolute worst case scenarios carried out by calculation of dermal exposure, assuming that the flame retardants migrate through first another foam layer and then the outer fabric layer before exposure can occur.
Because migration from a foam layer and the dermal exposure are considered to be of importance for a more accurate risk assessment, more accurate experimental values in this area would be necessary because of the uncertainties of the outlined calculation. (This may be the reason why RCR for dermal exposure in virtually all cases contributes the most to the total RCR value). The RCR

value for inhalation for TCPP also represents a significant part of the total RCR value. Here it should be noted that a worst case calculated TCPP concentration was used from some air chamber analyses. Thus, it is not a question of actually measured concentrations in indoor air in a home. Therefore, the contribution to the exposure from this is probably overestimated.

Substance	Scenario	RCR_{DUST}	RCR_{INHAL}	RCR_{DERMAL}
TCPP	Children	22%	44%	34%
TCPP	Adults	3.6%	37.9%	58.5%
TDCPP	Children	22%	2.7%	75.3%
TDCPP	Adults	2.7%	1.7%	95.7%

TABLE 39
THE SINGLE CONTRIBUTIONS TO THE TOTAL RCR IN % FOR CHILDREN AND ADULTS EXPOSED TO TCPP AND TDCPP. HERE THE CALCULATIONS INCLUDING THE MAXIMUM CONCENTRATIONS ARE FOUND FOR TCPP AND TDCPP IN DUST

If RCR is below 1, the exposure is not considered to pose an unacceptable risk. As indicated in Table 38, RCR is less than 1 for exposure to TCPP and TDCPP in the set worst case scenarios both for children and adults, which indicates that there is no risk from exposure to flame retardants in furniture. The exposure assessments include data on dust concentrations of the two substances generally, and therefore these data are not exclusively based on exposure to flame retardants in foam parts in furniture, but may also originate from other sources. The largest RCR is obtained for 2-3-year old children and for the substance TDCPP that has a lower DNEL value than TCPP. However, the RCR value of 0.65 is not considered to pose an unacceptable risk.

7.4 Environment

The found PNEC values for TCPP and TDCPP have been reported partly in section **Fejl! Bogmærke er ikke defineret.** and partly below in Table 40 and Table 41, where also the predicted environmental concentration (PEC) is indicated. For both substances, these data originate from data found in the EU risk assessment (EU RAR, 2008a; 2008b).

Environment	PNEC	PEC	PEC/PNEC ratio
Freshwater	0.64 mg/l	Up to 0.245 mg/l	0.383
Marine (extrapolation from freshwater)	0.064 mg/l	0.002 mg/l	0.024
Soil	1.5 mg/kg wet weight	0.305 mg/kg	0.203
Waste water treatment plant - microorganisms	0.784 mg/l	0.244 mg/l	0.312

TABLE 40
THE CALCULATED PNEC (PREDICTED NO EFFECT CONCENTRATION) VALUES FOR TCPP AND TDCPP, RESPECTIVELY

Environment	PNEC	PEC	PEC/PNEC ratio
Freshwater	0.01 mg/l	0.00184 mg/l	0.184
Marine (extrapolation from freshwater)	0.001 mg/l	0.000102 mg/l	0.102
Soil	0.29 mg/kg wet weight	0.0631 mg/kg	0.219
Waste water treatment plant - microorganisms	> 10 mg/l	0.41 mg/l	0.041

TABLE 41
THE CALCULATED PNEC (PREDICTED NO EFFECT CONCENTRATION) VALUES FOR TCPP AND TDCPP, RESPECTIVELY

For all compartments a PEC/PNEC ratio less than 1 is calculated for both TCPP and TDCPP indicating that TCPP and TDCPP pose a low risk to the environment. The EU risk assessment report on TDCPP indicates, for some confidential data, higher PEC levels than indicated in Table 41, which would result in an RCR above 1. These have not been used here, because in the EU risk assessment report, these data are considered to represent a data set, which according to information from the industry is no longer relevant.

TCPP and TDCPP are considered to fulfil the criteria as persistent (P) or potentially very persistent (vP), but they do not fulfil the criteria for bioaccumulation (B) and the criteria for toxicity (T). Thus, TCPP and TDCPP cannot be regarded as PBT substances.

Based on the method used here and available data for toxicity and exposure to the two substances, it is assessed that TCPP and TDCPP do not pose a risk to the environment.

8. Conclusion

Based on this survey and study of interior design on the Danish market, it is concluded that no immediate risk was found for Danish consumers associated with exposure to any flame retardants in products. It should be pointed out that only a small selection of products on the market have been examined, and therefore we cannot exclude that other products on the Danish market may contain flame retardants in higher quantities.

In contrast to what has been seen in studies from the US, where 80% of the examined furniture contained flame retardants, this study indicates that a smaller percentage of furniture on the Danish market contains flame retardants. This is partly based on the analyses, where 50% of the examined furniture (chairs and office chairs) contained flame retardants; partly on contact to the industry who gave the impression that furniture produced in Denmark exclusively for the Danish market is not added flame retardants. Furthermore, this study has also indicated that the use of the harmful brominated flame retardants in interior design on the Danish market may not be as big an issue as feared, as no bromine has been found in any of the 15 analysed products, but then again it should be pointed out that the study is based on a small selection of all interior design products on the market.

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Appendix 1: Questionnaire to be used in the survey

Questions concerning the use of flame retardants in textile products on the Danish market

DHI and FORCE Technology are in cooperation preparing an investigation on the use of flame retardants in textiles in consumer products on the Danish market for the Danish EPA. For this reason we are interested in the following information concerning your products:

1. Which type of interior design products (containing textiles) that you produce or sell contains flame retardants? E.g. curtains, furniture, carpets, mattresses etc.
2. Could you please list
    a. The type of products you sell/produce
    b. The type of flame retardants used (preferably by CAS No.) in the different products
    c. The concentration of flame retardants (or e.g. a maximum concentration used) in the different products
    d. A description of how the flame retardant is used in the different products
        - E.g. only on the surface of the couch and not in the padding or similar description
        - E.g. incorporated in the textile fibres or added to the fabric afterwards (reactive or added flame retardants)
    e. A description of when in the production process the flame retardants are added to the products (e.g. in the production of the textile fibres or in the production of the furniture)
3. Are the products you sell subject to certain demands on fire resistant properties through standards, legislation etc.? If so, could you please specify the exact standard and/or legislation? And if so, could you please specify if the demands are valid for Denmark only or other countries as well?
4. Do you have any suggestions with regard to whom we may benefit from contacting in search for information on this area? E.g. producers of flame retarded fibres, your competitors on this area etc.
5. Do you have knowledge about alternative flame retardants or alternatives to the use of flame retardants?

Thank you very much for your help!

Appendix 2: Companies contacted in relation to the survey

The survey includes the following companies that are suppliers or manufacturers of **carpets**:

- Interface
- Bentzon Carpets ApS
- Danfloor A/S
- Egetæpper
- Fletco Carpet Tiles A/S
- Garant (Inbogulve)
- Hammer Tæpper A/S
- HC Tæpper A/S
- Kilroy indbo A/S
- Meltex A/S
- Migadan A/S
- Tæppeland
- Foamtex

The survey includes the following companies that are suppliers or manufacturers of **curtains**:

- AvanT Gardiner
- Ado Nordic A/S
- Acrimo
- Andreas Hansen
- BOTEX - BIS Amba
- Faber
- Gardin Lis ApS
- GardinShoppen.dk
- Gardin Jensen
- J.O. Gardiner
- Kim's Gardiner
- MIGA Gardiner
- Nye gardiner
- Pagunette A/S
- Sega A/S
- Uniggardin Aps.
- Velux Gardinshop (Velux Danmark A/S)

The survey includes the following companies that are suppliers or manufacturers of **furniture** (including beds and mattresses):

- Actona
- Auping (Royal Auping)
- Biva
- BoConcept A/S
- Bramming Plast
- Cahetu
- Carl Thøgersen og Jensen
- Concetto
- Daels Bolighus
- Danbo Møbler
- Drømmeland A/S
- Eilersen A/S
- Erik Jørgensen Møbelfabrik A/S
- Erling Christensen Møbler A/S

- Espe Møbler ApS
- Fritz Hansen A/S
- Garant Møbler
- Getama Danmark A/S
- Hansen Møbler A/S
- HJORT KNUDSEN A/S
- Idé Møbler
- IKEA
- Ilva
- Innovation
- Interstil A/S
- In2house Amba
- Jens Lyngsøe Interieur A/S
- Jysk Skum
- Jysk
- K. Balling Engelsen
- My Home
- Møbelhuset1
- Møbelkæden
- Raun A/S
- SAXO Living A/S
- Scandisleep
- Skandinavisk Skumindustri
- Skippers Møbler, Durup A/S
- Skum og madras Specialisterne ApS
- Smag & Behag
- Softline
- Stouby Furniture A/S

The survey includes the following companies that are suppliers or manufacturers of **textiles for interior design**:

- Almedahls
- Artex
- Ciba-Geigy
- Danish art weaving
- Drapilux
- Dupont
- Ellerbæk A/S
- Gabriel
- Green-Tex A/S
- Hoie
- Hoechst
- Hunter Douglas
- J&M
- Industrial Textiles A/S
- Kemotextil A/S
- Kvadrat A/S
- OBA AG
- Roocci Curtains
- Trevira
- Wellmann

Appendix 3: All XRF results

This appendix presents all XRF results or the 15 products and a total of 59 subsamples (layers). The following products were analysed:

- 3 office chair
  - KS1 – 3 layers
  - KS2 – 3 layers
  - KS3 – 4 layers
- 8 mattresses
  - M1 – 4 layers
  - M2 – 4 layers
  - M3 – 2 layers
  - M4 – 2 layers
  - M5 – 3 layers
  - M6 – 3 layers
  - M7 – 1 layer
  - M8 – 2 layers
- 3 chairs/armchairs
  - S1 – 4 layers, but layer 1 has a light and a dark side, which have been X-ray analysed separately
  - S2 – 8 layers
  - S3 – 11 layers
- 1 plaid
  - P1 – 2 layers, but both layers have two different kinds of fabric on each side, and therefore each side of the layers has been X-ray analysed separately

All 59 subsamples are presented on the following 59 pages.

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6333	Fortyndingsmiddel:	None
Beskrivelse:	**KS1 lag 1**	Prøvevægt (g):	2,619
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,066 %*
12	Mg	Magnesium	*< 0,015 %*
13	Al	Aluminum	*0,32 %*
14	Si	Silicon	*0,21 %*
15	P	Phosphorus	*0,00 %*
16	S	Sulfur	*0,28 %*
17	Cl	Chlorine	*0,33 %*
19	K	Potassium	*< 0,0064 %*
20	Ca	Calcium	*0,09 %*
22	Ti	Titanium	*0,48 %*
23	V	Vanadium	*0,01 %*
24	Cr	Chromium	*< 0,00038 %*
25	Mn	Manganese	*< 0,00022 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*1,90 µg/g*
28	Ni	Nickel	*42,70 µg/g*
29	Cu	Copper	*< 0,3 µg/g*
30	Zn	Zinc	*0,90 µg/g*
31	Ga	Gallium	*1,30 µg/g*
32	Ge	Germanium	*< 0,2 µg/g*
33	As	Arsenic	*< 0,3 µg/g*
34	Se	Selenium	*0,50 µg/g*
35	Br	Bromine	*24,00 µg/g*
37	Rb	Rubidium	*0,40 µg/g*
38	Sr	Strontium	*1,10 µg/g*
39	Y	Yttrium	*< 0,3 µg/g*
40	Zr	Zirconium	*< 2,7 µg/g*
41	Nb	Niobium	*< 2,6 µg/g*
42	Mo	Molybdenum	*< 2,0 µg/g*
47	Ag	Silver	*< 1,1 µg/g*
48	Cd	Cadmium	*< 0,9 µg/g*
49	In	Indium	*< 1,0 µg/g*
50	Sn	Tin	*1,10 µg/g*
51	Sb	Antimony	*61,90 µg/g*
52	Te	Tellurium	*< 2,1 µg/g*
53	I	Iodine	*< 3,8 µg/g*
55	Cs	Cesium	*< 5,7 µg/g*
56	Ba	Barium	*< 9,5 µg/g*
57	La	Lanthanum	*< 13 µg/g*
58	Ce	Cerium	*< 18 µg/g*
74	W	Tungsten	*< 2,3 µg/g*
80	Hg	Mercury	*< 0,4 µg/g*
81	Tl	Thallium	*0,40 µg/g*
82	Pb	Lead	*1,50 µg/g*
83	Bi	Bismuth	*0,60 µg/g*
90	Th	Thorium	*1,00 µg/g*
92	U	Uranium	*< 3,2 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6334	Fortyndingsmiddel:	None
Beskrivelse:	**KS1 lag 2**	Prøvevægt (g):	1,812
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 45 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*0,20 %*
12	Mg	Magnesium	*0,35 %*
13	Al	Aluminum	*0,67 %*
14	Si	Silicon	*1,29 %*
15	P	Phosphorus	*0,19 %*
16	S	Sulfur	*1,78 %*
17	Cl	Chlorine	*0,99 %*
19	K	Potassium	*< 0,014 %*
20	Ca	Calcium	*15,99 %*
22	Ti	Titanium	*0,27 %*
23	V	Vanadium	*< 0,0079 %*
24	Cr	Chromium	*< 0,0054 %*
25	Mn	Manganese	*0,03 %*
26	Fe	Iron	*< 0,00022 %*
27	Co	Cobalt	*3,80 µg/g*
28	Ni	Nickel	*48,30 µg/g*
29	Cu	Copper	*< 1,0 µg/g*
30	Zn	Zinc	*27,70 µg/g*
31	Ga	Gallium	*3,60 µg/g*
32	Ge	Germanium	*1,00 µg/g*
33	As	Arsenic	*2,20 µg/g*
34	Se	Selenium	*< 0,4 µg/g*
35	Br	Bromine	*1,00 µg/g*
37	Rb	Rubidium	*0,40 µg/g*
38	Sr	Strontium	*463,50 µg/g*
39	Y	Yttrium	*< 0,4 µg/g*
40	Zr	Zirconium	*< 15 µg/g*
41	Nb	Niobium	*< 6,2 µg/g*
42	Mo	Molybdenum	*< 5,4 µg/g*
47	Ag	Silver	*< 3,0 µg/g*
48	Cd	Cadmium	*5,90 µg/g*
49	In	Indium	*< 3,0 µg/g*
50	Sn	Tin	*68,40 µg/g*
51	Sb	Antimony	*< 3,1 µg/g*
52	Te	Tellurium	*< 4,6 µg/g*
53	I	Iodine	*< 10 µg/g*
55	Cs	Cesium	*68,40 µg/g*
56	Ba	Barium	*9.677,00 µg/g*
57	La	Lanthanum	*< 16 µg/g*
58	Ce	Cerium	*< 19 µg/g*
74	W	Tungsten	*< 5,1 µg/g*
80	Hg	Mercury	*< 1,1 µg/g*
81	Tl	Thallium	*< 0,9 µg/g*
82	Pb	Lead	*17,00 µg/g*
83	Bi	Bismuth	*< 0,9 µg/g*
90	Th	Thorium	*< 0,6 µg/g*
92	U	Uranium	*< 16 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6335	Fortyndingsmiddel:	None
Beskrivelse:	**KS1 lag 3**	Prøvevægt (g):	9,947
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 45 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*1,53 %*
12	Mg	Magnesium	*0,35 %*
13	Al	Aluminum	*0,61 %*
14	Si	Silicon	*1,18 %*
15	P	Phosphorus	*0,88 %*
16	S	Sulfur	*0,20 %*
17	Cl	Chlorine	*5,21 %*
19	K	Potassium	*< 0,011 %*
20	Ca	Calcium	*15,17 %*
22	Ti	Titanium	*0,09 %*
23	V	Vanadium	*< 0,0025 %*
24	Cr	Chromium	*< 0,0016 %*
25	Mn	Manganese	*0,01 %*
26	Fe	Iron	*0,06 %*
27	Co	Cobalt	*5,60 µg/g*
28	Ni	Nickel	*35,90 µg/g*
29	Cu	Copper	*< 0,8 µg/g*
30	Zn	Zinc	*6,40 µg/g*
31	Ga	Gallium	*2,20 µg/g*
32	Ge	Germanium	*< 0,5 µg/g*
33	As	Arsenic	*0,30 µg/g*
34	Se	Selenium	*< 0,3 µg/g*
35	Br	Bromine	*23,70 µg/g*
37	Rb	Rubidium	*0,60 µg/g*
38	Sr	Strontium	*40,90 µg/g*
39	Y	Yttrium	*1,80 µg/g*
40	Zr	Zirconium	*< 6,6 µg/g*
41	Nb	Niobium	*< 4,3 µg/g*
42	Mo	Molybdenum	*< 3,2 µg/g*
47	Ag	Silver	*< 1,5 µg/g*
48	Cd	Cadmium	*2,90 µg/g*
49	In	Indium	*< 1,4 µg/g*
50	Sn	Tin	*95,20 µg/g*
51	Sb	Antimony	*< 1,5 µg/g*
52	Te	Tellurium	*< 2,8 µg/g*
53	I	Iodine	*< 6,0 µg/g*
55	Cs	Cesium	*15,90 µg/g*
56	Ba	Barium	*653,90 µg/g*
57	La	Lanthanum	*< 9,4 µg/g*
58	Ce	Cerium	*< 13 µg/g*
74	W	Tungsten	*< 3,1 µg/g*
80	Hg	Mercury	*< 0,8 µg/g*
81	Tl	Thallium	*1,00 µg/g*
82	Pb	Lead	*3,90 µg/g*
83	Bi	Bismuth	*< 0,6 µg/g*
90	Th	Thorium	*1,20 µg/g*
92	U	Uranium	*< 9,7 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6338	Fortyndingsmiddel:	None
Beskrivelse:	**KS2 lag 1**	Prøvevægt (g):	2,282
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	< 0,051	%
12	Mg	Magnesium	< 0,013	%
13	Al	Aluminum	0,40	%
14	Si	Silicon	0,20	%
15	P	Phosphorus	0,02	%
16	S	Sulfur	0,11	%
17	Cl	Chlorine	0,13	%
19	K	Potassium	0,04	%
20	Ca	Calcium	0,13	%
22	Ti	Titanium	0,08	%
23	V	Vanadium	0,00	%
24	Cr	Chromium	< 0,00056	%
25	Mn	Manganese	0,00	%
26	Fe	Iron	0,01	%
27	Co	Cobalt	2,30	µg/g
28	Ni	Nickel	68,70	µg/g
29	Cu	Copper	315,10	µg/g
30	Zn	Zinc	177,80	µg/g
31	Ga	Gallium	1,10	µg/g
32	Ge	Germanium	0,20	µg/g
33	As	Arsenic	< 0,3	µg/g
34	Se	Selenium	0,60	µg/g
35	Br	Bromine	5,80	µg/g
37	Rb	Rubidium	0,40	µg/g
38	Sr	Strontium	29,10	µg/g
39	Y	Yttrium	< 0,3	µg/g
40	Zr	Zirconium	< 3,4	µg/g
41	Nb	Niobium	< 2,5	µg/g
42	Mo	Molybdenum	2,80	µg/g
47	Ag	Silver	< 1,1	µg/g
48	Cd	Cadmium	1,00	µg/g
49	In	Indium	< 1,0	µg/g
50	Sn	Tin	< 1,6	µg/g
51	Sb	Antimony	< 1,5	µg/g
52	Te	Tellurium	< 2,4	µg/g
53	I	Iodine	< 4,3	µg/g
55	Cs	Cesium	< 6,6	µg/g
56	Ba	Barium	130,30	µg/g
57	La	Lanthanum	< 14	µg/g
58	Ce	Cerium	< 20	µg/g
74	W	Tungsten	< 4,6	µg/g
80	Hg	Mercury	0,60	µg/g
81	Tl	Thallium	0,60	µg/g
82	Pb	Lead	5,30	µg/g
83	Bi	Bismuth	1,10	µg/g
90	Th	Thorium	< 0,3	µg/g
92	U	Uranium	< 4,9	µg/g

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6339	Fortyndingsmiddel:	None
Beskrivelse:	**KS2 lag 2**	Prøvevægt (g):	2,715
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,12*	*%*
12	Mg	Magnesium	*< 0,031*	*%*
13	Al	Aluminum	*0,77*	*%*
14	Si	Silicon	*1,18*	*%*
15	P	Phosphorus	*0,04*	*%*
16	S	Sulfur	*2,54*	*%*
17	Cl	Chlorine	*0,12*	*%*
19	K	Potassium	*< 0,015*	*%*
20	Ca	Calcium	*6,68*	*%*
22	Ti	Titanium	*0,44*	*%*
23	V	Vanadium	*< 0,0100*	*%*
24	Cr	Chromium	*< 0,0072*	*%*
25	Mn	Manganese	*0,05*	*%*
26	Fe	Iron	*0,01*	*%*
27	Co	Cobalt	*7,30*	*µg/g*
28	Ni	Nickel	*33,70*	*µg/g*
29	Cu	Copper	*49,20*	*µg/g*
30	Zn	Zinc	*44,00*	*µg/g*
31	Ga	Gallium	*3,30*	*µg/g*
32	Ge	Germanium	*< 0,6*	*µg/g*
33	As	Arsenic	*5,60*	*µg/g*
34	Se	Selenium	*0,30*	*µg/g*
35	Br	Bromine	*< 0,4*	*µg/g*
37	Rb	Rubidium	*0,60*	*µg/g*
38	Sr	Strontium	*1.036,00*	*µg/g*
39	Y	Yttrium	*< 0,4*	*µg/g*
40	Zr	Zirconium	*< 22*	*µg/g*
41	Nb	Niobium	*< 7,1*	*µg/g*
42	Mo	Molybdenum	*< 6,3*	*µg/g*
47	Ag	Silver	*< 3,4*	*µg/g*
48	Cd	Cadmium	*6,80*	*µg/g*
49	In	Indium	*< 3,2*	*µg/g*
50	Sn	Tin	*71,00*	*µg/g*
51	Sb	Antimony	*< 3,6*	*µg/g*
52	Te	Tellurium	*< 5,3*	*µg/g*
53	I	Iodine	*< 12*	*µg/g*
55	Cs	Cesium	*99,90*	*µg/g*
56	Ba	Barium	*14.350,00*	*µg/g*
57	La	Lanthanum	*< 17*	*µg/g*
58	Ce	Cerium	*< 20*	*µg/g*
74	W	Tungsten	*< 5,2*	*µg/g*
80	Hg	Mercury	*< 1,1*	*µg/g*
81	Tl	Thallium	*< 1,0*	*µg/g*
82	Pb	Lead	*10,20*	*µg/g*
83	Bi	Bismuth	*< 0,9*	*µg/g*
90	Th	Thorium	*< 0,6*	*µg/g*
92	U	Uranium	*39,00*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6340	Fortyndingsmiddel:	None
Beskrivelse:	**KS2 lag 3**	Prøvevægt (g):	2,261
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 45 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,11*	*%*
12	Mg	Magnesium	*< 0,028*	*%*
13	Al	Aluminum	*0,78*	*%*
14	Si	Silicon	*1,07*	*%*
15	P	Phosphorus	*0,05*	*%*
16	S	Sulfur	*2,09*	*%*
17	Cl	Chlorine	*0,14*	*%*
19	K	Potassium	*< 0,016*	*%*
20	Ca	Calcium	*6,19*	*%*
22	Ti	Titanium	*0,34*	*%*
23	V	Vanadium	*< 0,0097*	*%*
24	Cr	Chromium	*< 0,0072*	*%*
25	Mn	Manganese	*0,05*	*%*
26	Fe	Iron	*0,01*	*%*
27	Co	Cobalt	*6,80*	*µg/g*
28	Ni	Nickel	*29,70*	*µg/g*
29	Cu	Copper	*39,20*	*µg/g*
30	Zn	Zinc	*50,70*	*µg/g*
31	Ga	Gallium	*2,70*	*µg/g*
32	Ge	Germanium	*1,70*	*µg/g*
33	As	Arsenic	*6,30*	*µg/g*
34	Se	Selenium	*< 0,5*	*µg/g*
35	Br	Bromine	*0,80*	*µg/g*
37	Rb	Rubidium	*0,40*	*µg/g*
38	Sr	Strontium	*1.031,00*	*µg/g*
39	Y	Yttrium	*< 0,4*	*µg/g*
40	Zr	Zirconium	*< 24*	*µg/g*
41	Nb	Niobium	*< 7,9*	*µg/g*
42	Mo	Molybdenum	*< 6,1*	*µg/g*
47	Ag	Silver	*< 3,5*	*µg/g*
48	Cd	Cadmium	*6,10*	*µg/g*
49	In	Indium	*< 3,4*	*µg/g*
50	Sn	Tin	*78,80*	*µg/g*
51	Sb	Antimony	*< 4,0*	*µg/g*
52	Te	Tellurium	*< 5,7*	*µg/g*
53	I	Iodine	*< 12*	*µg/g*
55	Cs	Cesium	*92,20*	*µg/g*
56	Ba	Barium	*14.530,00*	*µg/g*
57	La	Lanthanum	*< 17*	*µg/g*
58	Ce	Cerium	*< 20*	*µg/g*
74	W	Tungsten	*< 5,5*	*µg/g*
80	Hg	Mercury	*< 1,3*	*µg/g*
81	Tl	Thallium	*1,00*	*µg/g*
82	Pb	Lead	*10,40*	*µg/g*
83	Bi	Bismuth	*< 0,9*	*µg/g*
90	Th	Thorium	*< 0,6*	*µg/g*
92	U	Uranium	*< 18*	*µg/g*

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6329	Fortyndingsmiddel:	None
Beskrivelse:	**KS3 lag 1**	Prøvevægt (g):	1,41
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	14-feb-13
Prøve status:	AAAXXX	Dato for beregning:	14-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,078 %*
12	Mg	Magnesium	*< 0,019 %*
13	Al	Aluminum	*0,62 %*
14	Si	Silicon	*0,31 %*
15	P	Phosphorus	*< 0,00071 %*
16	S	Sulfur	*0,11 %*
17	Cl	Chlorine	*0,05 %*
19	K	Potassium	*< 0,0092 %*
20	Ca	Calcium	*0,08 %*
22	Ti	Titanium	*0,72 %*
23	V	Vanadium	*< 0,0019 %*
24	Cr	Chromium	*< 0,00042 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*0,60 µg/g*
28	Ni	Nickel	*54,00 µg/g*
29	Cu	Copper	*< 1,0 µg/g*
30	Zn	Zinc	*1,00 µg/g*
31	Ga	Gallium	*1,20 µg/g*
32	Ge	Germanium	*< 0,3 µg/g*
33	As	Arsenic	*< 0,3 µg/g*
34	Se	Selenium	*< 0,3 µg/g*
35	Br	Bromine	*206,40 µg/g*
37	Rb	Rubidium	*< 0,7 µg/g*
38	Sr	Strontium	*0,80 µg/g*
39	Y	Yttrium	*0,40 µg/g*
40	Zr	Zirconium	*< 5,3 µg/g*
41	Nb	Niobium	*< 4,0 µg/g*
42	Mo	Molybdenum	*< 3,8 µg/g*
47	Ag	Silver	*< 1,8 µg/g*
48	Cd	Cadmium	*1,70 µg/g*
49	In	Indium	*< 1,7 µg/g*
50	Sn	Tin	*< 3,0 µg/g*
51	Sb	Antimony	*65,60 µg/g*
52	Te	Tellurium	*< 3,9 µg/g*
53	I	Iodine	*< 6,7 µg/g*
55	Cs	Cesium	*< 11 µg/g*
56	Ba	Barium	*< 18 µg/g*
57	La	Lanthanum	*< 24 µg/g*
58	Ce	Cerium	*< 35 µg/g*
74	W	Tungsten	*< 3,2 µg/g*
80	Hg	Mercury	*< 0,6 µg/g*
81	Tl	Thallium	*0,80 µg/g*
82	Pb	Lead	*1,80 µg/g*
83	Bi	Bismuth	*< 0,4 µg/g*
90	Th	Thorium	*1,30 µg/g*
92	U	Uranium	*< 8,8 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6330	Fortyndingsmiddel:	None
Beskrivelse:	**KS3 lag 2**	Prøvevægt (g):	1,195
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	14-feb-13
Prøve status:	AAAXXX	Dato for beregning:	14-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,093 %*
12	Mg	Magnesium	*1,23 %*
13	Al	Aluminum	*0,70 %*
14	Si	Silicon	*1,65 %*
15	P	Phosphorus	*< 0,0036 %*
16	S	Sulfur	*0,02 %*
17	Cl	Chlorine	*0,18 %*
19	K	Potassium	*< 0,014 %*
20	Ca	Calcium	*30,01 %*
22	Ti	Titanium	*< 0,0012 %*
23	V	Vanadium	*< 0,00095 %*
24	Cr	Chromium	*0,00 %*
25	Mn	Manganese	*0,01 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*< 2,7 µg/g*
28	Ni	Nickel	*84,00 µg/g*
29	Cu	Copper	*< 0,7 µg/g*
30	Zn	Zinc	*< 1,0 µg/g*
31	Ga	Gallium	*3,20 µg/g*
32	Ge	Germanium	*< 0,4 µg/g*
33	As	Arsenic	*< 0,4 µg/g*
34	Se	Selenium	*< 0,3 µg/g*
35	Br	Bromine	*< 0,3 µg/g*
37	Rb	Rubidium	*< 0,3 µg/g*
38	Sr	Strontium	*23,20 µg/g*
39	Y	Yttrium	*1,30 µg/g*
40	Zr	Zirconium	*< 7,2 µg/g*
41	Nb	Niobium	*< 4,1 µg/g*
42	Mo	Molybdenum	*< 4,3 µg/g*
47	Ag	Silver	*< 2,0 µg/g*
48	Cd	Cadmium	*0,70 µg/g*
49	In	Indium	*< 2,0 µg/g*
50	Sn	Tin	*74,00 µg/g*
51	Sb	Antimony	*< 2,3 µg/g*
52	Te	Tellurium	*< 3,1 µg/g*
53	I	Iodine	*< 7,6 µg/g*
55	Cs	Cesium	*< 8,0 µg/g*
56	Ba	Barium	*< 13 µg/g*
57	La	Lanthanum	*< 18 µg/g*
58	Ce	Cerium	*< 27 µg/g*
74	W	Tungsten	*< 4,4 µg/g*
80	Hg	Mercury	*< 0,7 µg/g*
81	Tl	Thallium	*< 0,7 µg/g*
82	Pb	Lead	*3,20 µg/g*
83	Bi	Bismuth	*< 0,6 µg/g*
90	Th	Thorium	*0,80 µg/g*
92	U	Uranium	*< 7,4 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6331	Fortyndingsmiddel:	None
Beskrivelse:	**KS3 lag 3**	Prøvevægt (g):	3,78
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	14-feb-13
Prøve status:	AAAXXX	Dato for beregning:	14-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,089 %*
12	Mg	Magnesium	*1,47 %*
13	Al	Aluminum	*0,68 %*
14	Si	Silicon	*0,97 %*
15	P	Phosphorus	*< 0,0039 %*
16	S	Sulfur	*0,03 %*
17	Cl	Chlorine	*0,10 %*
19	K	Potassium	*< 0,013 %*
20	Ca	Calcium	*36,23 %*
22	Ti	Titanium	*0,01 %*
23	V	Vanadium	*< 0,0010 %*
24	Cr	Chromium	*< 0,00069 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*0,01 %*
27	Co	Cobalt	*5,40 µg/g*
28	Ni	Nickel	*39,90 µg/g*
29	Cu	Copper	*< 0,7 µg/g*
30	Zn	Zinc	*8,90 µg/g*
31	Ga	Gallium	*3,00 µg/g*
32	Ge	Germanium	*< 0,4 µg/g*
33	As	Arsenic	*< 0,5 µg/g*
34	Se	Selenium	*< 0,3 µg/g*
35	Br	Bromine	*0,60 µg/g*
37	Rb	Rubidium	*0,80 µg/g*
38	Sr	Strontium	*44,20 µg/g*
39	Y	Yttrium	*1,50 µg/g*
40	Zr	Zirconium	*< 7,2 µg/g*
41	Nb	Niobium	*< 4,2 µg/g*
42	Mo	Molybdenum	*< 3,3 µg/g*
47	Ag	Silver	*< 1,0 µg/g*
48	Cd	Cadmium	*0,90 µg/g*
49	In	Indium	*< 1,3 µg/g*
50	Sn	Tin	*54,50 µg/g*
51	Sb	Antimony	*< 1,2 µg/g*
52	Te	Tellurium	*< 1,9 µg/g*
53	I	Iodine	*< 4,4 µg/g*
55	Cs	Cesium	*< 4,6 µg/g*
56	Ba	Barium	*< 7,4 µg/g*
57	La	Lanthanum	*< 9,0 µg/g*
58	Ce	Cerium	*< 14 µg/g*
74	W	Tungsten	*< 3,6 µg/g*
80	Hg	Mercury	*< 0,8 µg/g*
81	Tl	Thallium	*< 0,7 µg/g*
82	Pb	Lead	*3,50 µg/g*
83	Bi	Bismuth	*< 0,6 µg/g*
90	Th	Thorium	*< 0,6 µg/g*
92	U	Uranium	*< 9,0 µg/g*

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6332	Fortyndingsmiddel:	None
Beskrivelse:	**KS3 lag 4**	Prøvevægt (g):	3,337
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 45 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	14-feb-13
Prøve status:	AAAXXX	Dato for beregning:	14-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,089*	*%*
12	Mg	Magnesium	*1,30*	*%*
13	Al	Aluminum	*0,69*	*%*
14	Si	Silicon	*0,94*	*%*
15	P	Phosphorus	*< 0,0038*	*%*
16	S	Sulfur	*0,03*	*%*
17	Cl	Chlorine	*0,07*	*%*
19	K	Potassium	*< 0,012*	*%*
20	Ca	Calcium	*34,21*	*%*
22	Ti	Titanium	*< 0,0014*	*%*
23	V	Vanadium	*< 0,0010*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*< 2,8*	*µg/g*
28	Ni	Nickel	*43,70*	*µg/g*
29	Cu	Copper	*4,90*	*µg/g*
30	Zn	Zinc	*2,80*	*µg/g*
31	Ga	Gallium	*2,10*	*µg/g*
32	Ge	Germanium	*< 0,6*	*µg/g*
33	As	Arsenic	*< 0,6*	*µg/g*
34	Se	Selenium	*< 0,3*	*µg/g*
35	Br	Bromine	*0,40*	*µg/g*
37	Rb	Rubidium	*< 0,3*	*µg/g*
38	Sr	Strontium	*39,50*	*µg/g*
39	Y	Yttrium	*1,50*	*µg/g*
40	Zr	Zirconium	*< 5,3*	*µg/g*
41	Nb	Niobium	*< 3,1*	*µg/g*
42	Mo	Molybdenum	*< 3,0*	*µg/g*
47	Ag	Silver	*< 1,2*	*µg/g*
48	Cd	Cadmium	*2,60*	*µg/g*
49	In	Indium	*< 1,4*	*µg/g*
50	Sn	Tin	*58,40*	*µg/g*
51	Sb	Antimony	*< 1,5*	*µg/g*
52	Te	Tellurium	*< 2,1*	*µg/g*
53	I	Iodine	*< 4,5*	*µg/g*
55	Cs	Cesium	*< 4,5*	*µg/g*
56	Ba	Barium	*< 7,5*	*µg/g*
57	La	Lanthanum	*< 9,2*	*µg/g*
58	Ce	Cerium	*< 13*	*µg/g*
74	W	Tungsten	*< 4,0*	*µg/g*
80	Hg	Mercury	*< 0,9*	*µg/g*
81	Tl	Thallium	*< 0,7*	*µg/g*
82	Pb	Lead	*4,80*	*µg/g*
83	Bi	Bismuth	*< 0,6*	*µg/g*
90	Th	Thorium	*< 0,5*	*µg/g*
92	U	Uranium	*< 9,1*	*µg/g*

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6352	Fortyndingsmiddel:	None
Beskrivelse:	**M1 lag 1**	Prøvevægt (g):	2,91
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 45 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,066*	*%*
12	Mg	Magnesium	*0,09*	*%*
13	Al	Aluminum	*0,38*	*%*
14	Si	Silicon	*0,21*	*%*
15	P	Phosphorus	*0,02*	*%*
16	S	Sulfur	*0,02*	*%*
17	Cl	Chlorine	*0,02*	*%*
19	K	Potassium	*< 0,0079*	*%*
20	Ca	Calcium	*0,07*	*%*
22	Ti	Titanium	*0,53*	*%*
23	V	Vanadium	*< 0,0014*	*%*
24	Cr	Chromium	*< 0,00034*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*0,70*	*µg/g*
28	Ni	Nickel	*70,50*	*µg/g*
29	Cu	Copper	*< 0,5*	*µg/g*
30	Zn	Zinc	*2,30*	*µg/g*
31	Ga	Gallium	*1,10*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,2*	*µg/g*
34	Se	Selenium	*0,50*	*µg/g*
35	Br	Bromine	*1,30*	*µg/g*
37	Rb	Rubidium	*0,40*	*µg/g*
38	Sr	Strontium	*0,80*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 3,6*	*µg/g*
41	Nb	Niobium	*< 2,6*	*µg/g*
42	Mo	Molybdenum	*1,40*	*µg/g*
47	Ag	Silver	*< 1,0*	*µg/g*
48	Cd	Cadmium	*0,60*	*µg/g*
49	In	Indium	*< 1,3*	*µg/g*
50	Sn	Tin	*< 1,7*	*µg/g*
51	Sb	Antimony	*53,10*	*µg/g*
52	Te	Tellurium	*< 2,3*	*µg/g*
53	I	Iodine	*< 4,4*	*µg/g*
55	Cs	Cesium	*< 6,4*	*µg/g*
56	Ba	Barium	*< 10*	*µg/g*
57	La	Lanthanum	*< 14*	*µg/g*
58	Ce	Cerium	*< 20*	*µg/g*
74	W	Tungsten	*< 2,8*	*µg/g*
80	Hg	Mercury	*0,50*	*µg/g*
81	Tl	Thallium	*0,40*	*µg/g*
82	Pb	Lead	*1,70*	*µg/g*
83	Bi	Bismuth	*< 0,3*	*µg/g*
90	Th	Thorium	*0,30*	*µg/g*
92	U	Uranium	*< 5,1*	*µg/g*

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6353	Fortyndingsmiddel:	None
Beskrivelse:	**M1 lag 2**	Prøvevægt (g):	2,663
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,11*	*%*
12	Mg	Magnesium	*0,11*	*%*
13	Al	Aluminum	*0,73*	*%*
14	Si	Silicon	*0,76*	*%*
15	P	Phosphorus	*0,04*	*%*
16	S	Sulfur	*0,34*	*%*
17	Cl	Chlorine	*0,06*	*%*
19	K	Potassium	*< 0,016*	*%*
20	Ca	Calcium	*0,11*	*%*
22	Ti	Titanium	*1,07*	*%*
23	V	Vanadium	*0,01*	*%*
24	Cr	Chromium	*< 0,0013*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,00034*	*%*
27	Co	Cobalt	*12,30*	*µg/g*
28	Ni	Nickel	*161,10*	*µg/g*
29	Cu	Copper	*< 0,9*	*µg/g*
30	Zn	Zinc	*8,20*	*µg/g*
31	Ga	Gallium	*2,40*	*µg/g*
32	Ge	Germanium	*0,30*	*µg/g*
33	As	Arsenic	*< 0,4*	*µg/g*
34	Se	Selenium	*< 0,3*	*µg/g*
35	Br	Bromine	*1,30*	*µg/g*
37	Rb	Rubidium	*0,30*	*µg/g*
38	Sr	Strontium	*12,80*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 6,6*	*µg/g*
41	Nb	Niobium	*< 3,9*	*µg/g*
42	Mo	Molybdenum	*< 3,0*	*µg/g*
47	Ag	Silver	*< 1,4*	*µg/g*
48	Cd	Cadmium	*1,50*	*µg/g*
49	In	Indium	*< 1,4*	*µg/g*
50	Sn	Tin	*< 2,4*	*µg/g*
51	Sb	Antimony	*35,30*	*µg/g*
52	Te	Tellurium	*< 2,7*	*µg/g*
53	I	Iodine	*< 4,4*	*µg/g*
55	Cs	Cesium	*< 6,5*	*µg/g*
56	Ba	Barium	*157,40*	*µg/g*
57	La	Lanthanum	*< 13*	*µg/g*
58	Ce	Cerium	*< 19*	*µg/g*
74	W	Tungsten	*< 6,0*	*µg/g*
80	Hg	Mercury	*< 0,8*	*µg/g*
81	Tl	Thallium	*< 0,5*	*µg/g*
82	Pb	Lead	*1,80*	*µg/g*
83	Bi	Bismuth	*< 0,5*	*µg/g*
90	Th	Thorium	*< 0,4*	*µg/g*
92	U	Uranium	*< 7,3*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6369	Fortyndingsmiddel:	None
Beskrivelse:	**M1 lag 3**	Prøvevægt (g):	0,784
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,061*	*%*
12	Mg	Magnesium	*1,00*	*%*
13	Al	Aluminum	*0,36*	*%*
14	Si	Silicon	*0,46*	*%*
15	P	Phosphorus	*< 0,0026*	*%*
16	S	Sulfur	*0,01*	*%*
17	Cl	Chlorine	*0,03*	*%*
19	K	Potassium	*< 0,0083*	*%*
20	Ca	Calcium	*33,85*	*%*
22	Ti	Titanium	*0,01*	*%*
23	V	Vanadium	*< 0,0010*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*0,01*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*3,50*	*µg/g*
28	Ni	Nickel	*56,00*	*µg/g*
29	Cu	Copper	*< 0,4*	*µg/g*
30	Zn	Zinc	*13,70*	*µg/g*
31	Ga	Gallium	*1,90*	*µg/g*
32	Ge	Germanium	*< 0,4*	*µg/g*
33	As	Arsenic	*< 0,4*	*µg/g*
34	Se	Selenium	*0,60*	*µg/g*
35	Br	Bromine	*0,40*	*µg/g*
37	Rb	Rubidium	*0,60*	*µg/g*
38	Sr	Strontium	*21,20*	*µg/g*
39	Y	Yttrium	*0,80*	*µg/g*
40	Zr	Zirconium	*< 5,5*	*µg/g*
41	Nb	Niobium	*< 4,0*	*µg/g*
42	Mo	Molybdenum	*< 4,2*	*µg/g*
47	Ag	Silver	*< 2,7*	*µg/g*
48	Cd	Cadmium	*3,00*	*µg/g*
49	In	Indium	*< 2,2*	*µg/g*
50	Sn	Tin	*< 3,3*	*µg/g*
51	Sb	Antimony	*< 2,9*	*µg/g*
52	Te	Tellurium	*< 4,2*	*µg/g*
53	I	Iodine	*< 7,7*	*µg/g*
55	Cs	Cesium	*< 12*	*µg/g*
56	Ba	Barium	*< 18*	*µg/g*
57	La	Lanthanum	*< 26*	*µg/g*
58	Ce	Cerium	*< 37*	*µg/g*
74	W	Tungsten	*< 3,3*	*µg/g*
80	Hg	Mercury	*< 0,7*	*µg/g*
81	Tl	Thallium	*< 0,6*	*µg/g*
82	Pb	Lead	*2,50*	*µg/g*
83	Bi	Bismuth	*1,10*	*µg/g*
90	Th	Thorium	*< 0,5*	*µg/g*
92	U	Uranium	*10,80*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6370	Fortyndingsmiddel:	None
Beskrivelse:	**M1 lag 4**	Prøvevægt (g):	2,277
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 25 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,096*	*%*
12	Mg	Magnesium	*< 0,026*	*%*
13	Al	Aluminum	*0,69*	*%*
14	Si	Silicon	*0,81*	*%*
15	P	Phosphorus	*< 0,0025*	*%*
16	S	Sulfur	*0,01*	*%*
17	Cl	Chlorine	*0,04*	*%*
19	K	Potassium	*< 0,015*	*%*
20	Ca	Calcium	*9,38*	*%*
22	Ti	Titanium	*0,00*	*%*
23	V	Vanadium	*< 0,0010*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*< 0,00036*	*%*
26	Fe	Iron	*< 0,00019*	*%*
27	Co	Cobalt	*3,80*	*µg/g*
28	Ni	Nickel	*159,00*	*µg/g*
29	Cu	Copper	*< 0,9*	*µg/g*
30	Zn	Zinc	*< 1,0*	*µg/g*
31	Ga	Gallium	*3,10*	*µg/g*
32	Ge	Germanium	*< 0,4*	*µg/g*
33	As	Arsenic	*< 0,4*	*µg/g*
34	Se	Selenium	*0,20*	*µg/g*
35	Br	Bromine	*< 0,3*	*µg/g*
37	Rb	Rubidium	*0,30*	*µg/g*
38	Sr	Strontium	*5,00*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 7,7*	*µg/g*
41	Nb	Niobium	*< 5,0*	*µg/g*
42	Mo	Molybdenum	*< 3,3*	*µg/g*
47	Ag	Silver	*< 1,9*	*µg/g*
48	Cd	Cadmium	*1,00*	*µg/g*
49	In	Indium	*< 1,0*	*µg/g*
50	Sn	Tin	*46,40*	*µg/g*
51	Sb	Antimony	*< 1,4*	*µg/g*
52	Te	Tellurium	*< 2,1*	*µg/g*
53	I	Iodine	*< 4,4*	*µg/g*
55	Cs	Cesium	*< 4,7*	*µg/g*
56	Ba	Barium	*< 7,5*	*µg/g*
57	La	Lanthanum	*< 8,0*	*µg/g*
58	Ce	Cerium	*< 11*	*µg/g*
74	W	Tungsten	*< 5,4*	*µg/g*
80	Hg	Mercury	*< 0,7*	*µg/g*
81	Tl	Thallium	*< 0,6*	*µg/g*
82	Pb	Lead	*1,00*	*µg/g*
83	Bi	Bismuth	*< 0,5*	*µg/g*
90	Th	Thorium	*0,90*	*µg/g*
92	U	Uranium	*< 11*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6360	Fortyndingsmiddel:	None
Beskrivelse:	**M2 lag 1**	Prøvevægt (g):	2,887
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,054*	*%*
12	Mg	Magnesium	*< 0,013*	*%*
13	Al	Aluminum	*0,30*	*%*
14	Si	Silicon	*0,16*	*%*
15	P	Phosphorus	*< 0,0050*	*%*
16	S	Sulfur	*0,02*	*%*
17	Cl	Chlorine	*0,02*	*%*
19	K	Potassium	*< 0,0065*	*%*
20	Ca	Calcium	*0,03*	*%*
22	Ti	Titanium	*0,44*	*%*
23	V	Vanadium	*< 0,0013*	*%*
24	Cr	Chromium	*< 0,00030*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*1,50*	*µg/g*
28	Ni	Nickel	*46,60*	*µg/g*
29	Cu	Copper	*< 0,4*	*µg/g*
30	Zn	Zinc	*3,50*	*µg/g*
31	Ga	Gallium	*0,40*	*µg/g*
32	Ge	Germanium	*< 0,2*	*µg/g*
33	As	Arsenic	*< 0,2*	*µg/g*
34	Se	Selenium	*0,70*	*µg/g*
35	Br	Bromine	*0,40*	*µg/g*
37	Rb	Rubidium	*0,60*	*µg/g*
38	Sr	Strontium	*0,70*	*µg/g*
39	Y	Yttrium	*0,30*	*µg/g*
40	Zr	Zirconium	*6,80*	*µg/g*
41	Nb	Niobium	*< 2,9*	*µg/g*
42	Mo	Molybdenum	*< 2,3*	*µg/g*
47	Ag	Silver	*< 1,2*	*µg/g*
48	Cd	Cadmium	*1,80*	*µg/g*
49	In	Indium	*< 1,2*	*µg/g*
50	Sn	Tin	*< 1,6*	*µg/g*
51	Sb	Antimony	*43,40*	*µg/g*
52	Te	Tellurium	*< 2,3*	*µg/g*
53	I	Iodine	*< 3,9*	*µg/g*
55	Cs	Cesium	*< 6,1*	*µg/g*
56	Ba	Barium	*< 9,7*	*µg/g*
57	La	Lanthanum	*< 13*	*µg/g*
58	Ce	Cerium	*< 18*	*µg/g*
74	W	Tungsten	*< 2,3*	*µg/g*
80	Hg	Mercury	*0,90*	*µg/g*
81	Tl	Thallium	*< 2,0*	*µg/g*
82	Pb	Lead	*1,50*	*µg/g*
83	Bi	Bismuth	*1,00*	*µg/g*
90	Th	Thorium	*0,40*	*µg/g*
92	U	Uranium	*< 5,3*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6361	Fortyndingsmiddel:	None
Beskrivelse:	**M2 lag 2**	Prøvevægt (g):	1,391
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,10 %*
12	Mg	Magnesium	*0,05 %*
13	Al	Aluminum	*0,58 %*
14	Si	Silicon	*0,32 %*
15	P	Phosphorus	*0,01 %*
16	S	Sulfur	*0,03 %*
17	Cl	Chlorine	*0,06 %*
19	K	Potassium	*< 0,013 %*
20	Ca	Calcium	*0,09 %*
22	Ti	Titanium	*0,63 %*
23	V	Vanadium	*< 0,0020 %*
24	Cr	Chromium	*0,00 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*< 0,00028 %*
27	Co	Cobalt	*9,10 µg/g*
28	Ni	Nickel	*76,30 µg/g*
29	Cu	Copper	*< 0,5 µg/g*
30	Zn	Zinc	*< 1,0 µg/g*
31	Ga	Gallium	*1,40 µg/g*
32	Ge	Germanium	*< 0,4 µg/g*
33	As	Arsenic	*< 0,3 µg/g*
34	Se	Selenium	*< 0,2 µg/g*
35	Br	Bromine	*1,20 µg/g*
37	Rb	Rubidium	*< 0,2 µg/g*
38	Sr	Strontium	*0,80 µg/g*
39	Y	Yttrium	*0,50 µg/g*
40	Zr	Zirconium	*< 5,2 µg/g*
41	Nb	Niobium	*< 4,2 µg/g*
42	Mo	Molybdenum	*< 3,6 µg/g*
47	Ag	Silver	*< 1,9 µg/g*
48	Cd	Cadmium	*< 1,7 µg/g*
49	In	Indium	*< 1,7 µg/g*
50	Sn	Tin	*< 2,8 µg/g*
51	Sb	Antimony	*75,00 µg/g*
52	Te	Tellurium	*< 3,1 µg/g*
53	I	Iodine	*< 5,3 µg/g*
55	Cs	Cesium	*< 8,2 µg/g*
56	Ba	Barium	*< 13 µg/g*
57	La	Lanthanum	*< 17 µg/g*
58	Ce	Cerium	*< 24 µg/g*
74	W	Tungsten	*< 3,7 µg/g*
80	Hg	Mercury	*< 0,6 µg/g*
81	Tl	Thallium	*0,40 µg/g*
82	Pb	Lead	*1,70 µg/g*
83	Bi	Bismuth	*< 0,4 µg/g*
90	Th	Thorium	*0,50 µg/g*
92	U	Uranium	*< 6,4 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6362	Fortyndingsmiddel:	None
Beskrivelse:	**M2 lag 3**	Prøvevægt (g):	0,977
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,080*	*%*
12	Mg	Magnesium	*< 0,019*	*%*
13	Al	Aluminum	*0,67*	*%*
14	Si	Silicon	*0,37*	*%*
15	P	Phosphorus	*0,03*	*%*
16	S	Sulfur	*0,02*	*%*
17	Cl	Chlorine	*0,06*	*%*
19	K	Potassium	*< 0,011*	*%*
20	Ca	Calcium	*0,04*	*%*
22	Ti	Titanium	*1,36*	*%*
23	V	Vanadium	*< 0,0023*	*%*
24	Cr	Chromium	*< 0,00034*	*%*
25	Mn	Manganese	*< 0,00022*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*1,50*	*µg/g*
28	Ni	Nickel	*112,40*	*µg/g*
29	Cu	Copper	*< 0,4*	*µg/g*
30	Zn	Zinc	*0,80*	*µg/g*
31	Ga	Gallium	*1,00*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,3*	*µg/g*
34	Se	Selenium	*< 0,2*	*µg/g*
35	Br	Bromine	*0,30*	*µg/g*
37	Rb	Rubidium	*0,30*	*µg/g*
38	Sr	Strontium	*0,70*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 4,8*	*µg/g*
41	Nb	Niobium	*5,10*	*µg/g*
42	Mo	Molybdenum	*< 3,6*	*µg/g*
47	Ag	Silver	*< 2,2*	*µg/g*
48	Cd	Cadmium	*< 1,8*	*µg/g*
49	In	Indium	*< 2,1*	*µg/g*
50	Sn	Tin	*< 3,1*	*µg/g*
51	Sb	Antimony	*< 2,6*	*µg/g*
52	Te	Tellurium	*< 3,5*	*µg/g*
53	I	Iodine	*< 7,0*	*µg/g*
55	Cs	Cesium	*< 10*	*µg/g*
56	Ba	Barium	*< 15*	*µg/g*
57	La	Lanthanum	*< 22*	*µg/g*
58	Ce	Cerium	*< 31*	*µg/g*
74	W	Tungsten	*< 3,4*	*µg/g*
80	Hg	Mercury	*< 0,5*	*µg/g*
81	Tl	Thallium	*0,80*	*µg/g*
82	Pb	Lead	*1,70*	*µg/g*
83	Bi	Bismuth	*0,40*	*µg/g*
90	Th	Thorium	*< 0,4*	*µg/g*
92	U	Uranium	*< 7,6*	*µg/g*

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6363	Fortyndingsmiddel:	None
Beskrivelse:	**M2 lag 4**	Prøvevægt (g):	6,865
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,093*	*%*
12	Mg	Magnesium	*< 0,025*	*%*
13	Al	Aluminum	*0,68*	*%*
14	Si	Silicon	*0,71*	*%*
15	P	Phosphorus	*< 0,0029*	*%*
16	S	Sulfur	*0,02*	*%*
17	Cl	Chlorine	*0,13*	*%*
19	K	Potassium	*< 0,014*	*%*
20	Ca	Calcium	*13,93*	*%*
22	Ti	Titanium	*< 0,00099*	*%*
23	V	Vanadium	*< 0,00092*	*%*
24	Cr	Chromium	*< 0,00068*	*%*
25	Mn	Manganese	*< 0,00040*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*3,80*	*µg/g*
28	Ni	Nickel	*112,70*	*µg/g*
29	Cu	Copper	*< 0,8*	*µg/g*
30	Zn	Zinc	*< 1,0*	*µg/g*
31	Ga	Gallium	*2,40*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,4*	*µg/g*
34	Se	Selenium	*< 0,3*	*µg/g*
35	Br	Bromine	*< 0,3*	*µg/g*
37	Rb	Rubidium	*0,40*	*µg/g*
38	Sr	Strontium	*7,60*	*µg/g*
39	Y	Yttrium	*0,30*	*µg/g*
40	Zr	Zirconium	*< 6,4*	*µg/g*
41	Nb	Niobium	*< 4,2*	*µg/g*
42	Mo	Molybdenum	*< 3,0*	*µg/g*
47	Ag	Silver	*< 1,3*	*µg/g*
48	Cd	Cadmium	*1,70*	*µg/g*
49	In	Indium	*< 1,5*	*µg/g*
50	Sn	Tin	*31,40*	*µg/g*
51	Sb	Antimony	*< 1,5*	*µg/g*
52	Te	Tellurium	*< 1,8*	*µg/g*
53	I	Iodine	*< 3,8*	*µg/g*
55	Cs	Cesium	*< 4,2*	*µg/g*
56	Ba	Barium	*< 7,0*	*µg/g*
57	La	Lanthanum	*< 8,3*	*µg/g*
58	Ce	Cerium	*< 11*	*µg/g*
74	W	Tungsten	*< 4,8*	*µg/g*
80	Hg	Mercury	*< 0,7*	*µg/g*
81	Tl	Thallium	*< 0,6*	*µg/g*
82	Pb	Lead	*1,70*	*µg/g*
83	Bi	Bismuth	*< 0,5*	*µg/g*
90	Th	Thorium	*0,90*	*µg/g*
92	U	Uranium	*< 9,2*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6356	Fortyndingsmiddel:	None
Beskrivelse:	**M3 lag 1**	Prøvevægt (g):	4,184
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,047*	*%*
12	Mg	Magnesium	*0,12*	*%*
13	Al	Aluminum	*0,22*	*%*
14	Si	Silicon	*0,12*	*%*
15	P	Phosphorus	*0,01*	*%*
16	S	Sulfur	*1,24*	*%*
17	Cl	Chlorine	*0,06*	*%*
19	K	Potassium	*0,03*	*%*
20	Ca	Calcium	*0,77*	*%*
22	Ti	Titanium	*< 0,00041*	*%*
23	V	Vanadium	*< 0,00038*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*2,10*	*µg/g*
28	Ni	Nickel	*12,10*	*µg/g*
29	Cu	Copper	*< 0,4*	*µg/g*
30	Zn	Zinc	*4,20*	*µg/g*
31	Ga	Gallium	*0,80*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,2*	*µg/g*
34	Se	Selenium	*0,40*	*µg/g*
35	Br	Bromine	*0,70*	*µg/g*
37	Rb	Rubidium	*0,80*	*µg/g*
38	Sr	Strontium	*12,30*	*µg/g*
39	Y	Yttrium	*1,90*	*µg/g*
40	Zr	Zirconium	*< 3,5*	*µg/g*
41	Nb	Niobium	*< 2,7*	*µg/g*
42	Mo	Molybdenum	*< 2,5*	*µg/g*
47	Ag	Silver	*< 1,4*	*µg/g*
48	Cd	Cadmium	*1,70*	*µg/g*
49	In	Indium	*< 1,2*	*µg/g*
50	Sn	Tin	*< 1,7*	*µg/g*
51	Sb	Antimony	*< 1,4*	*µg/g*
52	Te	Tellurium	*< 2,3*	*µg/g*
53	I	Iodine	*5,70*	*µg/g*
55	Cs	Cesium	*< 6,5*	*µg/g*
56	Ba	Barium	*< 11*	*µg/g*
57	La	Lanthanum	*< 14*	*µg/g*
58	Ce	Cerium	*< 20*	*µg/g*
74	W	Tungsten	*< 1,7*	*µg/g*
80	Hg	Mercury	*1,40*	*µg/g*
81	Tl	Thallium	*1,00*	*µg/g*
82	Pb	Lead	*1,50*	*µg/g*
83	Bi	Bismuth	*< 0,4*	*µg/g*
90	Th	Thorium	*0,80*	*µg/g*
92	U	Uranium	*< 5,5*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6357	Fortyndingsmiddel:	None
Beskrivelse:	**M3 lag 2**	Prøvevægt (g):	4,806
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,093*	*%*
12	Mg	Magnesium	*0,08*	*%*
13	Al	Aluminum	*0,70*	*%*
14	Si	Silicon	*0,74*	*%*
15	P	Phosphorus	*< 0,0010*	*%*
16	S	Sulfur	*0,05*	*%*
17	Cl	Chlorine	*0,05*	*%*
19	K	Potassium	*< 0,013*	*%*
20	Ca	Calcium	*0,05*	*%*
22	Ti	Titanium	*< 0,00077*	*%*
23	V	Vanadium	*< 0,00086*	*%*
24	Cr	Chromium	*< 0,00064*	*%*
25	Mn	Manganese	*< 0,00027*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*< 1,5*	*µg/g*
28	Ni	Nickel	*212,30*	*µg/g*
29	Cu	Copper	*< 0,8*	*µg/g*
30	Zn	Zinc	*< 1,0*	*µg/g*
31	Ga	Gallium	*2,50*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,3*	*µg/g*
34	Se	Selenium	*< 0,2*	*µg/g*
35	Br	Bromine	*0,30*	*µg/g*
37	Rb	Rubidium	*< 0,2*	*µg/g*
38	Sr	Strontium	*< 0,2*	*µg/g*
39	Y	Yttrium	*< 0,2*	*µg/g*
40	Zr	Zirconium	*< 5,8*	*µg/g*
41	Nb	Niobium	*< 4,3*	*µg/g*
42	Mo	Molybdenum	*< 3,2*	*µg/g*
47	Ag	Silver	*< 1,4*	*µg/g*
48	Cd	Cadmium	*1,50*	*µg/g*
49	In	Indium	*< 1,2*	*µg/g*
50	Sn	Tin	*24,00*	*µg/g*
51	Sb	Antimony	*< 1,1*	*µg/g*
52	Te	Tellurium	*< 1,6*	*µg/g*
53	I	Iodine	*< 3,8*	*µg/g*
55	Cs	Cesium	*< 4,5*	*µg/g*
56	Ba	Barium	*< 7,3*	*µg/g*
57	La	Lanthanum	*< 8,4*	*µg/g*
58	Ce	Cerium	*< 12*	*µg/g*
74	W	Tungsten	*< 5,9*	*µg/g*
80	Hg	Mercury	*< 0,6*	*µg/g*
81	Tl	Thallium	*< 0,5*	*µg/g*
82	Pb	Lead	*0,70*	*µg/g*
83	Bi	Bismuth	*< 0,4*	*µg/g*
90	Th	Thorium	*< 0,3*	*µg/g*
92	U	Uranium	*< 11*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6336	Fortyndingsmiddel:	None
Beskrivelse:	**M4 lag 1**	Prøvevægt (g):	3,605
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,043 %*
12	Mg	Magnesium	*< 0,0100 %*
13	Al	Aluminum	*0,24 %*
14	Si	Silicon	*0,13 %*
15	P	Phosphorus	*0,01 %*
16	S	Sulfur	*0,02 %*
17	Cl	Chlorine	*0,06 %*
19	K	Potassium	*< 0,0051 %*
20	Ca	Calcium	*0,04 %*
22	Ti	Titanium	*0,47 %*
23	V	Vanadium	*< 0,0011 %*
24	Cr	Chromium	*< 0,00032 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*< 0,00016 %*
27	Co	Cobalt	*3,60 µg/g*
28	Ni	Nickel	*16,40 µg/g*
29	Cu	Copper	*< 0,2 µg/g*
30	Zn	Zinc	*3,60 µg/g*
31	Ga	Gallium	*0,40 µg/g*
32	Ge	Germanium	*< 0,2 µg/g*
33	As	Arsenic	*< 0,2 µg/g*
34	Se	Selenium	*0,50 µg/g*
35	Br	Bromine	*4,50 µg/g*
37	Rb	Rubidium	*0,40 µg/g*
38	Sr	Strontium	*0,80 µg/g*
39	Y	Yttrium	*< 0,3 µg/g*
40	Zr	Zirconium	*< 3,8 µg/g*
41	Nb	Niobium	*2,50 µg/g*
42	Mo	Molybdenum	*< 2,1 µg/g*
47	Ag	Silver	*< 1,2 µg/g*
48	Cd	Cadmium	*0,40 µg/g*
49	In	Indium	*< 1,2 µg/g*
50	Sn	Tin	*2,80 µg/g*
51	Sb	Antimony	*87,50 µg/g*
52	Te	Tellurium	*2,30 µg/g*
53	I	Iodine	*< 4,3 µg/g*
55	Cs	Cesium	*< 6,6 µg/g*
56	Ba	Barium	*< 11 µg/g*
57	La	Lanthanum	*< 15 µg/g*
58	Ce	Cerium	*< 21 µg/g*
74	W	Tungsten	*< 1,7 µg/g*
80	Hg	Mercury	*< 0,4 µg/g*
81	Tl	Thallium	*0,80 µg/g*
82	Pb	Lead	*1,70 µg/g*
83	Bi	Bismuth	*< 0,3 µg/g*
90	Th	Thorium	*< 0,3 µg/g*
92	U	Uranium	*< 4,2 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6337	Fortyndingsmiddel:	None
Beskrivelse:	**M4 lag 2**	Prøvevægt (g):	2,023
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,098 %*
12	Mg	Magnesium	*< 0,024 %*
13	Al	Aluminum	*0,76 %*
14	Si	Silicon	*0,80 %*
15	P	Phosphorus	*< 0,0024 %*
16	S	Sulfur	*0,09 %*
17	Cl	Chlorine	*0,16 %*
19	K	Potassium	*< 0,013 %*
20	Ca	Calcium	*9,49 %*
22	Ti	Titanium	*0,00 %*
23	V	Vanadium	*< 0,00082 %*
24	Cr	Chromium	*< 0,00069 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*< 1,9 µg/g*
28	Ni	Nickel	*133,80 µg/g*
29	Cu	Copper	*< 0,9 µg/g*
30	Zn	Zinc	*< 0,4 µg/g*
31	Ga	Gallium	*2,70 µg/g*
32	Ge	Germanium	*< 0,3 µg/g*
33	As	Arsenic	*< 0,3 µg/g*
34	Se	Selenium	*< 0,3 µg/g*
35	Br	Bromine	*0,40 µg/g*
37	Rb	Rubidium	*< 0,2 µg/g*
38	Sr	Strontium	*3,00 µg/g*
39	Y	Yttrium	*< 0,3 µg/g*
40	Zr	Zirconium	*< 6,1 µg/g*
41	Nb	Niobium	*< 4,6 µg/g*
42	Mo	Molybdenum	*< 3,5 µg/g*
47	Ag	Silver	*< 1,6 µg/g*
48	Cd	Cadmium	*1,80 µg/g*
49	In	Indium	*< 1,8 µg/g*
50	Sn	Tin	*43,90 µg/g*
51	Sb	Antimony	*< 1,7 µg/g*
52	Te	Tellurium	*< 2,4 µg/g*
53	I	Iodine	*< 5,4 µg/g*
55	Cs	Cesium	*< 6,1 µg/g*
56	Ba	Barium	*< 9,6 µg/g*
57	La	Lanthanum	*< 13 µg/g*
58	Ce	Cerium	*< 18 µg/g*
74	W	Tungsten	*< 5,2 µg/g*
80	Hg	Mercury	*< 0,6 µg/g*
81	Tl	Thallium	*0,30 µg/g*
82	Pb	Lead	*0,90 µg/g*
83	Bi	Bismuth	*< 0,4 µg/g*
90	Th	Thorium	*< 0,3 µg/g*
92	U	Uranium	*< 8,9 µg/g*

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6347	Fortyndingsmiddel:	None
Beskrivelse:	**M5 lag 1**	Prøvevægt (g):	3,532
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 45 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,060*	*%*
12	Mg	Magnesium	*< 0,014*	*%*
13	Al	Aluminum	*0,34*	*%*
14	Si	Silicon	*0,18*	*%*
15	P	Phosphorus	*0,04*	*%*
16	S	Sulfur	*0,14*	*%*
17	Cl	Chlorine	*0,10*	*%*
19	K	Potassium	*< 0,0068*	*%*
20	Ca	Calcium	*0,05*	*%*
22	Ti	Titanium	*1,13*	*%*
23	V	Vanadium	*< 0,0019*	*%*
24	Cr	Chromium	*< 0,00043*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,00033*	*%*
27	Co	Cobalt	*17,80*	*µg/g*
28	Ni	Nickel	*38,20*	*µg/g*
29	Cu	Copper	*< 0,4*	*µg/g*
30	Zn	Zinc	*3,10*	*µg/g*
31	Ga	Gallium	*0,70*	*µg/g*
32	Ge	Germanium	*< 0,2*	*µg/g*
33	As	Arsenic	*< 0,3*	*µg/g*
34	Se	Selenium	*0,40*	*µg/g*
35	Br	Bromine	*3,10*	*µg/g*
37	Rb	Rubidium	*0,30*	*µg/g*
38	Sr	Strontium	*0,90*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 3,6*	*µg/g*
41	Nb	Niobium	*< 2,2*	*µg/g*
42	Mo	Molybdenum	*< 1,6*	*µg/g*
47	Ag	Silver	*< 1,0*	*µg/g*
48	Cd	Cadmium	*0,50*	*µg/g*
49	In	Indium	*1,30*	*µg/g*
50	Sn	Tin	*< 1,8*	*µg/g*
51	Sb	Antimony	*81,70*	*µg/g*
52	Te	Tellurium	*< 2,1*	*µg/g*
53	I	Iodine	*< 3,6*	*µg/g*
55	Cs	Cesium	*< 5,8*	*µg/g*
56	Ba	Barium	*< 9,1*	*µg/g*
57	La	Lanthanum	*< 12*	*µg/g*
58	Ce	Cerium	*< 17*	*µg/g*
74	W	Tungsten	*< 2,4*	*µg/g*
80	Hg	Mercury	*< 0,4*	*µg/g*
81	Tl	Thallium	*0,50*	*µg/g*
82	Pb	Lead	*1,90*	*µg/g*
83	Bi	Bismuth	*< 0,4*	*µg/g*
90	Th	Thorium	*0,90*	*µg/g*
92	U	Uranium	*< 4,3*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6348	Fortyndingsmiddel:	None
Beskrivelse:	**M5 lag 2**	Prøvevægt (g):	1,77
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,10*	*%*
12	Mg	Magnesium	*0,16*	*%*
13	Al	Aluminum	*0,75*	*%*
14	Si	Silicon	*0,96*	*%*
15	P	Phosphorus	*< 0,0031*	*%*
16	S	Sulfur	*0,03*	*%*
17	Cl	Chlorine	*0,06*	*%*
19	K	Potassium	*< 0,015*	*%*
20	Ca	Calcium	*17,71*	*%*
22	Ti	Titanium	*< 0,0010*	*%*
23	V	Vanadium	*0,00*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*< 0,00038*	*%*
26	Fe	Iron	*< 0,00018*	*%*
27	Co	Cobalt	*3,70*	*µg/g*
28	Ni	Nickel	*126,30*	*µg/g*
29	Cu	Copper	*< 1,2*	*µg/g*
30	Zn	Zinc	*0,80*	*µg/g*
31	Ga	Gallium	*2,50*	*µg/g*
32	Ge	Germanium	*< 0,4*	*µg/g*
33	As	Arsenic	*< 0,4*	*µg/g*
34	Se	Selenium	*< 0,3*	*µg/g*
35	Br	Bromine	*< 0,2*	*µg/g*
37	Rb	Rubidium	*< 0,2*	*µg/g*
38	Sr	Strontium	*4,80*	*µg/g*
39	Y	Yttrium	*0,40*	*µg/g*
40	Zr	Zirconium	*< 3,4*	*µg/g*
41	Nb	Niobium	*< 4,3*	*µg/g*
42	Mo	Molybdenum	*< 2,5*	*µg/g*
47	Ag	Silver	*< 1,5*	*µg/g*
48	Cd	Cadmium	*0,90*	*µg/g*
49	In	Indium	*< 1,3*	*µg/g*
50	Sn	Tin	*61,00*	*µg/g*
51	Sb	Antimony	*< 1,8*	*µg/g*
52	Te	Tellurium	*< 2,6*	*µg/g*
53	I	Iodine	*< 5,9*	*µg/g*
55	Cs	Cesium	*< 6,3*	*µg/g*
56	Ba	Barium	*< 10*	*µg/g*
57	La	Lanthanum	*< 15*	*µg/g*
58	Ce	Cerium	*< 20*	*µg/g*
74	W	Tungsten	*< 5,2*	*µg/g*
80	Hg	Mercury	*< 0,6*	*µg/g*
81	Tl	Thallium	*< 0,7*	*µg/g*
82	Pb	Lead	*1,50*	*µg/g*
83	Bi	Bismuth	*< 0,5*	*µg/g*
90	Th	Thorium	*< 0,4*	*µg/g*
92	U	Uranium	*< 8,1*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6349	Fortyndingsmiddel:	None
Beskrivelse:	**M5 lag 3**	Prøvevægt (g):	2,316
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 45 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,060*	*%*
12	Mg	Magnesium	*< 0,014*	*%*
13	Al	Aluminum	*0,41*	*%*
14	Si	Silicon	*0,19*	*%*
15	P	Phosphorus	*0,05*	*%*
16	S	Sulfur	*0,03*	*%*
17	Cl	Chlorine	*0,05*	*%*
19	K	Potassium	*0,04*	*%*
20	Ca	Calcium	*0,08*	*%*
22	Ti	Titanium	*0,16*	*%*
23	V	Vanadium	*< 0,00086*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*7,30*	*µg/g*
28	Ni	Nickel	*63,20*	*µg/g*
29	Cu	Copper	*< 0,5*	*µg/g*
30	Zn	Zinc	*1,80*	*µg/g*
31	Ga	Gallium	*1,00*	*µg/g*
32	Ge	Germanium	*< 0,2*	*µg/g*
33	As	Arsenic	*< 0,2*	*µg/g*
34	Se	Selenium	*0,40*	*µg/g*
35	Br	Bromine	*0,30*	*µg/g*
37	Rb	Rubidium	*< 0,2*	*µg/g*
38	Sr	Strontium	*0,70*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 3,3*	*µg/g*
41	Nb	Niobium	*< 2,1*	*µg/g*
42	Mo	Molybdenum	*< 2,1*	*µg/g*
47	Ag	Silver	*< 1,0*	*µg/g*
48	Cd	Cadmium	*0,40*	*µg/g*
49	In	Indium	*< 1,0*	*µg/g*
50	Sn	Tin	*< 1,6*	*µg/g*
51	Sb	Antimony	*19,60*	*µg/g*
52	Te	Tellurium	*< 2,5*	*µg/g*
53	I	Iodine	*< 4,4*	*µg/g*
55	Cs	Cesium	*< 6,9*	*µg/g*
56	Ba	Barium	*< 11*	*µg/g*
57	La	Lanthanum	*< 15*	*µg/g*
58	Ce	Cerium	*< 22*	*µg/g*
74	W	Tungsten	*< 2,5*	*µg/g*
80	Hg	Mercury	*< 0,4*	*µg/g*
81	Tl	Thallium	*0,60*	*µg/g*
82	Pb	Lead	*1,30*	*µg/g*
83	Bi	Bismuth	*< 0,3*	*µg/g*
90	Th	Thorium	*< 0,3*	*µg/g*
92	U	Uranium	*< 3,7*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6364	Fortyndingsmiddel:	None
Beskrivelse:	**M6 lag 1**	Prøvevægt (g):	5,814
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	< 0,081	%
12	Mg	Magnesium	< 0,019	%
13	Al	Aluminum	0,26	%
14	Si	Silicon	0,32	%
15	P	Phosphorus	0,01	%
16	S	Sulfur	0,08	%
17	Cl	Chlorine	0,03	%
19	K	Potassium	< 0,011	%
20	Ca	Calcium	0,05	%
22	Ti	Titanium	0,64	%
23	V	Vanadium	< 0,0022	%
24	Cr	Chromium	0,00	%
25	Mn	Manganese	< 0,00019	%
26	Fe	Iron	< 0,00019	%
27	Co	Cobalt	3,50	µg/g
28	Ni	Nickel	16,10	µg/g
29	Cu	Copper	1,10	µg/g
30	Zn	Zinc	238,40	µg/g
31	Ga	Gallium	0,70	µg/g
32	Ge	Germanium	< 0,3	µg/g
33	As	Arsenic	< 0,2	µg/g
34	Se	Selenium	< 0,2	µg/g
35	Br	Bromine	1,30	µg/g
37	Rb	Rubidium	0,50	µg/g
38	Sr	Strontium	1,20	µg/g
39	Y	Yttrium	< 0,3	µg/g
40	Zr	Zirconium	< 3,1	µg/g
41	Nb	Niobium	< 2,3	µg/g
42	Mo	Molybdenum	< 1,9	µg/g
47	Ag	Silver	< 0,9	µg/g
48	Cd	Cadmium	1,40	µg/g
49	In	Indium	< 1,1	µg/g
50	Sn	Tin	< 1,5	µg/g
51	Sb	Antimony	74,60	µg/g
52	Te	Tellurium	< 1,7	µg/g
53	I	Iodine	< 3,3	µg/g
55	Cs	Cesium	< 5,0	µg/g
56	Ba	Barium	< 8,0	µg/g
57	La	Lanthanum	< 10	µg/g
58	Ce	Cerium	< 15	µg/g
74	W	Tungsten	< 4,7	µg/g
80	Hg	Mercury	< 0,4	µg/g
81	Tl	Thallium	0,80	µg/g
82	Pb	Lead	1,70	µg/g
83	Bi	Bismuth	0,80	µg/g
90	Th	Thorium	< 0,3	µg/g
92	U	Uranium	3,80	µg/g

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6365	Fortyndingsmiddel:	None
Beskrivelse:	**M6 lag 2**	Prøvevægt (g):	4,48
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	< 0,12	%
12	Mg	Magnesium	0,19	%
13	Al	Aluminum	0,69	%
14	Si	Silicon	0,50	%
15	P	Phosphorus	0,05	%
16	S	Sulfur	0,05	%
17	Cl	Chlorine	0,25	%
19	K	Potassium	< 0,016	%
20	Ca	Calcium	0,04	%
22	Ti	Titanium	0,39	%
23	V	Vanadium	< 0,0018	%
24	Cr	Chromium	< 0,00068	%
25	Mn	Manganese	< 0,00034	%
26	Fe	Iron	< 0,00031	%
27	Co	Cobalt	9,00	µg/g
28	Ni	Nickel	198,70	µg/g
29	Cu	Copper	< 1,0	µg/g
30	Zn	Zinc	< 1,0	µg/g
31	Ga	Gallium	2,20	µg/g
32	Ge	Germanium	< 0,4	µg/g
33	As	Arsenic	< 0,4	µg/g
34	Se	Selenium	< 0,3	µg/g
35	Br	Bromine	0,80	µg/g
37	Rb	Rubidium	< 0,2	µg/g
38	Sr	Strontium	< 0,2	µg/g
39	Y	Yttrium	< 0,3	µg/g
40	Zr	Zirconium	< 8,2	µg/g
41	Nb	Niobium	< 4,8	µg/g
42	Mo	Molybdenum	< 3,6	µg/g
47	Ag	Silver	< 1,7	µg/g
48	Cd	Cadmium	1,40	µg/g
49	In	Indium	< 1,3	µg/g
50	Sn	Tin	0,70	µg/g
51	Sb	Antimony	19,30	µg/g
52	Te	Tellurium	< 2,0	µg/g
53	I	Iodine	< 3,5	µg/g
55	Cs	Cesium	< 4,5	µg/g
56	Ba	Barium	< 7,7	µg/g
57	La	Lanthanum	< 9,1	µg/g
58	Ce	Cerium	< 12	µg/g
74	W	Tungsten	< 5,7	µg/g
80	Hg	Mercury	< 0,5	µg/g
81	Tl	Thallium	< 0,5	µg/g
82	Pb	Lead	2,20	µg/g
83	Bi	Bismuth	< 0,4	µg/g
90	Th	Thorium	< 0,4	µg/g
92	U	Uranium	< 11	µg/g

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6366	Fortyndingsmiddel:	None
Beskrivelse:	**M6 lag 3**	Prøvevægt (g):	9,865
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	< 0,26	%
12	Mg	Magnesium	< 0,066	%
13	Al	Aluminum	0,62	%
14	Si	Silicon	0,57	%
15	P	Phosphorus	< 0,0071	%
16	S	Sulfur	0,03	%
17	Cl	Chlorine	< 0,0026	%
19	K	Potassium	< 0,031	%
20	Ca	Calcium	12,38	%
22	Ti	Titanium	< 0,0024	%
23	V	Vanadium	< 0,0021	%
24	Cr	Chromium	< 0,00065	%
25	Mn	Manganese	0,00	%
26	Fe	Iron	< 0,0015	%
27	Co	Cobalt	1,40	µg/g
28	Ni	Nickel	78,00	µg/g
29	Cu	Copper	< 0,7	µg/g
30	Zn	Zinc	< 0,3	µg/g
31	Ga	Gallium	2,20	µg/g
32	Ge	Germanium	< 0,4	µg/g
33	As	Arsenic	< 0,4	µg/g
34	Se	Selenium	0,30	µg/g
35	Br	Bromine	1,30	µg/g
37	Rb	Rubidium	0,50	µg/g
38	Sr	Strontium	6,10	µg/g
39	Y	Yttrium	< 0,4	µg/g
40	Zr	Zirconium	< 5,4	µg/g
41	Nb	Niobium	< 3,6	µg/g
42	Mo	Molybdenum	< 2,9	µg/g
47	Ag	Silver	< 1,6	µg/g
48	Cd	Cadmium	0,80	µg/g
49	In	Indium	< 1,1	µg/g
50	Sn	Tin	29,20	µg/g
51	Sb	Antimony	< 1,6	µg/g
52	Te	Tellurium	< 2,5	µg/g
53	I	Iodine	< 4,6	µg/g
55	Cs	Cesium	< 5,4	µg/g
56	Ba	Barium	< 9,4	µg/g
57	La	Lanthanum	< 11	µg/g
58	Ce	Cerium	< 14	µg/g
74	W	Tungsten	< 3,7	µg/g
80	Hg	Mercury	< 0,7	µg/g
81	Tl	Thallium	0,50	µg/g
82	Pb	Lead	2,00	µg/g
83	Bi	Bismuth	< 0,5	µg/g
90	Th	Thorium	< 0,4	µg/g
92	U	Uranium	< 9,4	µg/g

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6367	Fortyndingsmiddel:	None
Beskrivelse:	**M7 lag 1**	Prøvevægt (g):	7,777
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,094 %*
12	Mg	Magnesium	*< 0,023 %*
13	Al	Aluminum	*0,63 %*
14	Si	Silicon	*0,42 %*
15	P	Phosphorus	*< 0,00093 %*
16	S	Sulfur	*0,06 %*
17	Cl	Chlorine	*0,05 %*
19	K	Potassium	*< 0,013 %*
20	Ca	Calcium	*0,19 %*
22	Ti	Titanium	*0,00 %*
23	V	Vanadium	*< 0,00082 %*
24	Cr	Chromium	*0,00 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*3,10 µg/g*
28	Ni	Nickel	*109,60 µg/g*
29	Cu	Copper	*< 0,2 µg/g*
30	Zn	Zinc	*< 1,0 µg/g*
31	Ga	Gallium	*1,80 µg/g*
32	Ge	Germanium	*< 0,3 µg/g*
33	As	Arsenic	*< 0,3 µg/g*
34	Se	Selenium	*< 0,2 µg/g*
35	Br	Bromine	*0,80 µg/g*
37	Rb	Rubidium	*0,50 µg/g*
38	Sr	Strontium	*5,10 µg/g*
39	Y	Yttrium	*< 0,3 µg/g*
40	Zr	Zirconium	*< 6,4 µg/g*
41	Nb	Niobium	*< 4,2 µg/g*
42	Mo	Molybdenum	*< 2,8 µg/g*
47	Ag	Silver	*< 1,5 µg/g*
48	Cd	Cadmium	*2,90 µg/g*
49	In	Indium	*< 1,5 µg/g*
50	Sn	Tin	*56,20 µg/g*
51	Sb	Antimony	*< 1,5 µg/g*
52	Te	Tellurium	*< 2,7 µg/g*
53	I	Iodine	*< 5,0 µg/g*
55	Cs	Cesium	*< 5,6 µg/g*
56	Ba	Barium	*< 9,4 µg/g*
57	La	Lanthanum	*< 11 µg/g*
58	Ce	Cerium	*< 15 µg/g*
74	W	Tungsten	*< 4,1 µg/g*
80	Hg	Mercury	*0,70 µg/g*
81	Tl	Thallium	*0,60 µg/g*
82	Pb	Lead	*2,00 µg/g*
83	Bi	Bismuth	*< 0,5 µg/g*
90	Th	Thorium	*0,70 µg/g*
92	U	Uranium	*7,80 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6350	Fortyndingsmiddel:	None
Beskrivelse:	**M8 lag 1**	Prøvevægt (g):	3,906
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 45 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,038*	*%*
12	Mg	Magnesium	*0,14*	*%*
13	Al	Aluminum	*0,22*	*%*
14	Si	Silicon	*0,22*	*%*
15	P	Phosphorus	*0,02*	*%*
16	S	Sulfur	*0,02*	*%*
17	Cl	Chlorine	*0,02*	*%*
19	K	Potassium	*0,04*	*%*
20	Ca	Calcium	*0,16*	*%*
22	Ti	Titanium	*0,31*	*%*
23	V	Vanadium	*< 0,00086*	*%*
24	Cr	Chromium	*< 0,00031*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,00015*	*%*
27	Co	Cobalt	*3,00*	*µg/g*
28	Ni	Nickel	*17,30*	*µg/g*
29	Cu	Copper	*< 0,4*	*µg/g*
30	Zn	Zinc	*15,20*	*µg/g*
31	Ga	Gallium	*< 0,3*	*µg/g*
32	Ge	Germanium	*< 0,2*	*µg/g*
33	As	Arsenic	*< 0,2*	*µg/g*
34	Se	Selenium	*0,40*	*µg/g*
35	Br	Bromine	*2,10*	*µg/g*
37	Rb	Rubidium	*0,30*	*µg/g*
38	Sr	Strontium	*6,40*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 3,0*	*µg/g*
41	Nb	Niobium	*< 2,1*	*µg/g*
42	Mo	Molybdenum	*< 1,5*	*µg/g*
47	Ag	Silver	*< 0,8*	*µg/g*
48	Cd	Cadmium	*0,70*	*µg/g*
49	In	Indium	*< 0,8*	*µg/g*
50	Sn	Tin	*< 1,3*	*µg/g*
51	Sb	Antimony	*31,50*	*µg/g*
52	Te	Tellurium	*< 2,0*	*µg/g*
53	I	Iodine	*< 3,4*	*µg/g*
55	Cs	Cesium	*< 5,6*	*µg/g*
56	Ba	Barium	*< 8,9*	*µg/g*
57	La	Lanthanum	*< 12*	*µg/g*
58	Ce	Cerium	*< 17*	*µg/g*
74	W	Tungsten	*< 1,8*	*µg/g*
80	Hg	Mercury	*1,00*	*µg/g*
81	Tl	Thallium	*0,60*	*µg/g*
82	Pb	Lead	*1,20*	*µg/g*
83	Bi	Bismuth	*0,70*	*µg/g*
90	Th	Thorium	*0,30*	*µg/g*
92	U	Uranium	*< 3,3*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6351	Fortyndingsmiddel:	None
Beskrivelse:	**M8 lag 2**	Prøvevægt (g):	11,31
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,15*	*%*
12	Mg	Magnesium	*< 0,030*	*%*
13	Al	Aluminum	*1,84*	*%*
14	Si	Silicon	*4,38*	*%*
15	P	Phosphorus	*0,04*	*%*
16	S	Sulfur	*7,13*	*%*
17	Cl	Chlorine	*0,01*	*%*
19	K	Potassium	*5,22*	*%*
20	Ca	Calcium	*0,27*	*%*
22	Ti	Titanium	*< 0,0013*	*%*
23	V	Vanadium	*< 0,00096*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*< 0,00040*	*%*
26	Fe	Iron	*< 0,0010*	*%*
27	Co	Cobalt	*< 7,1*	*µg/g*
28	Ni	Nickel	*132,30*	*µg/g*
29	Cu	Copper	*< 4,7*	*µg/g*
30	Zn	Zinc	*29.950,00*	*µg/g*
31	Ga	Gallium	*< 4,2*	*µg/g*
32	Ge	Germanium	*< 2,7*	*µg/g*
33	As	Arsenic	*< 0,8*	*µg/g*
34	Se	Selenium	*0,50*	*µg/g*
35	Br	Bromine	*< 0,4*	*µg/g*
37	Rb	Rubidium	*9,50*	*µg/g*
38	Sr	Strontium	*20,90*	*µg/g*
39	Y	Yttrium	*1,70*	*µg/g*
40	Zr	Zirconium	*< 5,4*	*µg/g*
41	Nb	Niobium	*< 3,0*	*µg/g*
42	Mo	Molybdenum	*< 2,1*	*µg/g*
47	Ag	Silver	*< 1,2*	*µg/g*
48	Cd	Cadmium	*1,10*	*µg/g*
49	In	Indium	*< 1,0*	*µg/g*
50	Sn	Tin	*< 2,0*	*µg/g*
51	Sb	Antimony	*< 1,5*	*µg/g*
52	Te	Tellurium	*< 2,2*	*µg/g*
53	I	Iodine	*< 3,6*	*µg/g*
55	Cs	Cesium	*< 4,7*	*µg/g*
56	Ba	Barium	*< 6,9*	*µg/g*
57	La	Lanthanum	*< 9,1*	*µg/g*
58	Ce	Cerium	*< 11*	*µg/g*
74	W	Tungsten	*< 67*	*µg/g*
80	Hg	Mercury	*4,00*	*µg/g*
81	Tl	Thallium	*1,20*	*µg/g*
82	Pb	Lead	*10,90*	*µg/g*
83	Bi	Bismuth	*< 0,8*	*µg/g*
90	Th	Thorium	*< 0,6*	*µg/g*
92	U	Uranium	*< 6,1*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6324 S1 mørk	Fortyndingsmiddel:	None
Beskrivelse:	**S1 Lag 1 mørk side**	Prøvevægt (g):	3,998
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	14-feb-13
Prøve status:	AAAXXX	Dato for beregning:	14-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,043*	*%*
12	Mg	Magnesium	*< 0,011*	*%*
13	Al	Aluminum	*0,24*	*%*
14	Si	Silicon	*0,16*	*%*
15	P	Phosphorus	*0,01*	*%*
16	S	Sulfur	*0,57*	*%*
17	Cl	Chlorine	*0,05*	*%*
19	K	Potassium	*< 0,0047*	*%*
20	Ca	Calcium	*0,18*	*%*
22	Ti	Titanium	*0,36*	*%*
23	V	Vanadium	*0,00*	*%*
24	Cr	Chromium	*< 0,00035*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*1,60*	*µg/g*
28	Ni	Nickel	*23,10*	*µg/g*
29	Cu	Copper	*< 1,0*	*µg/g*
30	Zn	Zinc	*99,60*	*µg/g*
31	Ga	Gallium	*0,70*	*µg/g*
32	Ge	Germanium	*< 0,2*	*µg/g*
33	As	Arsenic	*< 0,2*	*µg/g*
34	Se	Selenium	*0,60*	*µg/g*
35	Br	Bromine	*39,50*	*µg/g*
37	Rb	Rubidium	*< 0,3*	*µg/g*
38	Sr	Strontium	*1,50*	*µg/g*
39	Y	Yttrium	*0,50*	*µg/g*
40	Zr	Zirconium	*< 3,0*	*µg/g*
41	Nb	Niobium	*< 2,1*	*µg/g*
42	Mo	Molybdenum	*< 1,4*	*µg/g*
47	Ag	Silver	*< 1,0*	*µg/g*
48	Cd	Cadmium	*0,70*	*µg/g*
49	In	Indium	*< 0,9*	*µg/g*
50	Sn	Tin	*< 1,4*	*µg/g*
51	Sb	Antimony	*34,00*	*µg/g*
52	Te	Tellurium	*< 1,7*	*µg/g*
53	I	Iodine	*< 3,1*	*µg/g*
55	Cs	Cesium	*< 5,0*	*µg/g*
56	Ba	Barium	*< 7,8*	*µg/g*
57	La	Lanthanum	*< 10*	*µg/g*
58	Ce	Cerium	*< 15*	*µg/g*
74	W	Tungsten	*< 3,1*	*µg/g*
80	Hg	Mercury	*< 0,4*	*µg/g*
81	Tl	Thallium	*0,60*	*µg/g*
82	Pb	Lead	*1,10*	*µg/g*
83	Bi	Bismuth	*0,50*	*µg/g*
90	Th	Thorium	*0,30*	*µg/g*
92	U	Uranium	*< 3,9*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6325 S1 lys	Fortyndingsmiddel:	None
Beskrivelse:	**S1 Lag 1 lys side**	Prøvevægt (g):	3,998
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	14-feb-13
Prøve status:	AAAXXX	Dato for beregning:	14-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,052 %*
12	Mg	Magnesium	*0,12 %*
13	Al	Aluminum	*0,30 %*
14	Si	Silicon	*0,20 %*
15	P	Phosphorus	*< 0,0050 %*
16	S	Sulfur	*0,16 %*
17	Cl	Chlorine	*0,15 %*
19	K	Potassium	*< 0,0059 %*
20	Ca	Calcium	*0,19 %*
22	Ti	Titanium	*0,64 %*
23	V	Vanadium	*< 0,0014 %*
24	Cr	Chromium	*0,00 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*2,50 µg/g*
28	Ni	Nickel	*19,70 µg/g*
29	Cu	Copper	*< 0,3 µg/g*
30	Zn	Zinc	*89,90 µg/g*
31	Ga	Gallium	*0,60 µg/g*
32	Ge	Germanium	*< 0,3 µg/g*
33	As	Arsenic	*< 0,2 µg/g*
34	Se	Selenium	*0,40 µg/g*
35	Br	Bromine	*38,60 µg/g*
37	Rb	Rubidium	*< 0,3 µg/g*
38	Sr	Strontium	*1,50 µg/g*
39	Y	Yttrium	*< 0,3 µg/g*
40	Zr	Zirconium	*< 3,2 µg/g*
41	Nb	Niobium	*< 2,3 µg/g*
42	Mo	Molybdenum	*< 1,6 µg/g*
47	Ag	Silver	*< 0,8 µg/g*
48	Cd	Cadmium	*1,00 µg/g*
49	In	Indium	*< 0,7 µg/g*
50	Sn	Tin	*< 1,2 µg/g*
51	Sb	Antimony	*25,00 µg/g*
52	Te	Tellurium	*< 1,8 µg/g*
53	I	Iodine	*< 3,0 µg/g*
55	Cs	Cesium	*< 4,8 µg/g*
56	Ba	Barium	*< 7,8 µg/g*
57	La	Lanthanum	*< 10 µg/g*
58	Ce	Cerium	*< 14 µg/g*
74	W	Tungsten	*< 3,2 µg/g*
80	Hg	Mercury	*0,30 µg/g*
81	Tl	Thallium	*< 0,3 µg/g*
82	Pb	Lead	*1,40 µg/g*
83	Bi	Bismuth	*< 0,3 µg/g*
90	Th	Thorium	*< 0,3 µg/g*
92	U	Uranium	*< 3,0 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6326	Fortyndingsmiddel:	None
Beskrivelse:	**S1 lag 2**	Prøvevægt (g):	1,13
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	14-feb-13
Prøve status:	AAAXXX	Dato for beregning:	14-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,091*	*%*
12	Mg	Magnesium	*< 0,022*	*%*
13	Al	Aluminum	*0,53*	*%*
14	Si	Silicon	*0,42*	*%*
15	P	Phosphorus	*< 0,00079*	*%*
16	S	Sulfur	*0,05*	*%*
17	Cl	Chlorine	*0,06*	*%*
19	K	Potassium	*< 0,0096*	*%*
20	Ca	Calcium	*0,12*	*%*
22	Ti	Titanium	*1,14*	*%*
23	V	Vanadium	*< 0,0025*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*1,90*	*µg/g*
28	Ni	Nickel	*98,40*	*µg/g*
29	Cu	Copper	*< 0,7*	*µg/g*
30	Zn	Zinc	*5,60*	*µg/g*
31	Ga	Gallium	*1,20*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,3*	*µg/g*
34	Se	Selenium	*< 0,2*	*µg/g*
35	Br	Bromine	*0,30*	*µg/g*
37	Rb	Rubidium	*0,40*	*µg/g*
38	Sr	Strontium	*1,00*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 5,2*	*µg/g*
41	Nb	Niobium	*< 3,6*	*µg/g*
42	Mo	Molybdenum	*< 3,5*	*µg/g*
47	Ag	Silver	*< 1,9*	*µg/g*
48	Cd	Cadmium	*1,60*	*µg/g*
49	In	Indium	*< 1,8*	*µg/g*
50	Sn	Tin	*< 2,6*	*µg/g*
51	Sb	Antimony	*87,10*	*µg/g*
52	Te	Tellurium	*< 3,1*	*µg/g*
53	I	Iodine	*< 6,2*	*µg/g*
55	Cs	Cesium	*< 9,7*	*µg/g*
56	Ba	Barium	*< 15*	*µg/g*
57	La	Lanthanum	*< 21*	*µg/g*
58	Ce	Cerium	*< 30*	*µg/g*
74	W	Tungsten	*< 3,9*	*µg/g*
80	Hg	Mercury	*1,20*	*µg/g*
81	Tl	Thallium	*< 0,4*	*µg/g*
82	Pb	Lead	*1,90*	*µg/g*
83	Bi	Bismuth	*0,50*	*µg/g*
90	Th	Thorium	*< 0,3*	*µg/g*
92	U	Uranium	*< 6,3*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6327	Fortyndingsmiddel:	None
Beskrivelse:	**S1 lag 3**	Prøvevægt (g):	1,943
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	14-feb-13
Prøve status:	AAAXXX	Dato for beregning:	14-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,25*	*%*
12	Mg	Magnesium	*0,16*	*%*
13	Al	Aluminum	*0,91*	*%*
14	Si	Silicon	*1,05*	*%*
15	P	Phosphorus	*< 0,0025*	*%*
16	S	Sulfur	*0,08*	*%*
17	Cl	Chlorine	*0,23*	*%*
19	K	Potassium	*< 0,033*	*%*
20	Ca	Calcium	*0,25*	*%*
22	Ti	Titanium	*< 0,0029*	*%*
23	V	Vanadium	*< 0,0021*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*< 0,00052*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*< 2,2*	*µg/g*
28	Ni	Nickel	*178,00*	*µg/g*
29	Cu	Copper	*< 0,8*	*µg/g*
30	Zn	Zinc	*< 1,0*	*µg/g*
31	Ga	Gallium	*2,20*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,4*	*µg/g*
34	Se	Selenium	*< 0,2*	*µg/g*
35	Br	Bromine	*0,80*	*µg/g*
37	Rb	Rubidium	*0,30*	*µg/g*
38	Sr	Strontium	*0,80*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 4,1*	*µg/g*
41	Nb	Niobium	*< 4,1*	*µg/g*
42	Mo	Molybdenum	*< 2,9*	*µg/g*
47	Ag	Silver	*2,00*	*µg/g*
48	Cd	Cadmium	*1,70*	*µg/g*
49	In	Indium	*< 1,0*	*µg/g*
50	Sn	Tin	*59,60*	*µg/g*
51	Sb	Antimony	*< 1,6*	*µg/g*
52	Te	Tellurium	*< 2,4*	*µg/g*
53	I	Iodine	*< 5,4*	*µg/g*
55	Cs	Cesium	*< 6,5*	*µg/g*
56	Ba	Barium	*< 9,4*	*µg/g*
57	La	Lanthanum	*< 13*	*µg/g*
58	Ce	Cerium	*< 19*	*µg/g*
74	W	Tungsten	*< 5,7*	*µg/g*
80	Hg	Mercury	*< 0,6*	*µg/g*
81	Tl	Thallium	*< 0,5*	*µg/g*
82	Pb	Lead	*1,50*	*µg/g*
83	Bi	Bismuth	*< 0,4*	*µg/g*
90	Th	Thorium	*0,40*	*µg/g*
92	U	Uranium	*< 9,2*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6328	Fortyndingsmiddel:	None
Beskrivelse:	**S1 lag 4**	Prøvevægt (g):	3,372
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	14-feb-13
Prøve status:	AAAXXX	Dato for beregning:	14-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,13*	*%*
12	Mg	Magnesium	*< 0,034*	*%*
13	Al	Aluminum	*0,82*	*%*
14	Si	Silicon	*1,39*	*%*
15	P	Phosphorus	*< 0,0028*	*%*
16	S	Sulfur	*2,89*	*%*
17	Cl	Chlorine	*0,30*	*%*
19	K	Potassium	*< 0,017*	*%*
20	Ca	Calcium	*0,98*	*%*
22	Ti	Titanium	*0,51*	*%*
23	V	Vanadium	*< 0,0092*	*%*
24	Cr	Chromium	*< 0,0067*	*%*
25	Mn	Manganese	*0,04*	*%*
26	Fe	Iron	*0,11*	*%*
27	Co	Cobalt	*5,80*	*µg/g*
28	Ni	Nickel	*47,90*	*µg/g*
29	Cu	Copper	*63,60*	*µg/g*
30	Zn	Zinc	*< 1,0*	*µg/g*
31	Ga	Gallium	*3,70*	*µg/g*
32	Ge	Germanium	*< 0,6*	*µg/g*
33	As	Arsenic	*3,60*	*µg/g*
34	Se	Selenium	*0,60*	*µg/g*
35	Br	Bromine	*0,70*	*µg/g*
37	Rb	Rubidium	*< 0,4*	*µg/g*
38	Sr	Strontium	*673,20*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 21*	*µg/g*
41	Nb	Niobium	*< 7,4*	*µg/g*
42	Mo	Molybdenum	*< 5,9*	*µg/g*
47	Ag	Silver	*< 3,1*	*µg/g*
48	Cd	Cadmium	*3,90*	*µg/g*
49	In	Indium	*< 2,9*	*µg/g*
50	Sn	Tin	*107,00*	*µg/g*
51	Sb	Antimony	*< 3,4*	*µg/g*
52	Te	Tellurium	*< 5,0*	*µg/g*
53	I	Iodine	*< 10*	*µg/g*
55	Cs	Cesium	*55,50*	*µg/g*
56	Ba	Barium	*9.196,00*	*µg/g*
57	La	Lanthanum	*< 14*	*µg/g*
58	Ce	Cerium	*< 19*	*µg/g*
74	W	Tungsten	*< 4,3*	*µg/g*
80	Hg	Mercury	*< 1,0*	*µg/g*
81	Tl	Thallium	*< 0,8*	*µg/g*
82	Pb	Lead	*2,30*	*µg/g*
83	Bi	Bismuth	*< 0,8*	*µg/g*
90	Th	Thorium	*< 0,5*	*µg/g*
92	U	Uranium	*26,80*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6341	Fortyndingsmiddel:	None
Beskrivelse:	**S2 lag 1**	Prøvevægt (g):	4,807
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,041*	*%*
12	Mg	Magnesium	*0,06*	*%*
13	Al	Aluminum	*0,30*	*%*
14	Si	Silicon	*0,17*	*%*
15	P	Phosphorus	*< 0,0050*	*%*
16	S	Sulfur	*0,29*	*%*
17	Cl	Chlorine	*0,24*	*%*
19	K	Potassium	*< 0,0043*	*%*
20	Ca	Calcium	*0,09*	*%*
22	Ti	Titanium	*0,39*	*%*
23	V	Vanadium	*0,00*	*%*
24	Cr	Chromium	*< 0,00035*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*1,70*	*µg/g*
28	Ni	Nickel	*11,60*	*µg/g*
29	Cu	Copper	*< 0,3*	*µg/g*
30	Zn	Zinc	*8,50*	*µg/g*
31	Ga	Gallium	*0,90*	*µg/g*
32	Ge	Germanium	*< 0,2*	*µg/g*
33	As	Arsenic	*< 0,3*	*µg/g*
34	Se	Selenium	*< 0,3*	*µg/g*
35	Br	Bromine	*386,00*	*µg/g*
37	Rb	Rubidium	*< 0,7*	*µg/g*
38	Sr	Strontium	*0,90*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 2,7*	*µg/g*
41	Nb	Niobium	*< 1,8*	*µg/g*
42	Mo	Molybdenum	*< 1,4*	*µg/g*
47	Ag	Silver	*< 0,8*	*µg/g*
48	Cd	Cadmium	*1,50*	*µg/g*
49	In	Indium	*< 0,9*	*µg/g*
50	Sn	Tin	*< 1,3*	*µg/g*
51	Sb	Antimony	*68,60*	*µg/g*
52	Te	Tellurium	*< 1,9*	*µg/g*
53	I	Iodine	*< 3,4*	*µg/g*
55	Cs	Cesium	*< 5,6*	*µg/g*
56	Ba	Barium	*< 9,0*	*µg/g*
57	La	Lanthanum	*< 12*	*µg/g*
58	Ce	Cerium	*< 18*	*µg/g*
74	W	Tungsten	*< 1,5*	*µg/g*
80	Hg	Mercury	*< 0,4*	*µg/g*
81	Tl	Thallium	*0,90*	*µg/g*
82	Pb	Lead	*2,20*	*µg/g*
83	Bi	Bismuth	*0,40*	*µg/g*
90	Th	Thorium	*1,00*	*µg/g*
92	U	Uranium	*< 3,8*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6342	Fortyndingsmiddel:	None
Beskrivelse:	**S2 lag 2**	Prøvevægt (g):	1,37
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,12*	*%*
12	Mg	Magnesium	*0,09*	*%*
13	Al	Aluminum	*0,74*	*%*
14	Si	Silicon	*0,38*	*%*
15	P	Phosphorus	*0,00*	*%*
16	S	Sulfur	*0,24*	*%*
17	Cl	Chlorine	*0,34*	*%*
19	K	Potassium	*< 0,013*	*%*
20	Ca	Calcium	*0,08*	*%*
22	Ti	Titanium	*0,04*	*%*
23	V	Vanadium	*< 0,00089*	*%*
24	Cr	Chromium	*< 0,00051*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*5,00*	*µg/g*
28	Ni	Nickel	*198,50*	*µg/g*
29	Cu	Copper	*< 1,0*	*µg/g*
30	Zn	Zinc	*< 1,0*	*µg/g*
31	Ga	Gallium	*1,50*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,3*	*µg/g*
34	Se	Selenium	*< 0,2*	*µg/g*
35	Br	Bromine	*1,90*	*µg/g*
37	Rb	Rubidium	*< 0,2*	*µg/g*
38	Sr	Strontium	*0,20*	*µg/g*
39	Y	Yttrium	*0,50*	*µg/g*
40	Zr	Zirconium	*< 6,7*	*µg/g*
41	Nb	Niobium	*< 4,1*	*µg/g*
42	Mo	Molybdenum	*< 4,1*	*µg/g*
47	Ag	Silver	*< 1,8*	*µg/g*
48	Cd	Cadmium	*1,50*	*µg/g*
49	In	Indium	*< 1,7*	*µg/g*
50	Sn	Tin	*< 1,6*	*µg/g*
51	Sb	Antimony	*21,00*	*µg/g*
52	Te	Tellurium	*< 2,9*	*µg/g*
53	I	Iodine	*< 4,8*	*µg/g*
55	Cs	Cesium	*< 7,4*	*µg/g*
56	Ba	Barium	*< 11*	*µg/g*
57	La	Lanthanum	*< 15*	*µg/g*
58	Ce	Cerium	*< 22*	*µg/g*
74	W	Tungsten	*< 5,7*	*µg/g*
80	Hg	Mercury	*< 0,5*	*µg/g*
81	Tl	Thallium	*< 0,4*	*µg/g*
82	Pb	Lead	*1,40*	*µg/g*
83	Bi	Bismuth	*< 0,3*	*µg/g*
90	Th	Thorium	*< 0,3*	*µg/g*
92	U	Uranium	*7,00*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6371	Fortyndingsmiddel:	None
Beskrivelse:	**S2 lag 3**	Prøvevægt (g):	2,818
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,11*	*%*
12	Mg	Magnesium	*0,28*	*%*
13	Al	Aluminum	*0,68*	*%*
14	Si	Silicon	*0,76*	*%*
15	P	Phosphorus	*0,01*	*%*
16	S	Sulfur	*0,12*	*%*
17	Cl	Chlorine	*0,24*	*%*
19	K	Potassium	*< 0,015*	*%*
20	Ca	Calcium	*4,40*	*%*
22	Ti	Titanium	*< 0,0012*	*%*
23	V	Vanadium	*< 0,0010*	*%*
24	Cr	Chromium	*< 0,00063*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*6,00*	*µg/g*
28	Ni	Nickel	*143,50*	*µg/g*
29	Cu	Copper	*< 0,9*	*µg/g*
30	Zn	Zinc	*2,60*	*µg/g*
31	Ga	Gallium	*2,90*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,4*	*µg/g*
34	Se	Selenium	*0,70*	*µg/g*
35	Br	Bromine	*1,80*	*µg/g*
37	Rb	Rubidium	*0,60*	*µg/g*
38	Sr	Strontium	*2,60*	*µg/g*
39	Y	Yttrium	*0,70*	*µg/g*
40	Zr	Zirconium	*< 6,9*	*µg/g*
41	Nb	Niobium	*< 4,7*	*µg/g*
42	Mo	Molybdenum	*< 4,0*	*µg/g*
47	Ag	Silver	*< 2,0*	*µg/g*
48	Cd	Cadmium	*1,60*	*µg/g*
49	In	Indium	*< 1,9*	*µg/g*
50	Sn	Tin	*81,40*	*µg/g*
51	Sb	Antimony	*< 1,7*	*µg/g*
52	Te	Tellurium	*< 2,8*	*µg/g*
53	I	Iodine	*< 6,0*	*µg/g*
55	Cs	Cesium	*< 6,6*	*µg/g*
56	Ba	Barium	*< 10*	*µg/g*
57	La	Lanthanum	*< 13*	*µg/g*
58	Ce	Cerium	*< 18*	*µg/g*
74	W	Tungsten	*< 5,0*	*µg/g*
80	Hg	Mercury	*0,80*	*µg/g*
81	Tl	Thallium	*1,00*	*µg/g*
82	Pb	Lead	*2,60*	*µg/g*
83	Bi	Bismuth	*0,70*	*µg/g*
90	Th	Thorium	*0,50*	*µg/g*
92	U	Uranium	*< 12*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6372	Fortyndingsmiddel:	None
Beskrivelse:	**S2 lag 4**	Prøvevægt (g):	5,613
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 45 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,092*	*%*
12	Mg	Magnesium	*0,97*	*%*
13	Al	Aluminum	*0,64*	*%*
14	Si	Silicon	*0,69*	*%*
15	P	Phosphorus	*< 0,0029*	*%*
16	S	Sulfur	*0,05*	*%*
17	Cl	Chlorine	*0,16*	*%*
19	K	Potassium	*< 0,014*	*%*
20	Ca	Calcium	*14,54*	*%*
22	Ti	Titanium	*< 0,0010*	*%*
23	V	Vanadium	*< 0,00098*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,00021*	*%*
27	Co	Cobalt	*4,60*	*µg/g*
28	Ni	Nickel	*85,80*	*µg/g*
29	Cu	Copper	*< 0,7*	*µg/g*
30	Zn	Zinc	*< 0,2*	*µg/g*
31	Ga	Gallium	*2,50*	*µg/g*
32	Ge	Germanium	*< 0,5*	*µg/g*
33	As	Arsenic	*< 0,4*	*µg/g*
34	Se	Selenium	*< 0,3*	*µg/g*
35	Br	Bromine	*0,90*	*µg/g*
37	Rb	Rubidium	*0,40*	*µg/g*
38	Sr	Strontium	*5,00*	*µg/g*
39	Y	Yttrium	*< 0,4*	*µg/g*
40	Zr	Zirconium	*< 6,6*	*µg/g*
41	Nb	Niobium	*< 5,3*	*µg/g*
42	Mo	Molybdenum	*< 4,3*	*µg/g*
47	Ag	Silver	*< 1,3*	*µg/g*
48	Cd	Cadmium	*1,50*	*µg/g*
49	In	Indium	*< 1,2*	*µg/g*
50	Sn	Tin	*55,90*	*µg/g*
51	Sb	Antimony	*< 1,5*	*µg/g*
52	Te	Tellurium	*< 2,2*	*µg/g*
53	I	Iodine	*< 4,8*	*µg/g*
55	Cs	Cesium	*< 4,8*	*µg/g*
56	Ba	Barium	*< 8,0*	*µg/g*
57	La	Lanthanum	*< 9,4*	*µg/g*
58	Ce	Cerium	*< 12*	*µg/g*
74	W	Tungsten	*< 4,8*	*µg/g*
80	Hg	Mercury	*0,90*	*µg/g*
81	Tl	Thallium	*0,70*	*µg/g*
82	Pb	Lead	*1,60*	*µg/g*
83	Bi	Bismuth	*< 0,6*	*µg/g*
90	Th	Thorium	*0,40*	*µg/g*
92	U	Uranium	*< 11*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6373	Fortyndingsmiddel:	None
Beskrivelse:	**S2 lag 5**	Prøvevægt (g):	4,832
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 45 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*0,39 %*
12	Mg	Magnesium	*0,22 %*
13	Al	Aluminum	*0,69 %*
14	Si	Silicon	*0,96 %*
15	P	Phosphorus	*0,17 %*
16	S	Sulfur	*0,05 %*
17	Cl	Chlorine	*1,69 %*
19	K	Potassium	*0,07 %*
20	Ca	Calcium	*1,67 %*
22	Ti	Titanium	*0,04 %*
23	V	Vanadium	*0,00 %*
24	Cr	Chromium	*< 0,00081 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*0,01 %*
27	Co	Cobalt	*3,60 µg/g*
28	Ni	Nickel	*82,00 µg/g*
29	Cu	Copper	*< 0,5 µg/g*
30	Zn	Zinc	*11,60 µg/g*
31	Ga	Gallium	*2,20 µg/g*
32	Ge	Germanium	*< 0,4 µg/g*
33	As	Arsenic	*< 0,4 µg/g*
34	Se	Selenium	*< 0,3 µg/g*
35	Br	Bromine	*3,20 µg/g*
37	Rb	Rubidium	*0,60 µg/g*
38	Sr	Strontium	*8,80 µg/g*
39	Y	Yttrium	*0,60 µg/g*
40	Zr	Zirconium	*< 5,8 µg/g*
41	Nb	Niobium	*< 3,5 µg/g*
42	Mo	Molybdenum	*< 3,6 µg/g*
47	Ag	Silver	*< 1,6 µg/g*
48	Cd	Cadmium	*2,80 µg/g*
49	In	Indium	*< 1,4 µg/g*
50	Sn	Tin	*93,20 µg/g*
51	Sb	Antimony	*< 1,8 µg/g*
52	Te	Tellurium	*< 2,6 µg/g*
53	I	Iodine	*< 5,9 µg/g*
55	Cs	Cesium	*< 5,8 µg/g*
56	Ba	Barium	*31,40 µg/g*
57	La	Lanthanum	*< 11 µg/g*
58	Ce	Cerium	*< 14 µg/g*
74	W	Tungsten	*< 4,3 µg/g*
80	Hg	Mercury	*< 0,7 µg/g*
81	Tl	Thallium	*0,70 µg/g*
82	Pb	Lead	*1,90 µg/g*
83	Bi	Bismuth	*1,40 µg/g*
90	Th	Thorium	*0,50 µg/g*
92	U	Uranium	*< 9,5 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6374	Fortyndingsmiddel:	None
Beskrivelse:	**S2 lag 6**	Prøvevægt (g):	0,35
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 30 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*0,47 %*
12	Mg	Magnesium	*0,07 %*
13	Al	Aluminum	*0,41 %*
14	Si	Silicon	*0,23 %*
15	P	Phosphorus	*< 0,00052 %*
16	S	Sulfur	*0,16 %*
17	Cl	Chlorine	*0,34 %*
19	K	Potassium	*< 0,0069 %*
20	Ca	Calcium	*0,12 %*
22	Ti	Titanium	*0,52 %*
23	V	Vanadium	*< 0,0012 %*
24	Cr	Chromium	*0,00 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*0,90 µg/g*
28	Ni	Nickel	*40,00 µg/g*
29	Cu	Copper	*< 0,3 µg/g*
30	Zn	Zinc	*4,20 µg/g*
31	Ga	Gallium	*1,10 µg/g*
32	Ge	Germanium	*< 0,2 µg/g*
33	As	Arsenic	*< 0,3 µg/g*
34	Se	Selenium	*0,60 µg/g*
35	Br	Bromine	*111,20 µg/g*
37	Rb	Rubidium	*< 0,5 µg/g*
38	Sr	Strontium	*1,90 µg/g*
39	Y	Yttrium	*4,50 µg/g*
40	Zr	Zirconium	*< 5,0 µg/g*
41	Nb	Niobium	*< 4,5 µg/g*
42	Mo	Molybdenum	*< 5,6 µg/g*
47	Ag	Silver	*< 2,3 µg/g*
48	Cd	Cadmium	*< 2,3 µg/g*
49	In	Indium	*2,40 µg/g*
50	Sn	Tin	*< 4,3 µg/g*
51	Sb	Antimony	*47,90 µg/g*
52	Te	Tellurium	*< 5,5 µg/g*
53	I	Iodine	*< 9,6 µg/g*
55	Cs	Cesium	*< 17 µg/g*
56	Ba	Barium	*< 25 µg/g*
57	La	Lanthanum	*< 36 µg/g*
58	Ce	Cerium	*< 50 µg/g*
74	W	Tungsten	*< 2,2 µg/g*
80	Hg	Mercury	*< 0,4 µg/g*
81	Tl	Thallium	*< 2,0 µg/g*
82	Pb	Lead	*2,40 µg/g*
83	Bi	Bismuth	*0,40 µg/g*
90	Th	Thorium	*1,90 µg/g*
92	U	Uranium	*< 7,4 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6375	Fortyndingsmiddel:	None
Beskrivelse:	**S2 lag 7**	Prøvevægt (g):	0,641
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*0,40 %*
12	Mg	Magnesium	*0,30 %*
13	Al	Aluminum	*0,37 %*
14	Si	Silicon	*0,20 %*
15	P	Phosphorus	*< 0,0020 %*
16	S	Sulfur	*0,11 %*
17	Cl	Chlorine	*0,06 %*
19	K	Potassium	*< 0,0065 %*
20	Ca	Calcium	*24,77 %*
22	Ti	Titanium	*0,19 %*
23	V	Vanadium	*0,00 %*
24	Cr	Chromium	*< 0,00067 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*1,00 µg/g*
28	Ni	Nickel	*38,20 µg/g*
29	Cu	Copper	*46,00 µg/g*
30	Zn	Zinc	*10,60 µg/g*
31	Ga	Gallium	*1,80 µg/g*
32	Ge	Germanium	*< 0,3 µg/g*
33	As	Arsenic	*0,50 µg/g*
34	Se	Selenium	*< 0,3 µg/g*
35	Br	Bromine	*3,70 µg/g*
37	Rb	Rubidium	*0,90 µg/g*
38	Sr	Strontium	*20,10 µg/g*
39	Y	Yttrium	*< 0,5 µg/g*
40	Zr	Zirconium	*< 5,2 µg/g*
41	Nb	Niobium	*< 4,2 µg/g*
42	Mo	Molybdenum	*< 4,5 µg/g*
47	Ag	Silver	*< 2,8 µg/g*
48	Cd	Cadmium	*< 2,3 µg/g*
49	In	Indium	*< 3,0 µg/g*
50	Sn	Tin	*3,40 µg/g*
51	Sb	Antimony	*< 3,9 µg/g*
52	Te	Tellurium	*< 5,2 µg/g*
53	I	Iodine	*< 9,6 µg/g*
55	Cs	Cesium	*< 16 µg/g*
56	Ba	Barium	*260,30 µg/g*
57	La	Lanthanum	*< 33 µg/g*
58	Ce	Cerium	*< 47 µg/g*
74	W	Tungsten	*< 2,6 µg/g*
80	Hg	Mercury	*2,20 µg/g*
81	Tl	Thallium	*1,00 µg/g*
82	Pb	Lead	*2,70 µg/g*
83	Bi	Bismuth	*1,00 µg/g*
90	Th	Thorium	*0,60 µg/g*
92	U	Uranium	*< 8,6 µg/g*

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6376	Fortyndingsmiddel:	None
Beskrivelse:	**S2 lag 8**	Prøvevægt (g):	3,064
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 35 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,044*	*%*
12	Mg	Magnesium	*0,38*	*%*
13	Al	Aluminum	*0,56*	*%*
14	Si	Silicon	*0,62*	*%*
15	P	Phosphorus	*< 0,00086*	*%*
16	S	Sulfur	*0,18*	*%*
17	Cl	Chlorine	*0,54*	*%*
19	K	Potassium	*0,04*	*%*
20	Ca	Calcium	*4,86*	*%*
22	Ti	Titanium	*2,23*	*%*
23	V	Vanadium	*< 0,0025*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*0,01*	*%*
26	Fe	Iron	*0,09*	*%*
27	Co	Cobalt	*3,10*	*µg/g*
28	Ni	Nickel	*16,30*	*µg/g*
29	Cu	Copper	*259,70*	*µg/g*
30	Zn	Zinc	*6.999,00*	*µg/g*
31	Ga	Gallium	*< 1,5*	*µg/g*
32	Ge	Germanium	*1,90*	*µg/g*
33	As	Arsenic	*0,80*	*µg/g*
34	Se	Selenium	*0,80*	*µg/g*
35	Br	Bromine	*121,30*	*µg/g*
37	Rb	Rubidium	*6,30*	*µg/g*
38	Sr	Strontium	*33,00*	*µg/g*
39	Y	Yttrium	*< 0,4*	*µg/g*
40	Zr	Zirconium	*16,80*	*µg/g*
41	Nb	Niobium	*5,30*	*µg/g*
42	Mo	Molybdenum	*< 2,4*	*µg/g*
47	Ag	Silver	*< 1,0*	*µg/g*
48	Cd	Cadmium	*1,60*	*µg/g*
49	In	Indium	*< 1,0*	*µg/g*
50	Sn	Tin	*2,80*	*µg/g*
51	Sb	Antimony	*18,10*	*µg/g*
52	Te	Tellurium	*< 2,0*	*µg/g*
53	I	Iodine	*< 3,5*	*µg/g*
55	Cs	Cesium	*< 5,3*	*µg/g*
56	Ba	Barium	*62,10*	*µg/g*
57	La	Lanthanum	*< 11*	*µg/g*
58	Ce	Cerium	*< 16*	*µg/g*
74	W	Tungsten	*< 20*	*µg/g*
80	Hg	Mercury	*1,80*	*µg/g*
81	Tl	Thallium	*1,80*	*µg/g*
82	Pb	Lead	*50,40*	*µg/g*
83	Bi	Bismuth	*0,80*	*µg/g*
90	Th	Thorium	*< 0,5*	*µg/g*
92	U	Uranium	*< 5,1*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6354	Fortyndingsmiddel:	None
Beskrivelse:	**S3 lag 1**	Prøvevægt (g):	2,284
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,042 %*
12	Mg	Magnesium	*< 0,0100 %*
13	Al	Aluminum	*0,32 %*
14	Si	Silicon	*0,16 %*
15	P	Phosphorus	*0,02 %*
16	S	Sulfur	*0,11 %*
17	Cl	Chlorine	*0,09 %*
19	K	Potassium	*0,03 %*
20	Ca	Calcium	*0,09 %*
22	Ti	Titanium	*0,29 %*
23	V	Vanadium	*< 0,00089 %*
24	Cr	Chromium	*0,00 %*
25	Mn	Manganese	*< 0,00019 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*2,00 µg/g*
28	Ni	Nickel	*50,10 µg/g*
29	Cu	Copper	*186,60 µg/g*
30	Zn	Zinc	*131,90 µg/g*
31	Ga	Gallium	*1,30 µg/g*
32	Ge	Germanium	*< 0,2 µg/g*
33	As	Arsenic	*0,40 µg/g*
34	Se	Selenium	*0,50 µg/g*
35	Br	Bromine	*5,80 µg/g*
37	Rb	Rubidium	*0,40 µg/g*
38	Sr	Strontium	*18,70 µg/g*
39	Y	Yttrium	*< 0,3 µg/g*
40	Zr	Zirconium	*< 3,3 µg/g*
41	Nb	Niobium	*< 1,8 µg/g*
42	Mo	Molybdenum	*< 1,8 µg/g*
47	Ag	Silver	*< 0,9 µg/g*
48	Cd	Cadmium	*0,60 µg/g*
49	In	Indium	*< 0,9 µg/g*
50	Sn	Tin	*< 1,5 µg/g*
51	Sb	Antimony	*1,20 µg/g*
52	Te	Tellurium	*1,90 µg/g*
53	I	Iodine	*< 3,8 µg/g*
55	Cs	Cesium	*< 6,5 µg/g*
56	Ba	Barium	*< 10 µg/g*
57	La	Lanthanum	*< 14 µg/g*
58	Ce	Cerium	*< 20 µg/g*
74	W	Tungsten	*< 3,9 µg/g*
80	Hg	Mercury	*0,60 µg/g*
81	Tl	Thallium	*0,40 µg/g*
82	Pb	Lead	*4,80 µg/g*
83	Bi	Bismuth	*1,90 µg/g*
90	Th	Thorium	*< 0,3 µg/g*
92	U	Uranium	*< 3,7 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6355	Fortyndingsmiddel:	None
Beskrivelse:	**S3 lag 2**	Prøvevægt (g):	0,996
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,094 %*
12	Mg	Magnesium	*0,21 %*
13	Al	Aluminum	*0,69 %*
14	Si	Silicon	*0,93 %*
15	P	Phosphorus	*0,02 %*
16	S	Sulfur	*0,08 %*
17	Cl	Chlorine	*0,22 %*
19	K	Potassium	*< 0,012 %*
20	Ca	Calcium	*23,52 %*
22	Ti	Titanium	*< 0,0011 %*
23	V	Vanadium	*0,00 %*
24	Cr	Chromium	*0,00 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*3,90 µg/g*
28	Ni	Nickel	*186,50 µg/g*
29	Cu	Copper	*< 1,0 µg/g*
30	Zn	Zinc	*< 1,0 µg/g*
31	Ga	Gallium	*2,60 µg/g*
32	Ge	Germanium	*< 0,4 µg/g*
33	As	Arsenic	*< 0,4 µg/g*
34	Se	Selenium	*< 0,3 µg/g*
35	Br	Bromine	*1,30 µg/g*
37	Rb	Rubidium	*< 0,2 µg/g*
38	Sr	Strontium	*17,40 µg/g*
39	Y	Yttrium	*1,30 µg/g*
40	Zr	Zirconium	*< 5,7 µg/g*
41	Nb	Niobium	*< 4,5 µg/g*
42	Mo	Molybdenum	*< 3,4 µg/g*
47	Ag	Silver	*< 1,5 µg/g*
48	Cd	Cadmium	*0,50 µg/g*
49	In	Indium	*< 2,0 µg/g*
50	Sn	Tin	*53,90 µg/g*
51	Sb	Antimony	*< 1,8 µg/g*
52	Te	Tellurium	*< 2,5 µg/g*
53	I	Iodine	*< 5,9 µg/g*
55	Cs	Cesium	*< 7,2 µg/g*
56	Ba	Barium	*< 10 µg/g*
57	La	Lanthanum	*< 15 µg/g*
58	Ce	Cerium	*< 21 µg/g*
74	W	Tungsten	*< 5,7 µg/g*
80	Hg	Mercury	*< 0,7 µg/g*
81	Tl	Thallium	*< 0,6 µg/g*
82	Pb	Lead	*1,30 µg/g*
83	Bi	Bismuth	*< 0,5 µg/g*
90	Th	Thorium	*< 0,4 µg/g*
92	U	Uranium	*< 8,1 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6377	Fortyndingsmiddel:	None
Beskrivelse:	**S3 lag 3**	Prøvevægt (g):	1,388
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 35 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,13*	*%*
12	Mg	Magnesium	*0,11*	*%*
13	Al	Aluminum	*0,49*	*%*
14	Si	Silicon	*0,35*	*%*
15	P	Phosphorus	*0,11*	*%*
16	S	Sulfur	*0,45*	*%*
17	Cl	Chlorine	*0,46*	*%*
19	K	Potassium	*0,12*	*%*
20	Ca	Calcium	*0,20*	*%*
22	Ti	Titanium	*0,33*	*%*
23	V	Vanadium	*< 0,0015*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,00029*	*%*
27	Co	Cobalt	*15,60*	*µg/g*
28	Ni	Nickel	*88,50*	*µg/g*
29	Cu	Copper	*< 0,3*	*µg/g*
30	Zn	Zinc	*9,50*	*µg/g*
31	Ga	Gallium	*1,70*	*µg/g*
32	Ge	Germanium	*0,80*	*µg/g*
33	As	Arsenic	*< 0,4*	*µg/g*
34	Se	Selenium	*0,30*	*µg/g*
35	Br	Bromine	*13,00*	*µg/g*
37	Rb	Rubidium	*0,60*	*µg/g*
38	Sr	Strontium	*2,10*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 6,4*	*µg/g*
41	Nb	Niobium	*< 3,5*	*µg/g*
42	Mo	Molybdenum	*< 2,9*	*µg/g*
47	Ag	Silver	*< 1,9*	*µg/g*
48	Cd	Cadmium	*1,20*	*µg/g*
49	In	Indium	*< 1,5*	*µg/g*
50	Sn	Tin	*< 2,8*	*µg/g*
51	Sb	Antimony	*54,80*	*µg/g*
52	Te	Tellurium	*< 2,8*	*µg/g*
53	I	Iodine	*< 4,6*	*µg/g*
55	Cs	Cesium	*< 7,2*	*µg/g*
56	Ba	Barium	*< 11*	*µg/g*
57	La	Lanthanum	*< 15*	*µg/g*
58	Ce	Cerium	*< 22*	*µg/g*
74	W	Tungsten	*< 3,9*	*µg/g*
80	Hg	Mercury	*< 0,7*	*µg/g*
81	Tl	Thallium	*< 0,4*	*µg/g*
82	Pb	Lead	*3,40*	*µg/g*
83	Bi	Bismuth	*0,50*	*µg/g*
90	Th	Thorium	*0,80*	*µg/g*
92	U	Uranium	*< 7,1*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6378	Fortyndingsmiddel:	None
Beskrivelse:	**S3 lag 4**	Prøvevægt (g):	4,625
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 35 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	< 0,14	%
12	Mg	Magnesium	0,47	%
13	Al	Aluminum	0,72	%
14	Si	Silicon	1,46	%
15	P	Phosphorus	0,26	%
16	S	Sulfur	0,72	%
17	Cl	Chlorine	2,08	%
19	K	Potassium	< 0,015	%
20	Ca	Calcium	20,75	%
22	Ti	Titanium	0,27	%
23	V	Vanadium	< 0,0077	%
24	Cr	Chromium	< 0,0047	%
25	Mn	Manganese	0,03	%
26	Fe	Iron	0,09	%
27	Co	Cobalt	< 4,5	µg/g
28	Ni	Nickel	42,00	µg/g
29	Cu	Copper	< 0,7	µg/g
30	Zn	Zinc	132,20	µg/g
31	Ga	Gallium	2,80	µg/g
32	Ge	Germanium	0,40	µg/g
33	As	Arsenic	1,40	µg/g
34	Se	Selenium	0,90	µg/g
35	Br	Bromine	86,40	µg/g
37	Rb	Rubidium	0,40	µg/g
38	Sr	Strontium	194,60	µg/g
39	Y	Yttrium	0,80	µg/g
40	Zr	Zirconium	11,40	µg/g
41	Nb	Niobium	< 7,7	µg/g
42	Mo	Molybdenum	< 5,4	µg/g
47	Ag	Silver	< 3,3	µg/g
48	Cd	Cadmium	7,50	µg/g
49	In	Indium	< 2,7	µg/g
50	Sn	Tin	105,40	µg/g
51	Sb	Antimony	< 2,9	µg/g
52	Te	Tellurium	< 4,4	µg/g
53	I	Iodine	< 8,9	µg/g
55	Cs	Cesium	42,90	µg/g
56	Ba	Barium	7.420,00	µg/g
57	La	Lanthanum	< 12	µg/g
58	Ce	Cerium	< 15	µg/g
74	W	Tungsten	< 5,7	µg/g
80	Hg	Mercury	< 1,1	µg/g
81	Tl	Thallium	0,80	µg/g
82	Pb	Lead	7,00	µg/g
83	Bi	Bismuth	1,10	µg/g
90	Th	Thorium	< 0,6	µg/g
92	U	Uranium	< 18	µg/g

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6379	Fortyndingsmiddel:	None
Beskrivelse:	**S3 lag 5**	Prøvevægt (g):	1,043
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*0,26*	*%*
12	Mg	Magnesium	*0,24*	*%*
13	Al	Aluminum	*0,16*	*%*
14	Si	Silicon	*0,10*	*%*
15	P	Phosphorus	*< 0,0011*	*%*
16	S	Sulfur	*0,04*	*%*
17	Cl	Chlorine	*0,11*	*%*
19	K	Potassium	*< 0,0035*	*%*
20	Ca	Calcium	*20,46*	*%*
22	Ti	Titanium	*0,14*	*%*
23	V	Vanadium	*0,00*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*0,03*	*%*
27	Co	Cobalt	*4,30*	*µg/g*
28	Ni	Nickel	*16,70*	*µg/g*
29	Cu	Copper	*61,40*	*µg/g*
30	Zn	Zinc	*78,40*	*µg/g*
31	Ga	Gallium	*2,20*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*7,00*	*µg/g*
34	Se	Selenium	*0,50*	*µg/g*
35	Br	Bromine	*3,30*	*µg/g*
37	Rb	Rubidium	*0,80*	*µg/g*
38	Sr	Strontium	*33,90*	*µg/g*
39	Y	Yttrium	*< 0,6*	*µg/g*
40	Zr	Zirconium	*< 4,8*	*µg/g*
41	Nb	Niobium	*< 4,3*	*µg/g*
42	Mo	Molybdenum	*< 4,4*	*µg/g*
47	Ag	Silver	*< 2,6*	*µg/g*
48	Cd	Cadmium	*< 2,4*	*µg/g*
49	In	Indium	*< 2,9*	*µg/g*
50	Sn	Tin	*< 4,2*	*µg/g*
51	Sb	Antimony	*< 3,8*	*µg/g*
52	Te	Tellurium	*< 5,4*	*µg/g*
53	I	Iodine	*< 11*	*µg/g*
55	Cs	Cesium	*< 17*	*µg/g*
56	Ba	Barium	*155,10*	*µg/g*
57	La	Lanthanum	*< 35*	*µg/g*
58	Ce	Cerium	*< 51*	*µg/g*
74	W	Tungsten	*< 2,3*	*µg/g*
80	Hg	Mercury	*0,80*	*µg/g*
81	Tl	Thallium	*1,50*	*µg/g*
82	Pb	Lead	*74,90*	*µg/g*
83	Bi	Bismuth	*1,40*	*µg/g*
90	Th	Thorium	*< 0,7*	*µg/g*
92	U	Uranium	*< 7,9*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6380	Fortyndingsmiddel:	None
Beskrivelse:	**S3 lag 6**	Prøvevægt (g):	2,952
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,041*	*%*
12	Mg	Magnesium	*0,51*	*%*
13	Al	Aluminum	*0,33*	*%*
14	Si	Silicon	*0,56*	*%*
15	P	Phosphorus	*0,00*	*%*
16	S	Sulfur	*0,11*	*%*
17	Cl	Chlorine	*0,31*	*%*
19	K	Potassium	*0,03*	*%*
20	Ca	Calcium	*5,70*	*%*
22	Ti	Titanium	*0,23*	*%*
23	V	Vanadium	*< 0,00090*	*%*
24	Cr	Chromium	*0,00*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*0,06*	*%*
27	Co	Cobalt	*4,50*	*µg/g*
28	Ni	Nickel	*9,50*	*µg/g*
29	Cu	Copper	*103,20*	*µg/g*
30	Zn	Zinc	*2.741,00*	*µg/g*
31	Ga	Gallium	*< 1,0*	*µg/g*
32	Ge	Germanium	*0,70*	*µg/g*
33	As	Arsenic	*< 0,5*	*µg/g*
34	Se	Selenium	*< 0,2*	*µg/g*
35	Br	Bromine	*6,70*	*µg/g*
37	Rb	Rubidium	*0,80*	*µg/g*
38	Sr	Strontium	*44,10*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 4,1*	*µg/g*
41	Nb	Niobium	*< 2,6*	*µg/g*
42	Mo	Molybdenum	*5,20*	*µg/g*
47	Ag	Silver	*1,90*	*µg/g*
48	Cd	Cadmium	*2,40*	*µg/g*
49	In	Indium	*< 1,2*	*µg/g*
50	Sn	Tin	*< 1,9*	*µg/g*
51	Sb	Antimony	*16,00*	*µg/g*
52	Te	Tellurium	*< 2,4*	*µg/g*
53	I	Iodine	*< 4,3*	*µg/g*
55	Cs	Cesium	*< 6,8*	*µg/g*
56	Ba	Barium	*< 10*	*µg/g*
57	La	Lanthanum	*< 15*	*µg/g*
58	Ce	Cerium	*< 22*	*µg/g*
74	W	Tungsten	*< 12*	*µg/g*
80	Hg	Mercury	*1,00*	*µg/g*
81	Tl	Thallium	*0,50*	*µg/g*
82	Pb	Lead	*10,40*	*µg/g*
83	Bi	Bismuth	*< 0,5*	*µg/g*
90	Th	Thorium	*< 0,3*	*µg/g*
92	U	Uranium	*< 5,3*	*µg/g*

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6381	Fortyndingsmiddel:	None
Beskrivelse:	**S3 lag 7**	Prøvevægt (g):	7,42
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,10*	*%*
12	Mg	Magnesium	*0,34*	*%*
13	Al	Aluminum	*0,88*	*%*
14	Si	Silicon	*0,85*	*%*
15	P	Phosphorus	*0,08*	*%*
16	S	Sulfur	*0,62*	*%*
17	Cl	Chlorine	*0,57*	*%*
19	K	Potassium	*0,19*	*%*
20	Ca	Calcium	*25,55*	*%*
22	Ti	Titanium	*< 0,0100*	*%*
23	V	Vanadium	*0,01*	*%*
24	Cr	Chromium	*< 0,0026*	*%*
25	Mn	Manganese	*0,01*	*%*
26	Fe	Iron	*0,04*	*%*
27	Co	Cobalt	*7,90*	*µg/g*
28	Ni	Nickel	*18,00*	*µg/g*
29	Cu	Copper	*< 2,5*	*µg/g*
30	Zn	Zinc	*9.152,00*	*µg/g*
31	Ga	Gallium	*< 2,2*	*µg/g*
32	Ge	Germanium	*1,10*	*µg/g*
33	As	Arsenic	*< 0,9*	*µg/g*
34	Se	Selenium	*0,60*	*µg/g*
35	Br	Bromine	*5,20*	*µg/g*
37	Rb	Rubidium	*1,80*	*µg/g*
38	Sr	Strontium	*167,90*	*µg/g*
39	Y	Yttrium	*2,20*	*µg/g*
40	Zr	Zirconium	*< 11*	*µg/g*
41	Nb	Niobium	*< 5,0*	*µg/g*
42	Mo	Molybdenum	*< 4,4*	*µg/g*
47	Ag	Silver	*< 2,2*	*µg/g*
48	Cd	Cadmium	*1,90*	*µg/g*
49	In	Indium	*< 2,3*	*µg/g*
50	Sn	Tin	*73,70*	*µg/g*
51	Sb	Antimony	*< 2,4*	*µg/g*
52	Te	Tellurium	*< 4,2*	*µg/g*
53	I	Iodine	*< 8,8*	*µg/g*
55	Cs	Cesium	*40,50*	*µg/g*
56	Ba	Barium	*6.915,00*	*µg/g*
57	La	Lanthanum	*< 13*	*µg/g*
58	Ce	Cerium	*< 18*	*µg/g*
74	W	Tungsten	*< 32*	*µg/g*
80	Hg	Mercury	*1,20*	*µg/g*
81	Tl	Thallium	*< 1,0*	*µg/g*
82	Pb	Lead	*15,10*	*µg/g*
83	Bi	Bismuth	*1,60*	*µg/g*
90	Th	Thorium	*< 0,6*	*µg/g*
92	U	Uranium	*< 13*	*µg/g*

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6382	Fortyndingsmiddel:	None
Beskrivelse:	**S3 lag 8**	Prøvevægt (g):	2,522
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 40 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,091 %*
12	Mg	Magnesium	*0,21 %*
13	Al	Aluminum	*0,56 %*
14	Si	Silicon	*0,78 %*
15	P	Phosphorus	*0,00 %*
16	S	Sulfur	*0,09 %*
17	Cl	Chlorine	*0,08 %*
19	K	Potassium	*< 0,014 %*
20	Ca	Calcium	*38,68 %*
22	Ti	Titanium	*0,01 %*
23	V	Vanadium	*< 0,0011 %*
24	Cr	Chromium	*< 0,00096 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*< 3,0 µg/g*
28	Ni	Nickel	*35,80 µg/g*
29	Cu	Copper	*< 0,2 µg/g*
30	Zn	Zinc	*< 1,0 µg/g*
31	Ga	Gallium	*2,70 µg/g*
32	Ge	Germanium	*< 0,5 µg/g*
33	As	Arsenic	*< 0,5 µg/g*
34	Se	Selenium	*< 0,4 µg/g*
35	Br	Bromine	*2,50 µg/g*
37	Rb	Rubidium	*1,10 µg/g*
38	Sr	Strontium	*36,90 µg/g*
39	Y	Yttrium	*2,00 µg/g*
40	Zr	Zirconium	*< 6,1 µg/g*
41	Nb	Niobium	*< 4,2 µg/g*
42	Mo	Molybdenum	*< 4,1 µg/g*
47	Ag	Silver	*< 1,6 µg/g*
48	Cd	Cadmium	*1,50 µg/g*
49	In	Indium	*< 1,4 µg/g*
50	Sn	Tin	*88,30 µg/g*
51	Sb	Antimony	*0,90 µg/g*
52	Te	Tellurium	*< 2,3 µg/g*
53	I	Iodine	*< 5,1 µg/g*
55	Cs	Cesium	*< 5,2 µg/g*
56	Ba	Barium	*< 7,8 µg/g*
57	La	Lanthanum	*< 10 µg/g*
58	Ce	Cerium	*< 14 µg/g*
74	W	Tungsten	*< 4,0 µg/g*
80	Hg	Mercury	*< 1,0 µg/g*
81	Tl	Thallium	*< 0,8 µg/g*
82	Pb	Lead	*2,10 µg/g*
83	Bi	Bismuth	*< 0,7 µg/g*
90	Th	Thorium	*< 0,6 µg/g*
92	U	Uranium	*< 9,8 µg/g*

XRF Analyse - XLAB 2000

FORCE TECHNOLOGY

Sag nr.: 113-22730.

Prøveidentifikation:	x6383	Fortyndingsmiddel:	None
Beskrivelse:	**S3 lag 9**	Prøvevægt (g):	3,756
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 30 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,042 %*
12	Mg	Magnesium	*0,13 %*
13	Al	Aluminum	*0,24 %*
14	Si	Silicon	*0,33 %*
15	P	Phosphorus	*< 0,0017 %*
16	S	Sulfur	*0,03 %*
17	Cl	Chlorine	*0,03 %*
19	K	Potassium	*< 0,0047 %*
20	Ca	Calcium	*18,43 %*
22	Ti	Titanium	*< 0,00060 %*
23	V	Vanadium	*< 0,00048 %*
24	Cr	Chromium	*0,00 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*0,00 %*
27	Co	Cobalt	*3,30 µg/g*
28	Ni	Nickel	*6,90 µg/g*
29	Cu	Copper	*< 0,7 µg/g*
30	Zn	Zinc	*8,40 µg/g*
31	Ga	Gallium	*1,40 µg/g*
32	Ge	Germanium	*< 0,3 µg/g*
33	As	Arsenic	*< 0,3 µg/g*
34	Se	Selenium	*0,50 µg/g*
35	Br	Bromine	*3,40 µg/g*
37	Rb	Rubidium	*1,00 µg/g*
38	Sr	Strontium	*51,60 µg/g*
39	Y	Yttrium	*2,10 µg/g*
40	Zr	Zirconium	*< 4,6 µg/g*
41	Nb	Niobium	*< 2,8 µg/g*
42	Mo	Molybdenum	*< 2,0 µg/g*
47	Ag	Silver	*< 1,1 µg/g*
48	Cd	Cadmium	*2,10 µg/g*
49	In	Indium	*< 1,1 µg/g*
50	Sn	Tin	*173,70 µg/g*
51	Sb	Antimony	*< 1,3 µg/g*
52	Te	Tellurium	*< 1,9 µg/g*
53	I	Iodine	*< 4,8 µg/g*
55	Cs	Cesium	*< 4,7 µg/g*
56	Ba	Barium	*< 7,2 µg/g*
57	La	Lanthanum	*< 9,3 µg/g*
58	Ce	Cerium	*< 13 µg/g*
74	W	Tungsten	*< 1,9 µg/g*
80	Hg	Mercury	*< 0,7 µg/g*
81	Tl	Thallium	*1,00 µg/g*
82	Pb	Lead	*2,00 µg/g*
83	Bi	Bismuth	*< 0,5 µg/g*
90	Th	Thorium	*1,10 µg/g*
92	U	Uranium	*< 6,5 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6384	Fortyndingsmiddel:	None
Beskrivelse:	**S3 lag 10**	Prøvevægt (g):	1,452
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 32 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,028 %*
12	Mg	Magnesium	*0,17 %*
13	Al	Aluminum	*0,20 %*
14	Si	Silicon	*0,32 %*
15	P	Phosphorus	*0,00 %*
16	S	Sulfur	*0,06 %*
17	Cl	Chlorine	*0,26 %*
19	K	Potassium	*0,02 %*
20	Ca	Calcium	*3,57 %*
22	Ti	Titanium	*0,19 %*
23	V	Vanadium	*0,00 %*
24	Cr	Chromium	*0,00 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*0,06 %*
27	Co	Cobalt	*< 2,0 µg/g*
28	Ni	Nickel	*9,70 µg/g*
29	Cu	Copper	*141,80 µg/g*
30	Zn	Zinc	*2.087,00 µg/g*
31	Ga	Gallium	*< 0,7 µg/g*
32	Ge	Germanium	*0,40 µg/g*
33	As	Arsenic	*< 0,4 µg/g*
34	Se	Selenium	*< 0,2 µg/g*
35	Br	Bromine	*5,20 µg/g*
37	Rb	Rubidium	*0,70 µg/g*
38	Sr	Strontium	*38,70 µg/g*
39	Y	Yttrium	*< 0,3 µg/g*
40	Zr	Zirconium	*4,60 µg/g*
41	Nb	Niobium	*< 2,4 µg/g*
42	Mo	Molybdenum	*3,40 µg/g*
47	Ag	Silver	*< 1,3 µg/g*
48	Cd	Cadmium	*1,30 µg/g*
49	In	Indium	*< 1,4 µg/g*
50	Sn	Tin	*2,70 µg/g*
51	Sb	Antimony	*23,70 µg/g*
52	Te	Tellurium	*< 2,8 µg/g*
53	I	Iodine	*< 5,1 µg/g*
55	Cs	Cesium	*< 7,9 µg/g*
56	Ba	Barium	*< 12 µg/g*
57	La	Lanthanum	*< 18 µg/g*
58	Ce	Cerium	*< 26 µg/g*
74	W	Tungsten	*< 9,6 µg/g*
80	Hg	Mercury	*1,30 µg/g*
81	Tl	Thallium	*0,50 µg/g*
82	Pb	Lead	*10,30 µg/g*
83	Bi	Bismuth	*< 0,4 µg/g*
90	Th	Thorium	*< 0,3 µg/g*
92	U	Uranium	*< 4,0 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6385	Fortyndingsmiddel:	None
Beskrivelse:	**S3 lag 11**	Prøvevægt (g):	0,37
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 30 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	18-feb-13
Prøve status:	AAAXXX	Dato for beregning:	18-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*0,05 %*
12	Mg	Magnesium	*0,09 %*
13	Al	Aluminum	*0,07 %*
14	Si	Silicon	*0,04 %*
15	P	Phosphorus	*< 0,0050 %*
16	S	Sulfur	*0,01 %*
17	Cl	Chlorine	*0,03 %*
19	K	Potassium	*< 0,0015 %*
20	Ca	Calcium	*9,83 %*
22	Ti	Titanium	*0,07 %*
23	V	Vanadium	*0,00 %*
24	Cr	Chromium	*0,00 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*0,02 %*
27	Co	Cobalt	*1,20 µg/g*
28	Ni	Nickel	*10,60 µg/g*
29	Cu	Copper	*35,00 µg/g*
30	Zn	Zinc	*53,90 µg/g*
31	Ga	Gallium	*1,10 µg/g*
32	Ge	Germanium	*< 0,2 µg/g*
33	As	Arsenic	*5,10 µg/g*
34	Se	Selenium	*0,40 µg/g*
35	Br	Bromine	*2,70 µg/g*
37	Rb	Rubidium	*0,60 µg/g*
38	Sr	Strontium	*29,50 µg/g*
39	Y	Yttrium	*< 0,6 µg/g*
40	Zr	Zirconium	*< 3,9 µg/g*
41	Nb	Niobium	*< 3,6 µg/g*
42	Mo	Molybdenum	*< 4,1 µg/g*
47	Ag	Silver	*< 2,2 µg/g*
48	Cd	Cadmium	*< 2,6 µg/g*
49	In	Indium	*< 2,6 µg/g*
50	Sn	Tin	*< 3,8 µg/g*
51	Sb	Antimony	*< 3,9 µg/g*
52	Te	Tellurium	*5,30 µg/g*
53	I	Iodine	*< 11 µg/g*
55	Cs	Cesium	*23,60 µg/g*
56	Ba	Barium	*< 24 µg/g*
57	La	Lanthanum	*< 37 µg/g*
58	Ce	Cerium	*< 53 µg/g*
74	W	Tungsten	*< 1,5 µg/g*
80	Hg	Mercury	*0,30 µg/g*
81	Tl	Thallium	*1,00 µg/g*
82	Pb	Lead	*58,70 µg/g*
83	Bi	Bismuth	*0,90 µg/g*
90	Th	Thorium	*< 0,6 µg/g*
92	U	Uranium	*< 7,2 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6343 ru side	Fortyndingsmiddel:	None
Beskrivelse:	**P1 lag 1 ru side**	Prøvevægt (g):	10,51
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,064*	*%*
12	Mg	Magnesium	*< 0,014*	*%*
13	Al	Aluminum	*0,32*	*%*
14	Si	Silicon	*0,33*	*%*
15	P	Phosphorus	*< 0,00060*	*%*
16	S	Sulfur	*0,06*	*%*
17	Cl	Chlorine	*0,31*	*%*
19	K	Potassium	*< 0,0066*	*%*
20	Ca	Calcium	*0,03*	*%*
22	Ti	Titanium	*0,83*	*%*
23	V	Vanadium	*0,00*	*%*
24	Cr	Chromium	*< 0,00036*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,00016*	*%*
27	Co	Cobalt	*2,00*	*µg/g*
28	Ni	Nickel	*26,20*	*µg/g*
29	Cu	Copper	*< 0,5*	*µg/g*
30	Zn	Zinc	*0,30*	*µg/g*
31	Ga	Gallium	*1,00*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,2*	*µg/g*
34	Se	Selenium	*0,20*	*µg/g*
35	Br	Bromine	*2,30*	*µg/g*
37	Rb	Rubidium	*0,40*	*µg/g*
38	Sr	Strontium	*0,90*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*6,90*	*µg/g*
41	Nb	Niobium	*< 2,4*	*µg/g*
42	Mo	Molybdenum	*< 1,7*	*µg/g*
47	Ag	Silver	*< 0,8*	*µg/g*
48	Cd	Cadmium	*0,70*	*µg/g*
49	In	Indium	*< 0,9*	*µg/g*
50	Sn	Tin	*< 1,5*	*µg/g*
51	Sb	Antimony	*34,60*	*µg/g*
52	Te	Tellurium	*< 1,8*	*µg/g*
53	I	Iodine	*< 3,1*	*µg/g*
55	Cs	Cesium	*< 4,5*	*µg/g*
56	Ba	Barium	*< 7,6*	*µg/g*
57	La	Lanthanum	*< 9,0*	*µg/g*
58	Ce	Cerium	*< 12*	*µg/g*
74	W	Tungsten	*< 2,1*	*µg/g*
80	Hg	Mercury	*< 0,4*	*µg/g*
81	Tl	Thallium	*< 0,3*	*µg/g*
82	Pb	Lead	*1,20*	*µg/g*
83	Bi	Bismuth	*0,60*	*µg/g*
90	Th	Thorium	*0,30*	*µg/g*
92	U	Uranium	*< 5,5*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6344 glat side	Fortyndingsmiddel:	None
Beskrivelse:	**P1 lag 1 glat side**	Prøvevægt (g):	10,51
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,066*	*%*
12	Mg	Magnesium	*< 0,014*	*%*
13	Al	Aluminum	*0,30*	*%*
14	Si	Silicon	*0,27*	*%*
15	P	Phosphorus	*< 0,00052*	*%*
16	S	Sulfur	*0,06*	*%*
17	Cl	Chlorine	*0,19*	*%*
19	K	Potassium	*< 0,0057*	*%*
20	Ca	Calcium	*0,04*	*%*
22	Ti	Titanium	*0,85*	*%*
23	V	Vanadium	*0,01*	*%*
24	Cr	Chromium	*< 0,00037*	*%*
25	Mn	Manganese	*0,00*	*%*
26	Fe	Iron	*< 0,00017*	*%*
27	Co	Cobalt	*2,70*	*µg/g*
28	Ni	Nickel	*43,40*	*µg/g*
29	Cu	Copper	*< 0,5*	*µg/g*
30	Zn	Zinc	*< 0,2*	*µg/g*
31	Ga	Gallium	*0,60*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,2*	*µg/g*
34	Se	Selenium	*< 0,2*	*µg/g*
35	Br	Bromine	*2,40*	*µg/g*
37	Rb	Rubidium	*0,40*	*µg/g*
38	Sr	Strontium	*0,70*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 3,3*	*µg/g*
41	Nb	Niobium	*2,40*	*µg/g*
42	Mo	Molybdenum	*< 1,7*	*µg/g*
47	Ag	Silver	*< 0,7*	*µg/g*
48	Cd	Cadmium	*0,60*	*µg/g*
49	In	Indium	*< 0,8*	*µg/g*
50	Sn	Tin	*< 1,2*	*µg/g*
51	Sb	Antimony	*33,30*	*µg/g*
52	Te	Tellurium	*< 1,7*	*µg/g*
53	I	Iodine	*< 2,9*	*µg/g*
55	Cs	Cesium	*< 4,2*	*µg/g*
56	Ba	Barium	*< 6,9*	*µg/g*
57	La	Lanthanum	*< 8,4*	*µg/g*
58	Ce	Cerium	*< 12*	*µg/g*
74	W	Tungsten	*< 2,3*	*µg/g*
80	Hg	Mercury	*0,40*	*µg/g*
81	Tl	Thallium	*0,40*	*µg/g*
82	Pb	Lead	*1,40*	*µg/g*
83	Bi	Bismuth	*< 0,3*	*µg/g*
90	Th	Thorium	*0,70*	*µg/g*
92	U	Uranium	*< 4,1*	*µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6345 ulden side	Fortyndingsmiddel:	None
Beskrivelse:	**P1 lag 2 ulden side**	Prøvevægt (g):	10,09
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

Z	Symbol	Element	Conc.
11	Na	Sodium	*< 0,12 %*
12	Mg	Magnesium	*0,32 %*
13	Al	Aluminum	*0,75 %*
14	Si	Silicon	*0,90 %*
15	P	Phosphorus	*< 0,00096 %*
16	S	Sulfur	*0,07 %*
17	Cl	Chlorine	*0,04 %*
19	K	Potassium	*< 0,014 %*
20	Ca	Calcium	*0,05 %*
22	Ti	Titanium	*1,23 %*
23	V	Vanadium	*< 0,0031 %*
24	Cr	Chromium	*< 0,00055 %*
25	Mn	Manganese	*0,00 %*
26	Fe	Iron	*< 0,0015 %*
27	Co	Cobalt	*< 2,0 µg/g*
28	Ni	Nickel	*191,10 µg/g*
29	Cu	Copper	*< 0,3 µg/g*
30	Zn	Zinc	*< 1,0 µg/g*
31	Ga	Gallium	*3,20 µg/g*
32	Ge	Germanium	*< 0,4 µg/g*
33	As	Arsenic	*< 0,4 µg/g*
34	Se	Selenium	*< 0,3 µg/g*
35	Br	Bromine	*2,40 µg/g*
37	Rb	Rubidium	*0,50 µg/g*
38	Sr	Strontium	*< 0,3 µg/g*
39	Y	Yttrium	*< 0,3 µg/g*
40	Zr	Zirconium	*< 5,5 µg/g*
41	Nb	Niobium	*< 4,6 µg/g*
42	Mo	Molybdenum	*< 3,2 µg/g*
47	Ag	Silver	*< 1,2 µg/g*
48	Cd	Cadmium	*1,00 µg/g*
49	In	Indium	*< 0,9 µg/g*
50	Sn	Tin	*0,40 µg/g*
51	Sb	Antimony	*17,60 µg/g*
52	Te	Tellurium	*< 1,6 µg/g*
53	I	Iodine	*< 3,5 µg/g*
55	Cs	Cesium	*< 4,7 µg/g*
56	Ba	Barium	*< 8,3 µg/g*
57	La	Lanthanum	*< 9,2 µg/g*
58	Ce	Cerium	*< 12 µg/g*
74	W	Tungsten	*< 5,8 µg/g*
80	Hg	Mercury	*< 0,7 µg/g*
81	Tl	Thallium	*< 0,5 µg/g*
82	Pb	Lead	*1,60 µg/g*
83	Bi	Bismuth	*< 0,5 µg/g*
90	Th	Thorium	*< 0,4 µg/g*
92	U	Uranium	*< 6,3 µg/g*

XRF Analyse - XLAB 2000

Sag nr.: 113-22730.

Prøveidentifikation:	x6346 glat side	Fortyndingsmiddel:	None
Beskrivelse:	**P1 lag 2 stof side**	Prøvevægt (g):	10,09
Metode:	Tq-3945r	Fort. middel vægt(g)	0
Sags Id.:	113-22730	Fortyndingsfaktor	1
Prøveform:	Pressed tablet, 50 mm	Prøverotation:	No
Prøvetype:	Preßtablette	Dato for optagelse:	15-feb-13
Prøve status:	AAAXXX	Dato for beregning:	15-feb-13

Resultater

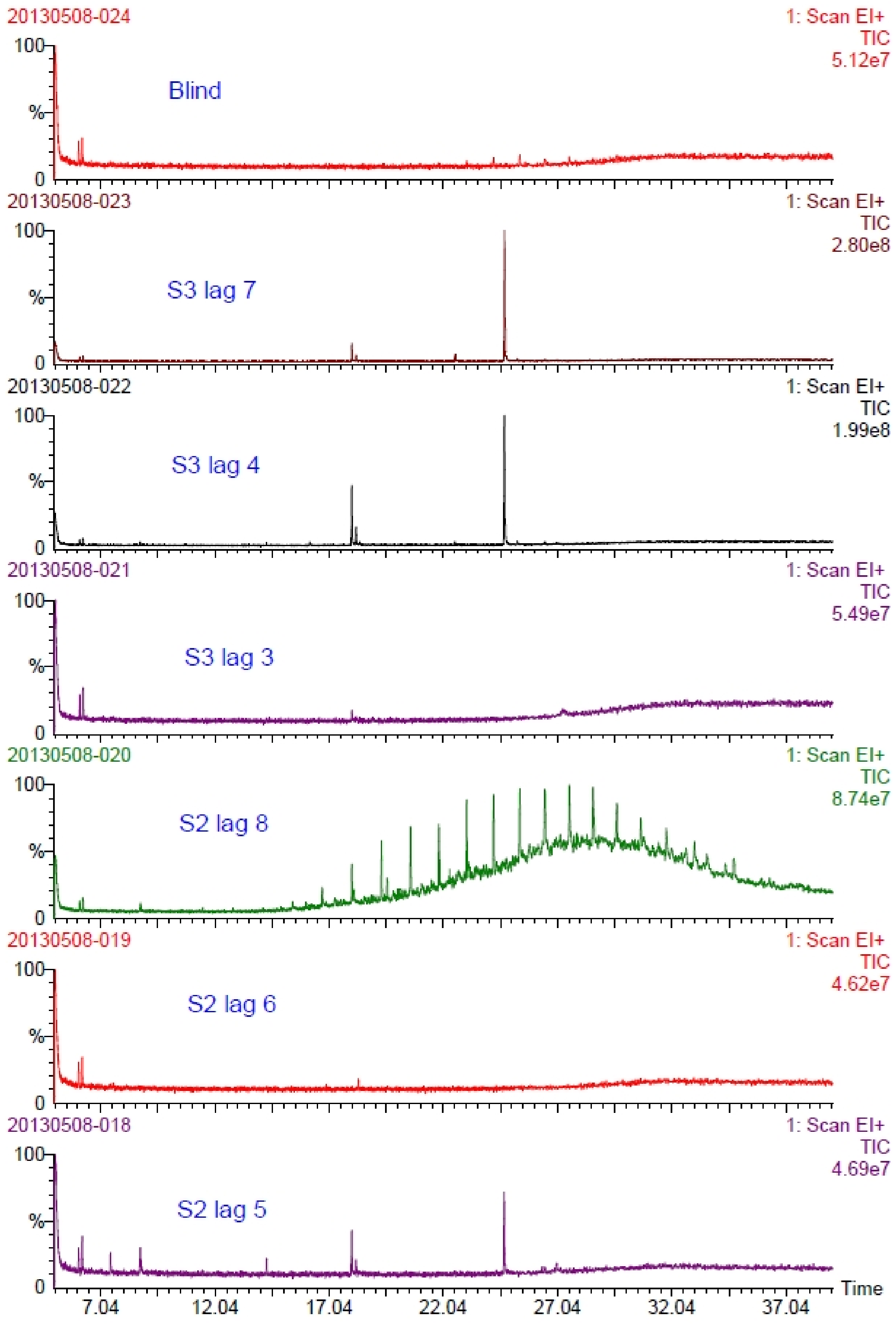
Z	Symbol	Element	Conc.	
11	Na	Sodium	*< 0,11*	*%*
12	Mg	Magnesium	*< 0,024*	*%*
13	Al	Aluminum	*0,64*	*%*
14	Si	Silicon	*0,53*	*%*
15	P	Phosphorus	*< 0,00097*	*%*
16	S	Sulfur	*0,05*	*%*
17	Cl	Chlorine	*0,04*	*%*
19	K	Potassium	*< 0,011*	*%*
20	Ca	Calcium	*0,05*	*%*
22	Ti	Titanium	*1,29*	*%*
23	V	Vanadium	*< 0,0028*	*%*
24	Cr	Chromium	*< 0,00046*	*%*
25	Mn	Manganese	*< 0,00029*	*%*
26	Fe	Iron	*< 0,0015*	*%*
27	Co	Cobalt	*1,70*	*µg/g*
28	Ni	Nickel	*101,10*	*µg/g*
29	Cu	Copper	*< 0,8*	*µg/g*
30	Zn	Zinc	*< 1,0*	*µg/g*
31	Ga	Gallium	*2,50*	*µg/g*
32	Ge	Germanium	*< 0,3*	*µg/g*
33	As	Arsenic	*< 0,3*	*µg/g*
34	Se	Selenium	*0,40*	*µg/g*
35	Br	Bromine	*2,70*	*µg/g*
37	Rb	Rubidium	*< 0,2*	*µg/g*
38	Sr	Strontium	*0,70*	*µg/g*
39	Y	Yttrium	*< 0,3*	*µg/g*
40	Zr	Zirconium	*< 6,0*	*µg/g*
41	Nb	Niobium	*4,00*	*µg/g*
42	Mo	Molybdenum	*< 2,4*	*µg/g*
47	Ag	Silver	*< 1,2*	*µg/g*
48	Cd	Cadmium	*< 1,0*	*µg/g*
49	In	Indium	*< 1,2*	*µg/g*
50	Sn	Tin	*< 1,9*	*µg/g*
51	Sb	Antimony	*30,30*	*µg/g*
52	Te	Tellurium	*< 2,1*	*µg/g*
53	I	Iodine	*< 3,9*	*µg/g*
55	Cs	Cesium	*< 5,2*	*µg/g*
56	Ba	Barium	*< 9,1*	*µg/g*
57	La	Lanthanum	*< 10*	*µg/g*
58	Ce	Cerium	*< 15*	*µg/g*
74	W	Tungsten	*< 4,3*	*µg/g*
80	Hg	Mercury	*< 0,6*	*µg/g*
81	Tl	Thallium	*< 0,4*	*µg/g*
82	Pb	Lead	*1,60*	*µg/g*
83	Bi	Bismuth	*< 0,4*	*µg/g*
90	Th	Thorium	*< 0,4*	*µg/g*
92	U	Uranium	*< 8,8*	*µg/g*

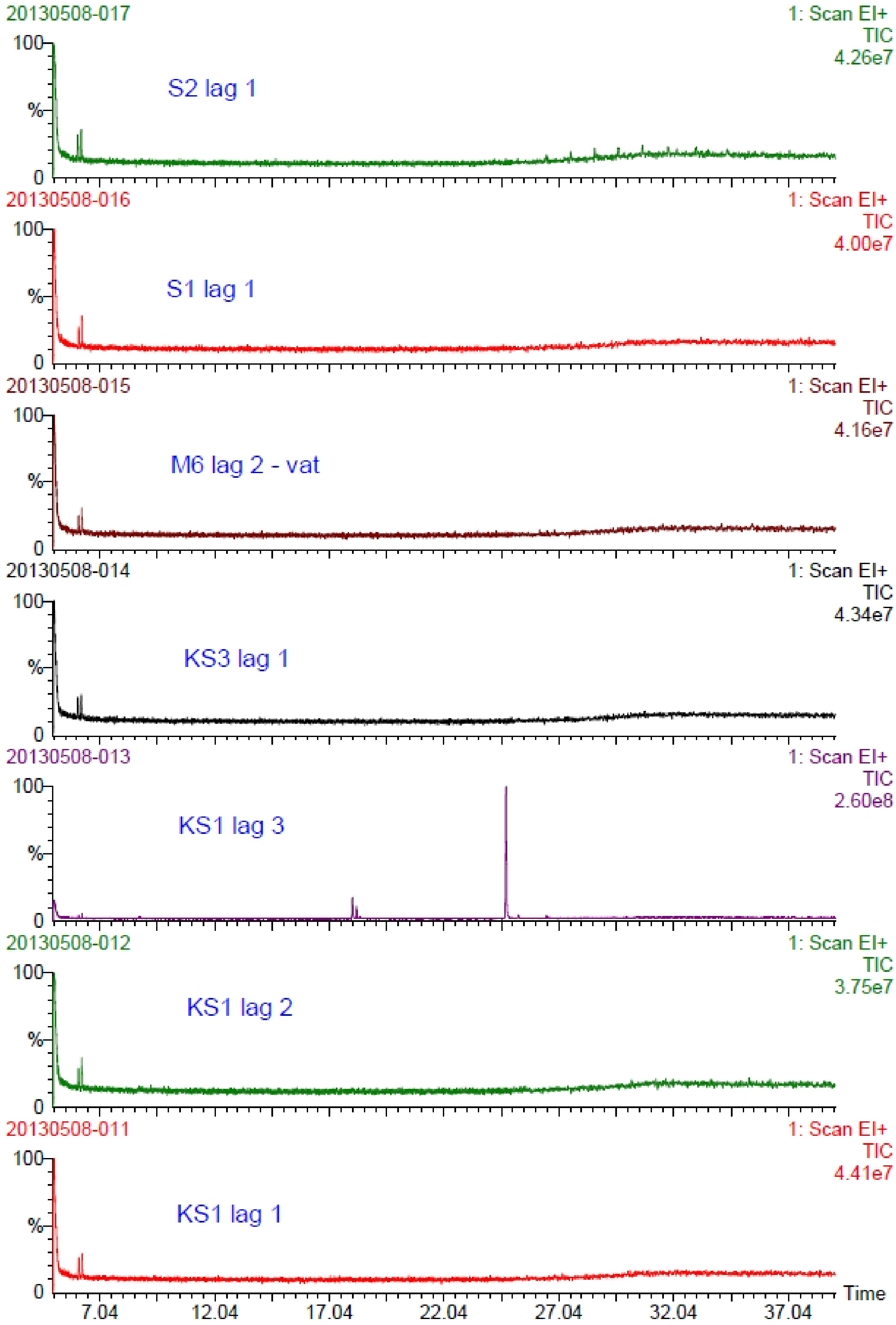
Appendix 4: Chromatograms from the screening of the 13 subsamples

This appendix presents the chromatograms from the screening of the 13 subsamples. As indicated on the chromatograms on the following two pages, the only identified flame retardants are TCPP and TDCPP.

The other peaks, apart from the two at the very beginning that also appear from the blind test indicated in the chromatograms, are:

- S2 layer 8 – a mineral oil (a wide curve illustrating the boiling point distribution in the oil)
- S2 layer 5 – BHT (14.5 min), a carboxylic acid (9 min) and something (8 min), which probably is a foamer from the production of the foam (azobisisobutyronitril)


20130508-024
1: Scan EI+
TIC
5.12e7
Blind
20130508-023
1: Scan EI+
TIC
2.80e8
S3 lag 7
20130508-022
1: Scan EI+
TIC
1.99e8
S3 lag 4
20130508-021
1: Scan EI+
TIC
5.49e7
S3 lag 3
20130508-020
1: Scan EI+
TIC
8.74e7
S2 lag 8
20130508-019
1: Scan EI+
TIC
4.62e7
S2 lag 6
20130508-018
1: Scan EI+
TIC
4.69e7
S2 lag 5
100
%
0
Time
7.04
12.04
17.04
22.04
27.04
32.04
37.04


20130508-017
1: Scan EI+
TIC
4.26e7
S2 lag 1
20130508-016
1: Scan EI+
TIC
4.00e7
S1 lag 1
20130508-015
1: Scan EI+
TIC
4.16e7
M6 lag 2 - vat
20130508-014
1: Scan EI+
TIC
4.34e7
KS3 lag 1
20130508-013
1: Scan EI+
TIC
2.60e8
KS1 lag 3
20130508-012
1: Scan EI+
TIC
3.75e7
KS1 lag 2
20130508-011
1: Scan EI+
TIC
4.41e7
KS1 lag 1
100
%
0
Time
7.04
12.04
17.04
22.04
27.04
32.04
37.04

Survey, health and environmental assessment of flame retardants in textiles
In this project the use of flame retardants in furniture and textiles for interiors has been described.

It is primarily textiles, carpets and curtains to be used in e.g. furniture in public buildings or other professional contexts where there are specific fire safety standards that contain flame retardants.

Fifteen products were analyzed, three office chairs, eight mattresses, three chairs/armchairs and one plaid. Three chairs contained flame retardants in the form of TCPP and TDCPP in the foam. None of the mattress or the rug containing flame retardants.

Exposure to TCPP and TDCPP can be made through inhalation, via skin or through ingestion of dust particles. The calculations show that it is probably skin contact with furnishings that give the largest contribution. The exposure to the furniture analyzed in this project does not give rise to any risk to the consumer.

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