pinfa
Phosphorus, Inorganic & Nitrogen Flame Retardants Association

pinfa Advisory Board – Fourth Meeting

Wednesday, 5th December 2018,
10:00 – 16:30 CET

BRUSSELS

The content of this report is a capture of the inputs from individual participants. The views included are therefore those of individual participants, and not the consensus of the group as a whole.

This report

1. Participants

External representatives

Per Blomquivst, *Senior Scientist, RISE Research Institutes of Sweden*

Serge Bourbigot, *Professor, Ecole Nationale Supérieure de Chimie de Lille, ENSCL*

Sophie Duquesne, *Professor, Ecole Nationale Supérieure de Chimie de Lille, ENSCL*

Diane Daems, *Material & Industry sustainability, Huntsman Corporation*

Quentin de Hults, *Senior Manager Construction Advocacy and Sustainability, BASF and Executive Chair of the Modern Building Alliance*

Herve Feuchter, *Fire Safety Engineer, CREPIM*

Frank Poutch, *Director, CREPIM*

Rudolf Pfaender, *Division Director Frauenhofer Institut*

Monika Sabaranska, *EMEA Material Program & Poland Sustainability Manager, EMEA, HP*

Lea Suhr, *Government Relations Manager for Sustainability HP*

Margaret Simonson McNamee, *Professor Lund University*

Frank Kuebart, *Managing Director, ECO Institut Germany GmbH*

Laurent Tribut, *Plastics expert, Schneider Electric*

Pinfa representatives

Adrian Beard *Chairman*

Jonathan Crozier *Secretary General*

Vicente Mans *Technical Advisor*

External moderators

Simon Levitt *Moderator, Harwood Levitt Consulting*

Lisa Schaefer *Assistant moderator / writer, Harwood Levitt Consulting*

2. Purpose of the meeting

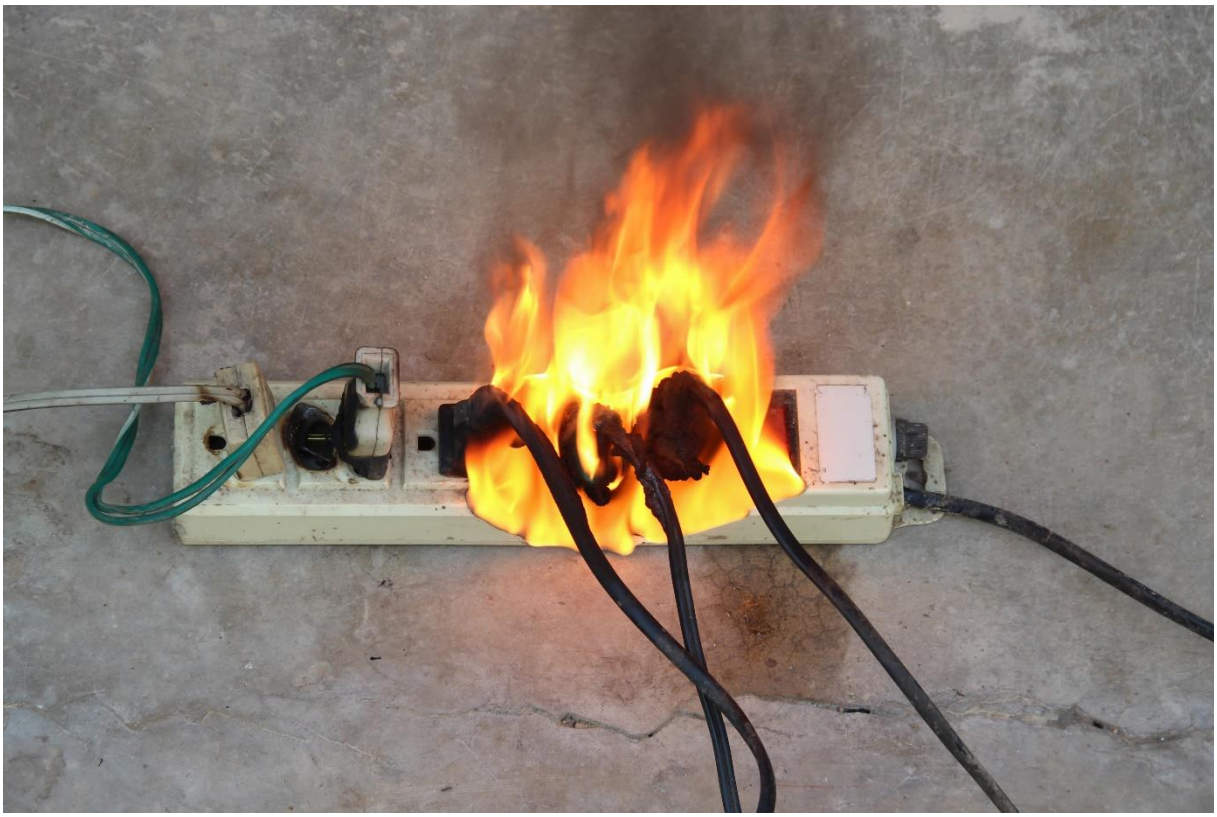
Pinfa represents the manufacturers of phosphorus, inorganic and nitrogen flame retardants (PIN FRs) and is a Sector Group within Cefic, the European Chemical Industry Council. The members of Pinfa share the common vision of continuously improving the environmental and health profile of their flame-retardant products. Therefore, Pinfa members seek to maintain a dialogue with the users of PIN FRs to identify the needs and technologies they are looking for.

In recent years, there has been much discussion and debate about FRs. There have been concerns raised about environmental impacts, largely but not solely about halogenated FRs. In cases where FR use is decreased, there are concerns about fire safety. Where are flame retardants critical for fire safety, where can other solutions be sufficient?

The aim is to bring together the group on average twice a year. It is not a fixed group, Pinfa will keep extending and updating the invitation list depending on the topics of meeting.

The Chatham House Rule

The meetings follow the Chatham House rule, whereby minutes include who attended and what was discussed, but opinions are not attributed to individual participants.



3. Topics discussed in previous meetings

During the past three meetings, different topics were discussed, some of which could be revisited, and some could be explored further.

Previous issues are as follows.

Fire spread. Discussions with fire fighters have confirmed an increase in flashovers that happen within as little as four minutes. This has real impacts on escape time and fire fatalities. Fire-fighters are convinced this is connected to the use of modern, polymeric materials in consumer products. Furthermore, single compartment fires can very easily develop into multi-compartment fires. Insulation materials are not always stopping the spread of fires, and polymeric window frames are not working to prevent spread sufficiently. Fire-fighters believe that standards are focusing too much on individual products in isolation, and not enough on the role of products in a room or house environment. A less mobile, ageing population worsens the risk of fire fatalities by as much as 30% by 2030 (in Belgium) because of reduced escape time in houses.

Fire statistics. Previous meetings noted the age-old problem of insufficient fire statistics (collected differently in different countries, focussed on ignition source but not what led to flashover). Case studies that should show whether extra regulation helps (e.g. the 1988 U.K. furniture regulations), have led to polarised debate. Can / should the statistics / evidence issue be addressed, or is this not possible in a timeframe that helps?

Fire safety advocacy.
Currently there is a disconnect between fire-fighters witnessing these problems on

the ground, industry, policy-makers and standard setters. Fire-fighters are organised differently in and within each country (e.g. professionals, volunteers, military), fire-fighters have not always had a resourced or unified advocacy voice. Into this partial vacuum advocacy groups have stepped in. This includes industries with a commercial interest, which has limited their credibility. Is it a medium-term solution to have a European fire safety agency, like the agencies that exist in other policy fields?

Do FRs do their fire safety job? If there is no consensus on a fact base for fire safety, how can this question be fully answered? How do we move from agreed 'micro' evidence (fire tests, videos etc) to 'macro' evidence focussed on number of fires, injuries and fatalities?

Smoke toxicity. Fire-fighters continue to worry about the potential long-term effects of being exposed to smoke. Pinfa previously commissioned scientific work on the smoke formation and toxicity of materials with flame retardants. Over 100 samples have been collected for testing, of materials with non-halogenated FRs, benchmarked against materials with brominated and chlorinated FRs, and base materials without FRs. Results were expected to be presented by end of 2018.

Environment and human health profile for FRs. The issue remains: what more can be done to convince the public that the FRs are safe? If companies are planning to move away from halogenated flame retardants, what gives them confidence in the alternatives? How do they avoid regrettable substitution?

Positive lists of FRs. TCO's positive list of 14 non-halogenated FRs in Sweden continues to be viewed as an excellent example. Moreover, Greenscreen has given high scores to a number of FRs and its potential to encourage safe FRs is recognized. One OEM is now telling its suppliers to only use chemicals which score 2 or higher on GreenScreen. Lastly, ChemSec has also launched a project, Marketplace, that focuses on listing chemicals that can be acceptable substitutes, i.e. a positive list, and encouraged pinfa and others to participate. It may be that this trend increases in the future to address the FR perception problem. For now, members had agreed to include specific information about product substances in their entries

Circular economy. As this topic moves from philosophy to concrete policies, what will this mean for plastic additives such as flame retardants? What will / should happen around product design and at end of life? What will / should happen to products currently in circulation? How can circular economy goals and fire safety both be achieved for polymeric materials? What practical questions and actions does this raise for this group and for pinfa?

Swedish FR tax. Sweden has created a tax on FRs, as a revenue raising measure and a way to implement chemical policy without deferring to Brussels. Such tax creates the precedent of a patchwork of signals to the supply chain, further complicating choices about substitution. It is estimated to increase the price of a computer monitor by approximately 20%. Previously it had been argued that it is futile to argue for the tax to be scrapped, but it could be possible for the tax to be amended and based on inherent hazard properties e.g. using Green Screen.

The subsequent discussions of the group covered many of these topics and gave opinions which are covered in the report sections below.

4. The 4th pinfa advisory board meeting

The fourth pinfa advisory board meeting took place on the 5th of December 2018 with a diverse group of stakeholders from the flame-retardant (FR) industry, downstream user industries as well as testing and research institutes. Participants expressed the wish to discuss the following topics.

Firstly, to pick up from previous meetings, participants were keen to discuss fire safety in the context of emerging technologies and new materials of FRs. New products need to comply with the existing regulation and there is a balance to be struck between a fast-emerging technology evolution with ever better products while guaranteeing fire safety. To address the need for coherent fire safety regulation, the creation of an EU fire safety agency was brought up. Specifically, to address advocacy issues on fire safety and make them a standalone priority of the European policy agenda post-Grenfell. Moreover, the current negative public climate surrounding plastics was recognized as a big concern for some participants.

Secondly, the pinfa smoke toxicity report that was mentioned during the last meeting was not yet ready to be shared completely. However, the rate of fire spread, and smoke toxicity remains a concern. Are FRs still performing as they should in a large fire? A lack of data often prohibits real-time characterization of smoke toxicity. Access to information on smoke, fumes, gases and condense phases is required to know exactly what happens when a fire is extinguished.

Thirdly, participants were keen to capture and discuss the environmental impact of FRs. Specifically, how to model environmental impact and how to address the recycling of FRs in a circular economy with data gaps on many products. Adding to that, improving the transparency and information on which FRs are used in different materials was also discussed.

Fire safety

While there is some statistical evidence that fire deaths in total have decreased, the number of casualties increased during flashovers in private and urban dwellings

Based on past discussions, fires spread much faster leading to limited escape time. Pinfa believes that the role of FRs is not to slow-down fire spread or prevent fire development in its entirety in these situations. Most materials that contain FRs will burn eventually and whatever the development of the fire, as soon as the primary fire source is in contact with large furniture, i.e. a sofa, an acceleration of the fire starts very quickly and creates a flashover. Anecdotal evidence from fire fighters during past meetings supported the idea that flashovers are increasing. However, during this meeting it was pointed out, that there are statistics in EU countries like France and the UK, where fire statistics have improved, and fire deaths have reportedly been reduced over the past three decades. Furthermore, there is some indication from US fire statistics, that in some domestic dwellings the amount of fire deaths is increasing while the overall number of fires has gone down. Therefore, higher risk consumer items around humans in modern society could have previously been counterbalanced by an increase of smoke detectors and less people smoking. Based on that, preventive action is even

more important. For example, via independent fire safety checks to create sensibilization and check preventative fire safety measures. While that is common practice in some EU countries, fire fighters are generally overwhelmed, and it is hard to identify the agency in charge for regular fire safety checks.

The Grenfell fire proved that fire safety is a social issue

Low-income households have a higher tendency to live in less fire safe buildings because they are older and less well-maintained. Additionally, the elderly are less mobile in a flashover situation. For these reasons, future questions in fire safety research will try to connect the social impact of fires with socio-economic indicators of at-risk groups to fire frequency and fire service engagements. During the Grenfell disaster, firefighting tactics gave rise to some controversy. Advising people in a rapidly spreading flashover to stay inside the building proved a controversial decision.

The role of FRs in fire safety is to prevent or slow down ignition, not preventing a flash-over once a fire develops

Proving the contribution of FRs to fire safety on a statistical level remains difficult. There is a role of FRs in ignition resistance but not necessarily in preventing fires entirely. Flashovers must be avoided in the first place but cannot be calmed via FRs. People must be outside of a building when a fire has already developed, especially with proper building construction.

Initiatives like FIEP and the European Fire Safety Alliance are trying to address data gaps. But an ambitious EU fire safety agency needs to go beyond that

In Europe, the problem of unreliable fire statistics remains. For example, in Germany fire brigades are municipal organizations and statistics are unstructured. The European Fire Safety Alliance is trying to collect national statistics on their website and is also considering an EU wide fire safety campaign. Furthermore, the EU Fire Information Exchange Platform (FIEP) is an additional initiative to exchange fire safety information and best practices among EU member states. It was set up by the EU institutions in a response to the Grenfell disaster, managed by DG Grow. In an update on a recent round table EuroFSA and the Dutch Fire Service Academy confirmed that furniture and defective electrical appliances are among the highest risk factors for residential fire development. However, the biggest hurdle to joint fire statistics remains the disengagement of EU member states. This could also be a hurdle for the development of a fire safety agency. Representatives from DG GROW indicated that the Joint Research Centre will be involved to advance the analysis in the future and to develop a European fire codex. This would auto-integrate fire safety engineering principles into building design, leaving the desired safety level to be agreed via EU member state recommendations. Additionally, they want to develop professional qualifications for fire safety engineers. Ideally, a more ambitious fire safety agency would integrate what FIEP is already doing and build on that with a clear vision and budget. When looking at other agencies, (i.e. EFSA) they usually have a regulatory remit and a defined scope. That would also be needed for an EU fire safety agency.

IAFFS Roadmap 2030 Update

IAFFS wants to globally promote research and innovation in fire safety science with a vision of improving fire safety in the world. IAFFS is calling for an 'Agenda 2030 for a Fire Safe World' in order to identify the research needs in fire safety. This will form the basis for more coherent fire safety regulation in the future. They understand the fire problem as ~3500 people killed by a fire and ~70 000 people injured by fire in Europe every year. These casualties cost countries an average of 1% of their GDP. Indirect costs of fires, like the loss of property through a fire or the cost of stopping a business, have estimated much greater costs around an average of up to 2% of GDP of a country like the US. In response to this, IAFFS created a taskforce to promote fire safety through science and developed a first white paper to lay out their agenda 2030. This white paper has recently been used in discussion with the European Commission to identify fire safety research needs in Europe within the Horizon Europe framework to create a fire safety mission. The starting point for research would be: "What are the societal challenges that fire safety can address?". Two basic groups of grand challenges were identified. Firstly, climate change, resiliency and sustainability with a specific impact on fire safety. Based on research in planetary boundaries and exceeding what the planet can sustain from human impact, this has become an increasingly important issue given an increase in big wildfires and other extreme weather conditions. The second grand challenge is population growth, urbanization and globalization. The world's maximum limit population estimate at the moment is 11bn people according to UN estimates. On top of that, an ageing population, urbanization and increasing global wealth inequality are impacting on fire safety. To address these challenges, several fields of action and recommendations were identified. These include, societal resilience, tall buildings, globally consistent regulations, new technology, big data, higher education and more. By the end of Q1 2019 a final version of the white paper is expected to be published.

Within the Commission it feels like nobody is directly responsible for fire safety

During the IAFFS dialogue meeting with the Commission, the feeling was that DGATD has not had the issue on the radar previously and other were unaware of IAFFS. It felt like nobody was directly responsible and that research projects are sometimes focussed on very specific issues. I.e.: a specific research on the fire safety of facades after the Grenfell disaster. In such an environment more horizontal fire safety challenges are difficult to address.

Smoke Toxicity

Smoke toxicity remains an issue and there is no doubt that fire smoke is toxic. Do FRs have an influence on smoke being toxic and carcinogenic?

The impacts of smoke toxicity are determined by different materials, ventilated or under-ventilated fire condition and degree of exposure. The impact on fire fighters is heavily dependent on their personal protection equipment. Fire victims are not under repeated smoke exposure while fire fighters are. At the same time, during a flashover situation, the smoke is more toxic because of lower ventilation and oxygen depletion that is harmful to victims. Smoke toxicity is about exposure that needs to be avoided and staying indoors is common advice in a fire situation, which can be vital during a flashover. Nevertheless, the point was made that most products containing FRs will never be incinerated. While toxic and carcinogenic smoke is dangerous, much more harm to humans is potentially being done indirectly, through

migration and degradation of consumer products into our environment.

To help fire fighters protect themselves, requires the correct maintenance and protection of equipment

To protect fire fighters from long term smoke exposure adequately, appropriate equipment and procedures fire fighters are using should be considered first. Given the cocktail of toxic smoke ingredients coming from both natural and synthetic materials, the right equipment and maintenance is the best way for fire fighters to protect themselves. They need to make sure that they avoid contact with dirty equipment and gear, that these are cleaned correctly after each fire and that tactics are employed to address different fire situations appropriately.

CREPIM update on pinfa smoke toxicity study

12 Member companies of pinfa (Adeka, BASF, Budenheim, Clariant, Dupont, FRX Polymers, Greenchemicals, Huber, Lanxess, Nabaltec, Sabic, Total) voluntarily send product samples for smoke toxicity testing to CREPIM. A total of 92 commercial and non-commercial plastic samples were evaluated for combustion. The influence of halogenated, phosphorus, inorganic or nitrogen-containing flame retardants (FRs) on smoke toxicity was studied in comparison with reference samples free of any FRs. The composition of the smoke was studied according to two different methods of analysis in a tubular furnace (NF X 70-100) at 600°C and under the single smoke chamber method (ISO 5659-2 at 50 kW m-2 and without pilot flame) equipped with a FTIR analyser (EN 45545-2, annexe C). The amount of asphyxiant gases such as carbon monoxide and hydrogen cyanide as well as irritant gases such as hydrogen chloride, bromide or nitrogen dioxide has been measured for each burned polymer. Smoke density at various time intervals was also assessed for each sample. Significant responses between sample composition, fire retardant nature, smoke composition and density were established. The influence of sample preparation as well as other factors such as the inclusion of glass fibre were evaluated as well. This remains the largest study on smoke toxicity today that will continue to be developed throughout 2019.

Whether chronic exposure to smoke by fire fighters is more hazardous due to FRs is still unclear

From a smoke toxicity point of view the difference between toxic smoke with FRs and toxic smoke without FRs is very hard to detect. For fire fighters, also long-term toxicity is important compared to short-term acute toxicity because they have adequate equipment to handle it in the short-term. It is extremely complicated when toxicity levels are very low. Ultimately, scientific models have difficulties to predict real life situations. While scientific tests are relevant, they remain mere tests and pushback on them will be likely if they are used to justify no difference in smoke toxicity levels with materials using FRs versus no FRs. Real-life fires are automatically always better ventilated than test fires. Therefore, a peer-review of the CREPIM study would allow a broader scope among academics to compare the results and analyse the entire set of materials. The work of CREPIM is very good and provides a first set of comparative data according to recent standards. At the same time, it was advised not to overgeneralize the CREPIM results.

6. PIN FRs and the environment

The lack of data availability prevents coherent scientific modelling on the impact of fire extinction on our environment

Data is always difficult to come by and having good, reliable and up to date manufacturing data is hard for academics. To make an appropriate life cycle analysis of different products and materials, data from over 10 years ago is required to compare the life cycle of products from the past. Usage today does not necessarily reflect that of 10 years ago, which needs to be considered. Developing scientific models can often only be done via costly private datasets as there is almost no public data available. Models are trying to analyse the environmental impact of extinguishing fires and whether more emissions are created when putting out a fire or not. In that context, academics need to know what combinations of products are being used. If they want to research how fires are occurring in the first place and how different products combust that contain different FRs, it becomes a sensitive topic for some producers.

Ecolabels should contribute to potential life cycle assessments of materials, even if pin FRs are only a small part of that

In previous discussions, the efficiency of ecolabelling of pin FRs were discussed. The idea is that pinfa will put product Greenscreen scores into the product selector on the pinfa website. Currently, this is still being discussed among pinfa member companies. The idea is to centralize all publicly available information on pin-FRs and include an ecolabel scoring via Greenscreen. Next to that, there is public information available from Greenscreen on individual members. Other individual companies such as BASF are using different tools (Proscale). Ultimately, whatever screening method is chosen, for a complete environmental life cycle assessment the FR is only one small factor to consider in the environmental impact of a finished product.

If there is no way to recycle consumer products in the future, chemical recycling needs to be developed for the circular economy

There does exist a good set of data on the circular economy. Most of the scientific models that are being used right now focus on recyclability and it is current practice to incinerate or landfill old materials. That will not be sustainable in the future if the European Commission keeps its momentum on the circular economy. Therefore, something else than mere energy recovery as a form of recycling needs to be developed because certain parts of post-consumer material must be recycled in the future. If this is not possible, chemical recycling needs to be considered. Currently, there exist successful examples in the automotive and packaging industry, but electronics are among the worst products to recycle. These products often contain small, different parts with many plastic types. They are hard to separate with a complete lack of data. Eventually, politicians will put forward a proposal for recycling of these products and it is better to be prepared for that.

There are potential lessons to be learned from how other industries are dealing with the challenges of a circular economy

There are many possibilities to do something. about a long-term application in the circular economy. However, this is an issue that is not just limited to FRs and there could be valuable lessons to be learned from other industries like the automotive and digital sectors. The electronics industry

and Digital Europe are currently in discussion with the automotive sector and plastics industry on how to set up a comprehensive recycling database by 2020 with the European Commission. It requires all the companies to provide a vast amount of information, which will be very difficult to provide by the deadline in 2020. This is one of the first attempts to develop a coherent data source for the circular economy.

7. Emerging trends

Natural based polymers or bio polymers are interesting from a research perspective. However, plastic production in the world amounts to 3.2 million tons per year on average. Out of that, only 0.1% can currently be substituted with the capacity of producing bio-polymers which also have technical limitations. Therefore, from a commercial point of view, traditional plastics are still much more important.

5. Ideas to Move Forward

The group was again positive about the initiative. The fact that there were participants from the scientific community was welcomed, particularly the range of backgrounds and expertise in the room. There was good expertise from the environment field, from fire safety, from industry and policymaking.

The timing of a next meeting should be May/June 2019. Pinfa participants indicated they were keen to progress some of the action items suggested, to be able to report back on progress at the next meeting. On eco-labelling, pinfa agreed with Monica Sabaranska and Margaret Simonson McNamee to discuss best approaches outside of the Advisory board meeting.

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This document, once agreed by the participants, can be used by any of the group in discussions with others, to show the areas of discussion and to encourage collaboration on the topics involved.

6. Link Collection

DG Grow, Report on FIEP Progress, November 2018, F. Raffaelli, [accessed April 2019] (http://www.modernbuildingalliance.eu/wp-content/uploads/2018/11/DG-Grow_presentation.pdf)

European Fire Safety Alliance, website, [accessed April 2019] (https://www.europeanfiresafetyalliance.org/)

Eurostat Circular Economy Indicators, Eurostat website, [accessed April 2019] (https://ec.europa.eu/eurostat/web/circular-economy/indicators/monitoring-framework)

Federation of the European Union Fire Officers Association, website, [accessed April 2019] (https://www.f-e-u.org/index.php)

Firefighter Safety Research Institute, Understanding and fighting basement fires, UL August 2018, D. Madrzykowski et. Al. (https://ulfirefightersafety.org/docs/Understanding_and_Fighting_Basement_Fires.pdf)

Greenscreen, website, [accessed April 2019] (https://www.greenscreenchemicals.org/)

International Association for Fire Safety Science, White Paper - Research in support of fire resilient societies (https://iafss.org/wp-content/uploads/IAFSS-White-Paper-June-25.pdf)

Modern Building Alliance, Our Roundtable in the European Parliament, November 2018, website [accessed April 2019] (http://www.modernbuildingalliance.eu/our-roundtable-in-the-european-parliament-november-2018)

Pinfa product selector, website [accessed April 2019] (https://www.pinfa.eu/product-selector/)

Proscale, website, [accessed April 2019] (https://www.proscale.org/)

The third European Symposium on Fire Safety Science, website, [accessed April 2019] (http://www.esfss2018.com/)