



EU flammability standards and ENFIRO

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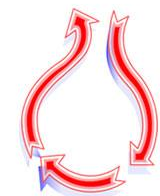
EU research project FP7: 226563

Life Cycle Assessment of Environment-Compatible Flame Retardants: Prototypical Case Study

ENFIRO

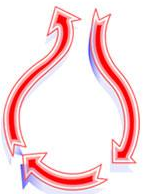
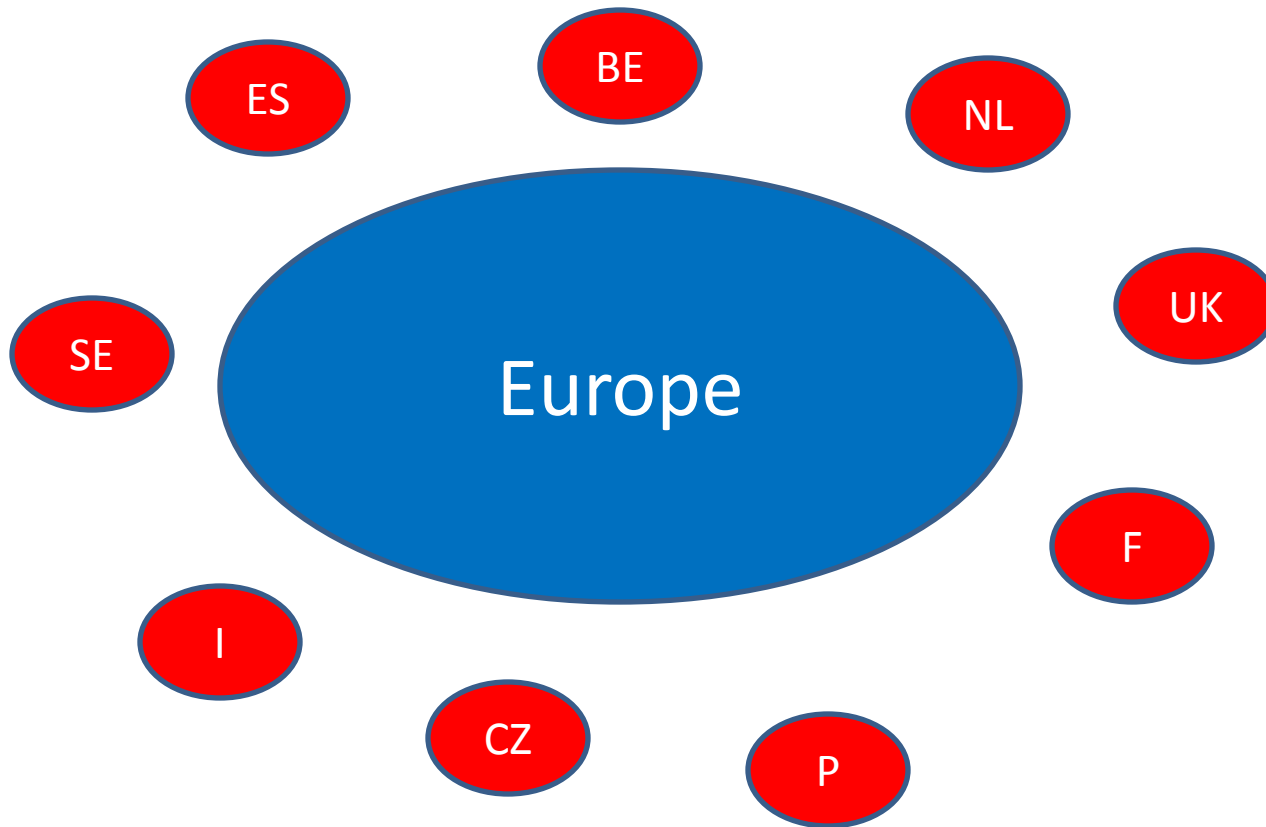


SEVENTH FRAMEWORK
PROGRAMME



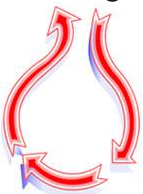
European regulations and standards

Classification is the same all over Europe
Legislation remains national



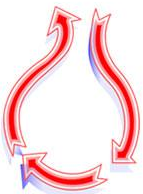
Regulation flame retardants and fire safety

- REACH
 - High production flame retardants are assessed for environmental and health and safety
- RoHS (Restriction of the use of certain Hazardous Substances)
 - PBBs and PBDEs restricted under RoHS 2011
- Eco-label
 - No leaching of hazardous compounds
- Fire regulations and standards



Fire regulations and standards in Europe

- European standards (EN) for reaction-to-fire are specified by the European Commission
- CEN, CENELEC, ETSI work out the test standards
 - Technical Committees (TC) are responsible for preparation of the European standards (EN).
ISO/TC92 Fire Safety, TC 89 Fire Hazard Testing
 - European system of classification
 - Test methods
- Test laboratories perform the fire tests according to the standards



Regulation and standardization upholstery furniture

| Country | Type of Building | Reference regulations | Type of furniture | Requirement | Test methods | Classification |
|--|----------------------|---|--------------------------------|---|-----------------------------------|----------------|
| France | Domestic | N°200-164 | Bedding | No ignition by cigarette | EN ISO 12952-1 and 2 | Pass/ Fail |
| | Public | U 23 (Health) | Bedding | No ignition by cigarette | EN ISO 12952-1 and 2 | Pass/ Fail |
| | | | Mattress | No ignition by cigarette | EN 597-1 | |
| | | AM 18 (Spectacle) | Seat | No ignition by 20g paper cushion equivalent burner | NF D 60013 | Pass/ Fail |
| | | | | No ignition of the frame | NF P92501 and NF P92507 | M3 |
| | | GPEMD1 – 90 (Prisons) | Mattress | No ignition by cigarette | EN 597-1 | E |
| | No ignition by match | | | EN 597-2 | D | |
| No ignition by higher ignition sources | GPEM D1-90 procedure | C,B,A (A the best) | | | | |
| UK/ Ireland | Domestic | Furniture and furnishing Regulations n°1324 | Seat/Mattress Covering Filling | No ignition by cigarette No ignition by match No ignition by crib five | EN 1021-1 EN 1021-2 BS 5852 | Pass/ Fail |
| | Public | BS 7176 | Seat | No ignition by cigarette No ignition by match No ignition by higher ignition sources in function of the level of hazard | EN 1021-1 EN 1021-2 BS 5852 | Pass/ Fail |

[viii] Sainrat A, Regulatory Trends and Standardization towards the Reaction of Fire or the Upholstery Furniture in France and in Europe. Proceedings of Flame retardants 2006

[ix] Troitzsch J., Furniture and furnishing, Plastics Flammability Handbook – Principe, regulations, testing and approval, 3rd Edition Hanser

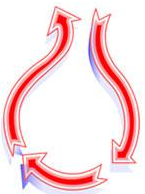
Book: Advances in fire retardant materials

Edited by A R Horrocks and D Price, University of Bolton, UK Woodhead Publishing Series in Textiles No. 70

Part 2: Chapter New and potential flammability regulations

J Troitzsch, Fire and Environmental Protection Service, Germany

- Introduction: overview of present fire safety regulations in Europe
- Building
- Fire testing of construction products in the European Union
- Fire safety requirements and tests for electrical engineering and electronics equipment
- Fire safety requirements and tests in transportation for rail vehicles and ships
- Fire safety requirements and tests in furniture
- Future trends
- Sources of further information and advice
- References



Book: Fire toxicity

Edited by A A Stec and T R Hull, University of Central Lancashire, UK

PART 5 NATIONAL AND INTERNATIONAL FIRE SAFETY REGULATIONS

Prescriptive regulations and tests considering the toxicity of fire effluents

J Troitzsch, Fire and Environment Protection Service FEPS, Germany

- Introduction
- Mandatory toxicity requirements, classification and tests for products used in transportation and building
- Transportation
- Building
- Future trends
- References

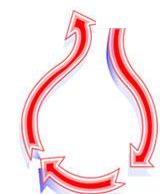
An international standardised framework for prediction of fire gas toxicity

T R Hull and A A Stec, University of Central Lancashire, UK

- Introduction
- The workings of the international organisation for standardisation (ISO) technical committee on fire safety (TC 92)
- Fire threat to people and the environment TC92 SC3
- Overview of assessment of hazards to life
- Current international organisation for standardisation (ISO) standards covering fire threat to people and the environment
- Proposed international organisation for standardisation (ISO) standards for fire toxicity
- Future standard development in fire toxicity and fire safety engineering: “the matrix”
- Proposed standards on the harmful effects of fire effluents on the environment
- References

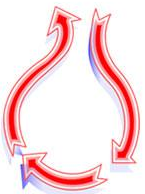


| | |
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| 13.2 Fire Behavior of Upholstered Furniture | 584 |
| 13.3 Regulations and Test Methods | 585 |
| 13.3.1 EC Draft Directive and European Tests | 585 |
| 13.3.2 Tests and Test Development | 586 |
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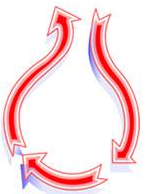
FR regulations

- Building
- Aircraft
- Ships
- Electrical engineering
- Furniture and furnishing
-



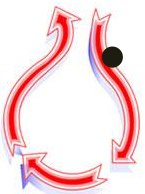
E&E

- Enclosures:
 - EU standard since July 2010
 - Standard UL 94 (V-1 or higher) in order to access the EU market
- Connectors
 - UL94 V-1 or V-0
 - IEC standards 60695- 2-11 to 13 (GWFI and GWIT)
 - IEC 60335 and 62368 specifications



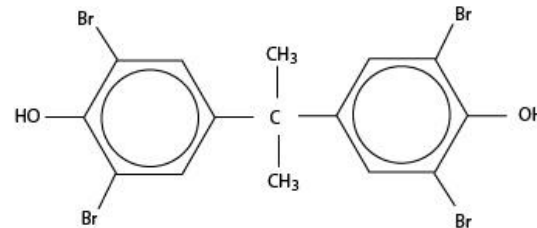
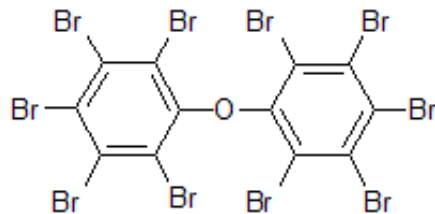
Furniture & Textile

- In many parts of Europe, not stringent fire safety regulations as for the **UK and Ireland**
 - ‘Furniture and Furnishings (Fire) (Safety) Regulations’ 1988 (No. 1324 Regulation 6)
 - All upholstered furniture (textiles, foams and fabrics) sold in UK BS 5852 and EN 1021-1 and 1021-2
- Many countries use EN standards
 - e.g. EN 1021 and 597 (ignitability of furniture by cigarette or match)
- National regulations and standards in Europe

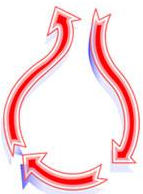


ENFIRO project

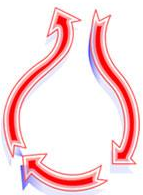
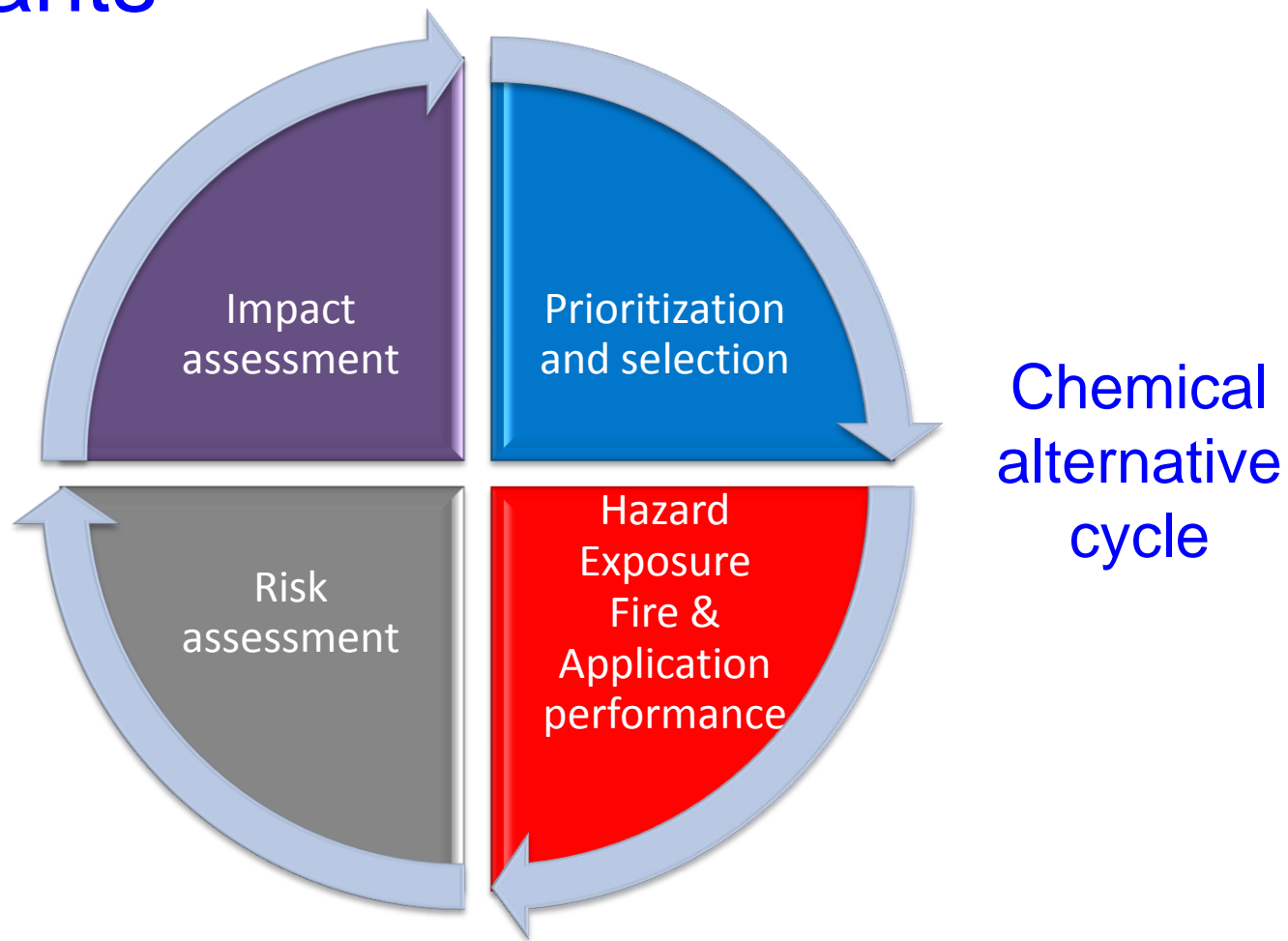
- To study the **substitution** options for some BFRs
 - DecaBDE, TBBP-A, brominated polystyrene



- European project, 12 partners, 3-years
- Alternative flame retardants selected:
 - 15 Halogen free flame retardants (HFFR)
 - Commercial available HFFRs

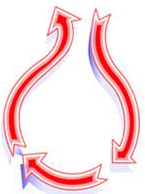


ENFIRO: Life Cycle Assessment of Environmentally Compatible Flame Retardants



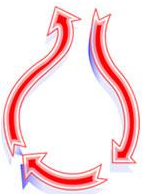
Selected polymers/materials

- E&E
 - Epoxy resins
 - Polystyrene blends: PC/ABS, PPE/HIPS
 - Polyamide 6,6
 - Polybutylene terephthalate (PBT)
 - Ethylene vinyl acetate (EVA)
 - Epoxy (encapsulants)
- Textile polymers (e.g. thermoplastics PUR)
- Intumescent Coatings (paints)

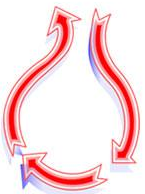
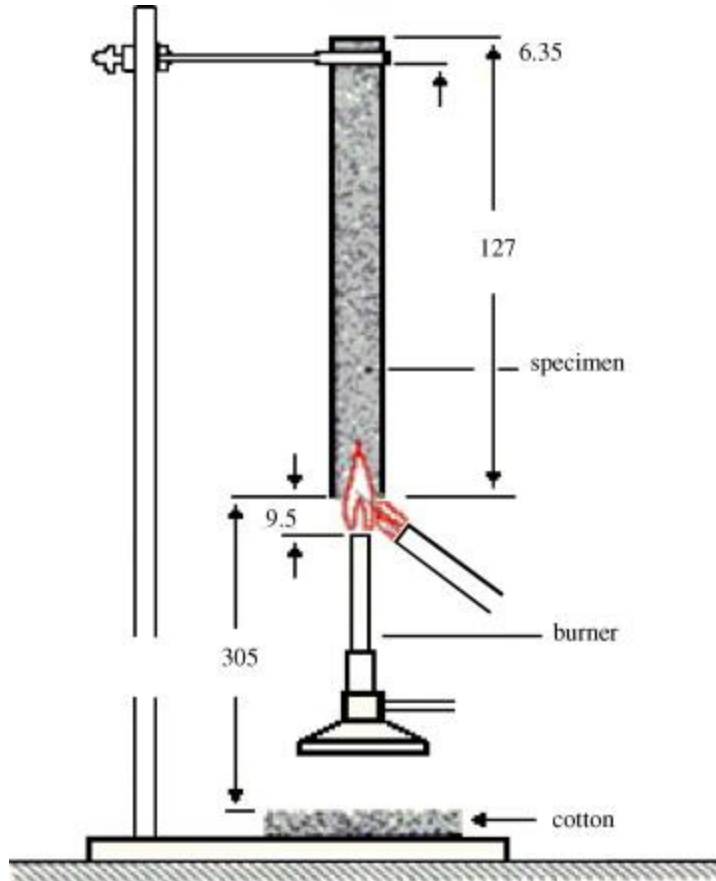


FIRE performance tests ENFIRO

- UL94
- LOI
- Cone calorimeter
- Smoke yield
- Toxic gases
- Char formation

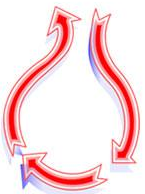


UL-94 Testing



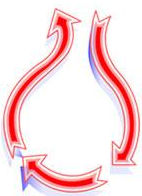
UL94 classification

- HB:** slow burning on a horizontal specimen; burning rate <76 mm/min for thickness < 3 mm
- V2:** burning stops within 30 seconds on a vertical specimen; drips of flaming particles are allowed
- V1:** burning stops within 30 seconds on a vertical specimen; drips of particles allowed as long as they are not inflamed
- V0:** burning stops within 10 seconds on a vertical specimen; drips of particles allowed as long as they are not inflamed
- 5VB:** burning stops within 60 seconds on a vertical specimen; no drips allowed; plaque specimens may develop a hole
- 5VA:** burning stops within 60 seconds on a vertical specimen; no drips allowed; plaque specimens may not develop a hole



UL-94 limited use

- To prioritize alternative flame retardants as all FR/material were V0
- It provides information on the performance of the material and therefore,
- Does not give information on “real world” fire



Cone Calorimeter

- Flammability testing of the polymer/flame retardant material
- Fire risk factors (e.g. heat release rate, ignition time and efficiency)
- Quantifies fire hazards (CO, CO₂, smoke)



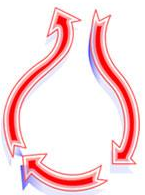
Polymer
+FR



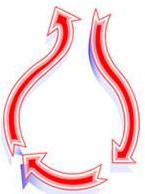
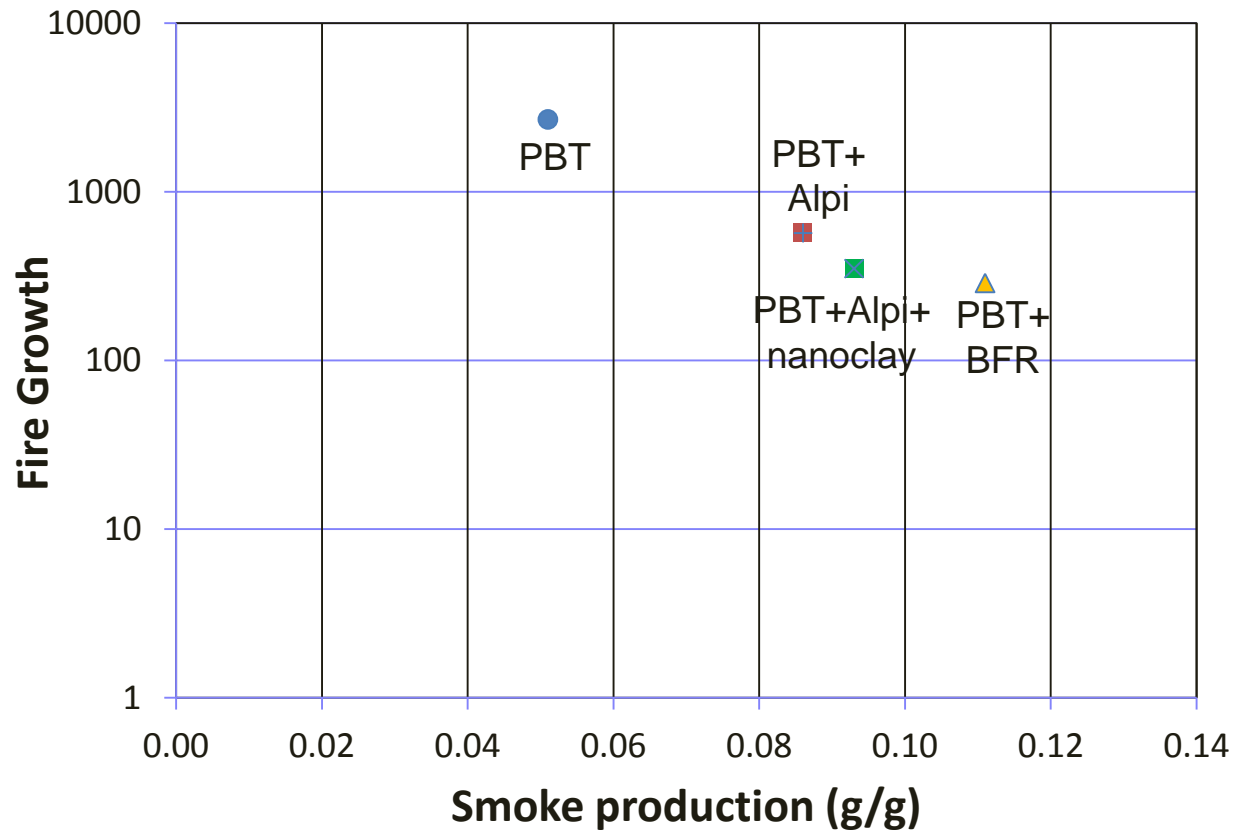
Combustion
Cone Calorimeter+
FTIR analysis



Char
formation

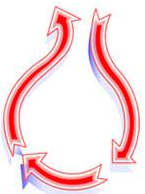


Fire Performance BFRs - HFFRS



Main conclusions

- In general, HFFRs had improved smoke suppression
- HFFRs had similar fire performance characteristics (heat release rates, ignition time and efficiency) as BFRs in polymers, except for polymer blends
- More sophisticated fire tests were needed to prioritize and select the most viable alternative FRs



Thank you for your attention

Acknowledgements

- ENFIRO consortium
- EU for funding ENFIRO (no. 226563)

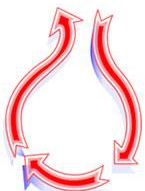
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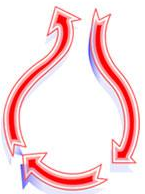
Dioxin2012

Thursday Room 5&6 Flame retardant alternatives

- 13.00 Outcomes of ENFIRO
- 13.20 ENFIRO film

Poster Monday Indoor Environments

- Leaching of HFFRs and BFRs from polymers





Burning questions

A workshop on alternative flame retardants looking at flammability, applications, toxicity, exposure to life cycle assessment

7-8 November 2012, Brussels, Belgium

Deadline early registration October 15th, 2012

