Conclusions of January 16th 2018 Stakeholder's Workshop

info@life-flarex.eu

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Executive summary

The stakeholder's workshop on January 16th 2018 was co-organized by FLAREX partnership, EURATEX-The European Apparel and Textile Confederation and the European Chemical Agency (ECHA).

The aim of the workshop was to discuss among experts of different competences the advances and alternatives for implementation of chemical substitution policies in the textile industry, particularly on the use of flame retardants for home textiles/contract markets including carpets, upholstery for furniture and other products such as mattresses or curtains.

Main outcomes of the workshop were:

- **More sustainable alternative flame retardants** with performance claimed to match the conventional flame retardants were mentioned by certain chemical producers. However, these solutions are still more expensive due to lack of demand and their applicability to the textile sector still needs to be examined.
- The **lack of harmonized regulations and public procurement requirements** across the union, even at regional levels, increases the costs for SME and limits the benefits of the single market. Several participants highlighted the need to harmonize public procurement across Europe including sustainability parameters in the selection criteria to favor the shift to more sustainable flame retardants and increase the competitiveness of European SMEs in the textile sector.
- There is a **lack of market pull** for alternative flame retardants, meaning consumers (individuals and organizations such as public bodies) are not aware of flame retardants used in textiles to comply with safety specifications nor their consequences for the environment and health. Awareness among the consumers might lead to different purchasing choices.
- **Legislation and regulations are the main drivers** of use (fire-safety regulations) and selection (human health and environmental legislation) of flame retardants in home (UK) and contract textiles (all EU) due to highly competitive cost-driven sector. Factors that could be taken into account for fire safety are careful assessment whether flame retardants are actually needed based on product design (i.e. materials used or fire exposure pathways) and the considerations from environmental and health safety assessment (toxicity, exposure path to human and environment). I Promotion of international fire testing standards should be required and parameters should be adjusted for each particular application.

LIFE-FLAREX project next steps are to assess and demonstrate the suitability of alternative flame retardants by benchmarking with conventional products, first at lab scale and later at industrial level. The demonstration will include technical performance, environmental impact, exposure and toxicological assessments. In parallel, further workshops will be organized at regional level in Italy, Czech Republic and Spain to raise awareness and at later stages of the project at EU level presenting the key results of the project to European-wide Stakeholders.

Contents

1. Agenda of the workshop

13:00	**13:30**	Registration and welcome coffee	
13:30	**13:40**	Welcome and round call presentation	AEI Tèxtils / EURATEX
13:40	**13:50**	LIFE-FLAREX presentation	AEI Tèxtils
13:50	**14:00**	Industry view on replacement of harmful chemicals	EURATEX
14:00	**14:15**	State of the art on safer flame retardant alternatives for home textile sector: "Which are the alternatives for home textiles?"	LEITAT/ CTB
14:15	**14:30**	Substitution of chemicals – early warnings, concepts and available tools	ECHA
14:30	**15:30**	"Industry concerns and vision on flame retardants for home textiles, a broad stakeholder approach" – World Café session - Use of flame retardants in home textiles – impact on downstream users, EURATEX and AEI Tèxtil - Flame retardant alternatives and best practices towards safer textiles, CTB, LEITAT and ECHA	
15:30	**15:50**	Networking break and coffee – Poster session on flame retardant substitution best practices and research developments	
15:50	**16:50**	"Industry concerns and vision on flame retardants for home textiles, a broad stakeholder approach" – World Café session second part	
16:50	**17:10**	Wrap-up session by the group chairs	AEI Tèxtils, EURATEX, ECHA, CTB, LEITAT
17:10	**17:20**	Next steps, closing remarks and farewell	AEI Tèxtils
17:20		Networking Drink	

2. List of participants

Organization	First name LAST NAME	Category
UPC	Mònica ARDANUY	Research
Pinfa / Clariant	Adrian BEARD	Chemical producer/association
Almedahls AB	Ewa BRÄCK	Textile company
International Antimony Association	Caroline BRAIBANT	Chemical association
GTFI / THOR CHEMICALS	Pierre CARDIN	Chemical company
CTF2000 NV	Luc CARLIER	Chemical company
FIRA International Ltd	Stuart COCHRANE	Research association
Balta Group	Wim DENECKER	Textile company
EFIC - European Furniture Industries Confederation	Roberta DESSI	End user association
Fedustria	Bruno EGGERMONT	Textile association
Flame Retardants Europe	Edie ENGELS	Chemical association
ECOS	Doreen FEDRIGO-FAZIO	Environmental association
Monks International	Christophe FERKET	Textile company
Cefic	Amaya JÁNOSI	Chemical association
BekaertDeslee	Francis MARTROYE	Textile company
BASF Polyurethanes	Thomas MERZ	Chemical company
EASME	Manuel MONTERO-RAMIREZ	Public sector
ICL-IP	Eric SITTERS	Chemical company
Université de Lorraine	Henri VAHABI	Research
EOC group	Sara VANWALLEGHEM	Chemical company
CSIC-ICAQ	Meritxell MARTÍ	Research
Undisclosed	- (undisclosed)	Environmental organization
Undisclosed	- (undisclosed)	Chemical company
Undisclosed	- (undisclosed)	Textile company

3. Organization

The members of organization committee which presented during the workshop were:

Organization	First name LAST NAME
AEI TÈXTILS	Josep CASAMADA
AEI TÈXTILS	Ariadna DETRELL
ECHA	Denis MOTTET
EURATEX	Dunja DRMAC
LEITAT	Lorenzo BAUTISTA
LEITAT	Paula FELIX
CENTEXBEL	Ine DE VILDER

Stakeholder's workshop plenary session

4. Workshop outcomes

4.1 Workshop presentations

During the first part of the workshop, there was a series of presentations related to the LIFE-FLAREX project as well as co-organizers within the topic of substitution toward safer flame retardants.

All presentations are publically available online at the project website (https://www.life-flarex.eu):

- **LIFE-FLAREX Introduction** – AEI TÈXTILS, LIFE-FLAREX project coordinator
- **State of the art on safer flame retardant alternatives for home textile sector** – LEITAT & CENTEXBEL
- **Industry view on replacement of harmful chemicals –** EURATEX
- **Substitution of chemicals – early warnings, concepts and available tools –** ECHA

4.2 World café session

The world café session took place around two main topics:

- "Use of flame retardants in home textiles – impact on downstream users"
- "Flame retardant alternatives and best practices towards safer textiles"

A total of four rounds of discussion were held where people went through each topic twice. Groups were mixed among different stakeholder's groups in order to favor discussions among them.

Groups were made using combinatorial paths, so attendees could also get together with most of the people and repeat with the least people as possible.

4.3 Workshop discussions outcomes and conclusions

4.3.1 Use of flame retardants in home textiles – impact on downstream users

This topic was chaired in group A by Dunja Drmač (EURATEX) and Josep Casamada (AEI TÈXTILS) and in group B by Ariadna Detrell (AEI TÈXTILS) and Mònica Ardanuy (UPC). During both groups discussing around this topic and across the four rounds of discussion, four key points flourished recurrently:

- Legislation differences across Europe
- Lack of market pull
- Matching alternatives with textile specifications
- Cost as ultimate driver

Legislation differences across Europe

Legislation is often country and even region specific (for contract market) making it difficult to harmonize a set of standards. For instance, France and Germany have the most stringent flame retardant standards in EU (performance wise), while they are not required for all textiles such as home textiles unlike in the UK. Usually, most companies tried to standardize the use of products which leads to concentration to very few active substances used in FR at large volumes and the rest remains at lower production scales. Usually, best performing FR products commonly used (such as halogenated) are also the ones with higher health and environmental safety concern. A suggestion was made on finding a way to harmonize and standardize flame retardant requirements across Europe, maybe through the European Commission.

Unlike UK, in continental Europe, home textiles comprise a very narrow market for flame retardants, whereas public contracting drives higher demand for FRs. Flame retardants needs in UK in terms of performance are different to those in continental Europe, mainly due to the legislation difference (compulsory use of flame retardants). While in UK all home textiles need to pass the flame retardancy test by law, in continental EU only textiles for contract market need to pass those stringent standards. Furthermore, testing requirements differ significantly depending on the final application; for instance, products which may be subject to washing (curtains, covers, beddings…) need to have durable flame retardants, meaning the FR will not migrate during the washing cycles and will retain the flame retardancy properties.

It was noted as well that, regulatory testing requirements should ensure fire safety above all and not become an approach to rescind the flame retardancy property as it was recently implemented in UK and California. Fire safety needs to be evaluated identifying risks of fire and mitigating those with protective measures such as flame retardants.

In summary, fire safety legislation (in views of lack of consumer pull) is the key driver for the use (or non-use) of flame retardants in home and contract textiles.

Lack of market pull

In general, it was noted that consumers are often unaware of the presence of flame retardants in the textiles found at home, cinemas, hotels, or even city hall. Market pull of alternative and more sustainable solutions represents less than 1% of all market demand.

Not all EU is equally unconcerned about FR, and was noted that Scandinavian and other northern EU countries are pushing towards more sustainable solutions. Some big furniture companies have recently implemented a policy toward the use of safer alternatives, labelled “halogen-free”. It should be noted that halogen-free does not necessarily mean safer nor halogenated harmful. A case-by-case full risk assessment and LCA is needed to demonstrate the environmental and health safety of new products.

Ecolabels could be a soft incentive for pulling safer flame retardants, although most of the labels are not known by consumers.

For public bodies, it was noted that different options on the inclusion of incentives such as green public procurement could drive the use of alternative flame retardants for contract market such as hospitals, public buildings and other facilities.

In summary, awareness raising is needed to inform the general public and public authorities in order for them to make better and more conscious decisions.

Matching alternatives with textile specifications

Several industrial partners mentioned they have already alternatives to hazardous FR in place, ready to market or even commercialized. However, due to lack of market pull toward those alternatives, those products are manufactured at significantly lower scale and, therefore, are more expensive. The alternatives available can have a significantly lower environmental and health impact than current mainstream solutions and are used where end-customer are aware and committed to sustainable solutions such as some furniture manufacturer who moved to such safer solution and labelled their products “halogen-free”. There are also some SMEs that are moving toward more “natural” solutions by using fibers which are naturally flame retardant such as wool. The applicability of these alternatives in the textile sector still needs to be examined against the performance and fabric composition, therefore, assessment of the alternatives needs to be done on a case-by-case basis.

Products available by manufacturers can even match and/or surpass performance of current solutions. At technical level, the main issue is the re-formulation of finishing recipes which is needed for every new product. Thus, providing support to SMEs who do not have in-house R&D for new formulations or simplified recipes from the industry is needed to support mainstream use of alternatives.

Ultimately, substitution also relies on the flame retardant cost (selling price and implementation cost). The shift toward more sustainable solutions is not only dependent on the chemical industry side, but highly on the market demand either conscious decision-making by consumers or by law through legislation and regulation limiting the use of the most hazardous substances.

Cost as ultimate driver

All discussions included the price as the main driver of product selection, only surpassed by legislation requirements. If it was not because it is needed by legislation, FR would generally not be used. When this is used as finishing for textiles the cheapest solution is usually the one selected without focus on human health safety or environmental impact.

Cheapest solutions are the ones that have been mass produced for the lasts decades. While alternative solutions have been developed by most chemical companies, those are still more expensive mainly due to lack of demand or inherent chemical complexity. A key comment was made on production costs which could be reduced and match those of conventional FR if the production volumes were alike. Therefore, a key conclusion is that while the price tag is higher now, if enough market pull happens, price will drop.

Topic conclusions

A general agreement in all discussion groups was the lack of awareness by consumers in terms of what textiles surrounding them contain as long as price is low. Price, as in previous section is a key driver on the selection of products for treatment. Nonetheless, fire safety legislation and regulation were agreed to be even more important than price in the decision-making process for the use of flame retardants. If there is no need, by law, to use flame retardants, those will usually not be added to the product as this is an extra cost to the final product which would be avoided if not required (unless there is a specific request from the customer for the product to have FR properties). Besides, the differences in regulations at national and even regional level on performance requirements drives industry standardization with the use of well-known flame retardant products (mainly halogenated) which in turn drives demand and lower prices. Moreover, the switch to safer alternatives is mainly driven by the existence of a legislation imposing the limitation of the use of certain hazardous substances. In absence of such legislation, there is no strong driver for substitution towards safer alternatives.

Awareness raising among the consumers might lead to promotion of substitution from upstream: it may adjust the market for sustainable solutions from a market-driven perspective.

In addition, there is also a need to standardize and harmonize the performance requirements of end-products across Europe with an accepted international testing standard. This should also lead to harmonization in public procurement requirements

(including the addition of sustainable parameters to prioritize greener alternatives) across different regions in Europe in order to favor SMEs growth in the textile sector. Disparity in requirements on public procurement limits the single market benefits due to the need of specialized know-how across different regions which effectively limits the benefits of the European toll-free trade market.

4.3.2 Flame retardant alternatives and best practices towards safer textiles

This topic was chaired in group C by Denis Mottet (ECHA) and Paula Felix (LEITAT) and in group D by Ine de Vilder (CTB) and Lorenzo Bautista (LEITAT).

This topic arose several discussions with focus on the best practices (adequate use of flame retardants), adaptation for SMEs to new products and alternative products available in the market.

Alternative flame retardant products

Several currently available alternative flame retardants were mentioned by different industrial manufacturers, while in general those are still produced at significantly smaller scales at higher prices.

Halogen-free flame retardants that are being used in the textile industry are mostly based on phosphorous or nitrogen, however, the technical performance by themselves is poor compared to halogenated products and often need additives to achieve sufficient performance. Several halogen-free formulations were claimed to match or surpass halogenated performance in different applications. However, this makes each end-flame retardant product (formulation) limited to certain particular applications requiring a lot of formulation fine tuning to broaden the scope of applications. This impacts particularly textile finishing SMEs which have limited resources for development of formulations in-house and end up buying conventional halogenated flame retardants. Other issues arising on those alternative chemistries is the wastewater treatment due to the migration of the components to the environment due to washing.

Technologically best performance seems to be achieved by using chemistries that combine promotion of char-formation such as phosphorous based products with gas-phase actuation (limitation of combustion) such as halogen technology.

Some technologies which were highlighted with huge interest from producers and textile users are polymeric flame retardants with the functional groups in the backbone. Polymers have generated a lot of attention driven by benefiting from well-known and stablished halogenated technology for flame retardancy but preventing leaching of the FRs during washing steps from the fabrics therefore achieving a permanent finishing. Performance-wise, these polymers are claimed to achieve similar levels of technical flame retardancy as traditional products and have a lot of versatility on the fine tuning of the properties. Some drawbacks identified are the stiffness of polymers, the fiber choice (for adhesion) and the cost (higher than conventional products). The stiffness and fibers can be adjusted using additives and adjusting the chemistry of the polymer.

Other technologies discussed were nano-based flame retardant technology, however, the lack of understanding of nanotechnology in terms of performance, the unclear legal and regulatory status, and the uncertain health and environmental impact makes those

solutions too much of a risk for most companies to invest on. Nonetheless, it remains as something to be considered in the future once those questions are answered.

In general, alternative solutions are available and are claimed to achieve good performance but interest is limited by the higher price which is due to lower market share. Some comments were on the line of lack of incentives (market demand, lack of regulation on public procurement and public spaces regulations).

SME impact on adaptation of alternatives

Several comments were made on the SME impact of the alternatives on the line of change management and reluctance to change to new products/processes. Clear information and properly identified alternatives should be delivered to SMEs in order to promote substitution. Most of the companies in the textile finishing sector are SMEs.

Constantly changing regulations and standards are a headache for most companies but in particular for small and medium sized due to their limited resources. Most of them are not even interested in the compositions or details of products they are applying as long as they are legal to use and sell. Thus, unless a clear framework is defined and propelled by market awareness, most SMEs will not drive those changes.

SMEs are generally reluctant to shift to new “untested/non-validated” substances fearing new environmental/health concerns arising in near future that could activate new regulatory actions.

In addition, changes on flame retardant products usually mean equipment adjustment (i.e. operating conditions, temperatures, velocities, etc.) and recipe development which are costs most SMEs struggle to afford and make them even more reticent to changes from well-known products and processes. Applicability of alternatives needs to also take into account textile fabric specification.

Best practices on the use of flame retardants

It was noted during the discussions the need for the complete assessment of the use of flame retardants in final products in order to properly assess the risks (intrinsic from the chemistry and the exposure paths). Some key points were the need for the use of flame retardants by using (natural) fibers with intrinsic flame retardant properties for instance or by designing the final products accounting for fire hazard, for example by using interlinings techniques (intrinsic flame retardant liner protecting the filler) which avoids the propagation of fire from the fabric to the whole embodiment. Other examples of design improvements mentioned were the use of flame retardants embedded in the fibers (i.e. during the extrusion process of synthetic polyester or polypropylene fibers) which avoids migration of the harmful chemicals to the surface.

Other comments were raised on the increase of water repellence on the final product or fabrics as a way to prevent leaching of the flame retardant to the environment during

washing steps. It is noted that current textile fire tests standards do not take into consideration the washing out of the product and its performance loss in the final application.

Concerns on the abuse of flame retardants were raised, in particular the indiscriminate use in furniture and other applications. Some participants raised the question whether flame retardants are actually needed for all furniture (particularly in UK) and applications (anywhere). While this generated a big debate some other comments were in the line of better assessing the actual risk of using a given flame-retarded product by identifying the substance hazards (intrinsic properties of the flame retardants on human health/environmental endpoints) and combine it with exposure mechanisms (leaching, migration, vaporization, degradation among others). There is a need to find a balance between risks and benefits of flame retardants with a proper assessment methodology. This one should be standardized across different sectors and applications in combination with legislation harmonization (for instance defining a harmonized methodology and requirements of the final products at EU level) in order to facilitate safer products to end-consumers.

Topic conclusions

There is the need to better understand different chemical alternatives and their impact on product performance, the environment and health in order to support SMEs in the textile sector to make informed and better decisions in the field of flame retardants. In general, the lack of environmental and health data and diverging policies at each market makes substitution unattractive to SMEs. Additional costs are still a huge driver on the selection and a market pull is needed from the end of the value chain.

There are several chemistries that are claimed to work as flame retardants beyond halogenated products including phosphorous, nitrogen, inorganic and combinations thereof. Polymers, although mainly halogenated, are claimed to have a huge potential due to reduced leaching and migration by its embedding around the fibers with higher adhesion than conventional FRs. Moreover, working at the design phase of the product to confer it intrinsic flame retardant properties, without the need to use flame retardant substances is key area of development which has the advantage of avoiding the potential risks caused by these substances to human health and the environment.

In addition, a thoughtful debate, at political stakeholder level, on the use of flame retardants is needed to discuss the needs for fire safety of products conferred by flame retardants and their effect at environmental and health level in order to feed into new regulations and standards.

5. FLAREX selection of products

Based on the feedback received throughout the workshop combined with the preparatory actions conducted in the last semester, the products that the FLAREX team is going to test for benchmarking alternatives against conventional technologies are:

Application	Fabric composition	Conventional Flame Retardants	Alternative Flame Retardants
Curtains	100% PES [1]	(1) Decabromo diphenyl ethane + melamine cyanurate (2) Decabromo diphenyl ethane + ATO[2]	(1) (phosphorous based polymers)phosphate-phosphinate (2) Brominated polymer
Upholstery	100% PES	(1) Decabromo diphenyl ethane + melamine cyanurate (2) Decabromo diphenyl ethane + ATO	(1) (phosphorous based polymers)phosphate-phosphinate (2) Brominated polymer
Mattress ticking	50-50 Cotton-PES	(1) Decabromo diphenyl ethane + melamine cyanurate (2) Decabromo diphenyl ethane + ATO	(1) Melamine encapsulated APP[3] (2) Brominated polymer (3) Guanidine Phosphate (4) Ammonium sulphamate
Bedding sheets	50-50 Cotton-PES and 100% Cotton	(1) Dialkyl phosphono carboxylic acid amide (2) Decabromo diphenyl ethane + melamine cyanurate (3) Decabromo diphenyl ethane + ATO	(1) Ammonium Sulfamate +Urea +PO(OH)2-R-PO(OH)2) (2) Melamine encapsulated APP (3) Brominated polymer (4) Guanidine Phosphate
Carpets	PES, PA [4]or PP[5]	(1) Aluminium tri-hydroxide	(1) Melamine encapsulated APP (2) Brominated polymer

[1] PES – Polyester
[2] ATO – Antimony trioxide
[3] APP - Ammonium polyphosphate
[4] PA – Polyamide
[5] PP – Polypropylene

6. Next steps

With the applications selected, technological partners of the FLAREX team will start assessing the technical performance and benchmarking the alternatives with conventional products. Thus, the activities foreseen for the coming months are:

- Make a lab-scale benchmark study of alternative FR against conventional products for the different applications selected. This include the optimization of conditions for application of flame retardant products at each fabric in study and the technical performance assessment.
- An industrial-scale demonstration will follow from which data for risk assessment, life-cycle assessment and exposure will be collected. This industrial-scale demonstration aims to validate the lab scale results, as well as collect factual energy and water consumptions as well as emissions.
- Life-cycle assessment for each of the alternatives will be conducted in order to analyze the environmental impact
- A risk assessment based on the exposure will also be performed
- A toxicological assessment with skin penetration tests will be conducted at lab scale for selected applications where direct skin contact is envisaged

In parallel to those technical activities, awareness raising workshops will also be conducted regionally in Spain, Italy and Czech Republic.

Later during the project, another EU-wide stakeholder's workshop is envisaged to present the results of the project including recommendations on alternatives to textile industry.