Epoxy resins, Intermediate usage, ABS plastics & EU Risk Assessment of TBBPA

cefic

PlasticsEurope
Association of Plastics Manufacturers

Epoxy resins

- are widely used in printed circuit boards
- used to meet fire safety regulations

TBBPA

- is the most widely used substance for FR epoxies
- is essential to comply with global fire safety requirements
- is currently under review:
  - EU Risk Assessment and
  - Classification and Labeling process

This Presentation

I. Epoxy resins

II. The need for flame retarded epoxy resins in Printed Circuit Boards

III. ABS Plastics

IV. TBBPA as intermediate

V. TBBPA

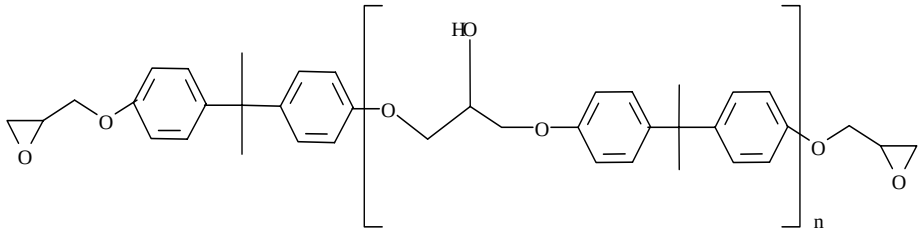
VI. Addressing TBBPA concerns

VII. Voluntary emissions reductions programme

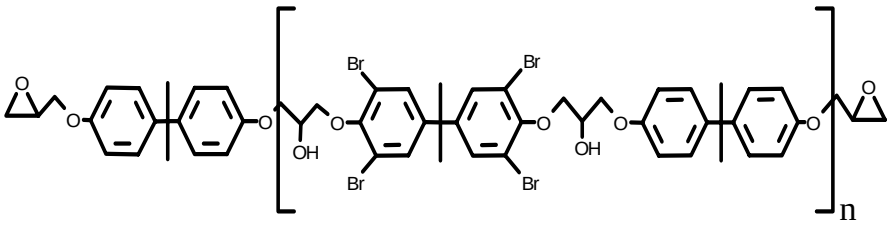
VIII. Conclusions

I. Epoxy resins: structure

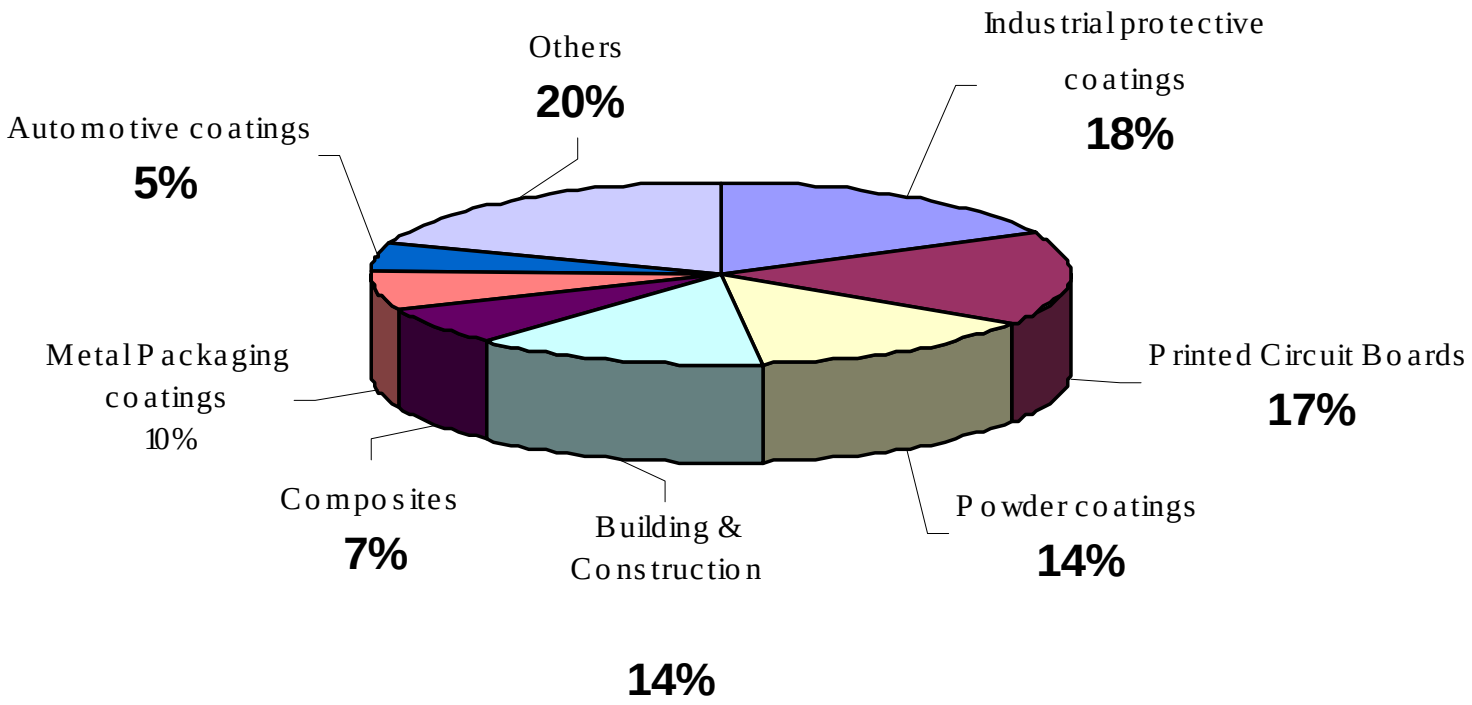
non-brominated bisphenol A based epoxy resins



brominated tetrabromobisphenol A based epoxy reins



I. Epoxy resins: essential applications



Note: Although epoxies are most widely used for Printed Circuit Boards, in fact the latter represent a minority share within the epoxy applications.

I. Epoxy resins: technical properties - advantages

- high mechanical stability, impact resistance
- high thermal stability
- excellent chemical / corrosion resistance
- good adhesion to variety of substrates
- excellent electro insulating properties
- lightweight
- versatile processing

I. Epoxy resins: socio-economic importance

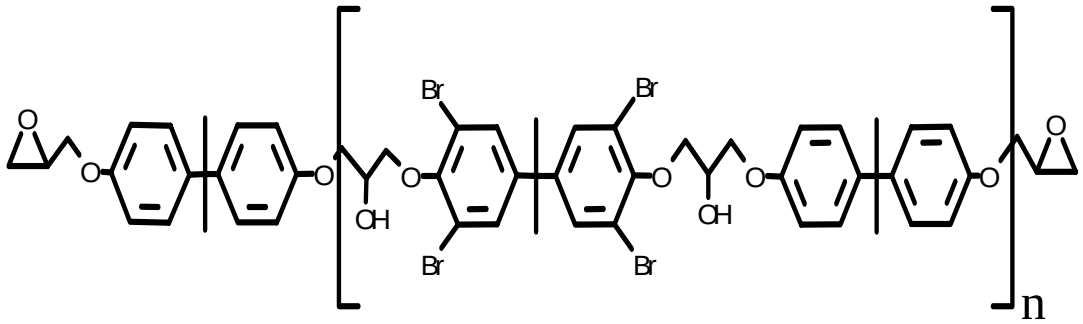
An important industry sector:

- global epoxy production volume estimated at 1.1 million tons
- approximately 1/3 of all epoxy resins manufactured in Europe
- supplying global markets worth at least 10 bn US $ in various sectors

A wide variety of products concerned:

- car coatings, anti-corrosion coatings for metal structures, industrial floorings, printed circuit boards, coatings for food & drink cans relying on epoxy resins for their product life, reliability, endurance or safety

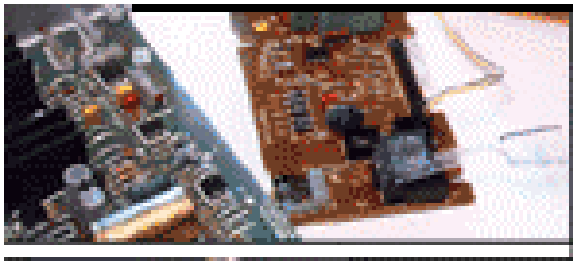
II.a. TBBPA as a flame retarded epoxy resin in Printed Circuit Boards and its benefits



- TBBPA is used as a reactive monomer ("reactive use")
- TBBPA is fully reacted in the epoxy polymer (only trace levels of free TBBPA)
- brominated epoxy resins are very stable (no thermal or chemical breakdown)

⇒ no release of TBBPA into the environment
⇒ no off gassing from Printed Circuit Boards

(Ergo Study on Offgasing of TBBPA from E&E Equipment)



III.a TBBPA as additive flame retarded in FR-ABS and its benefits

- TBBPA is used as an additive flame retardant in FR-ABS
  - Main alternative to Octa-BDE historically used as FR system for FR-ABS

⇨ no significant off gassing from computer monitors

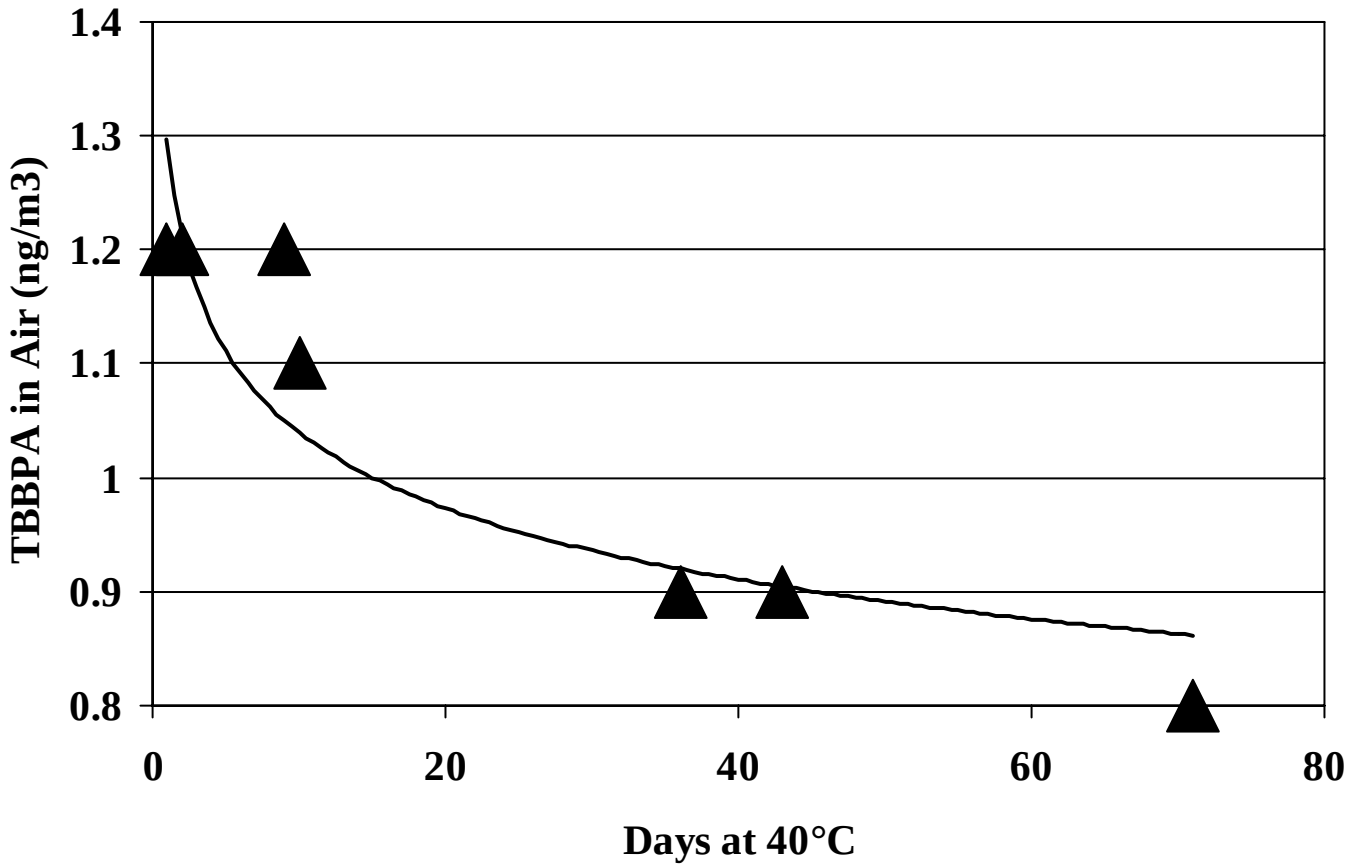
III.b CONSUMER EXPOSURE

Ergo Study on Offgasing of TBBPA from E&E Equipment

- *Scope*
  - Assess and quantify potential TBBPA consumer exposure from operating computer monitors (ABS/TBBPA housing)
- *Results*
  - Only minute amounts of TBBPA offgassing (in extended chamber/office exp.)
  - Emissions decreasing over time (see next slides)

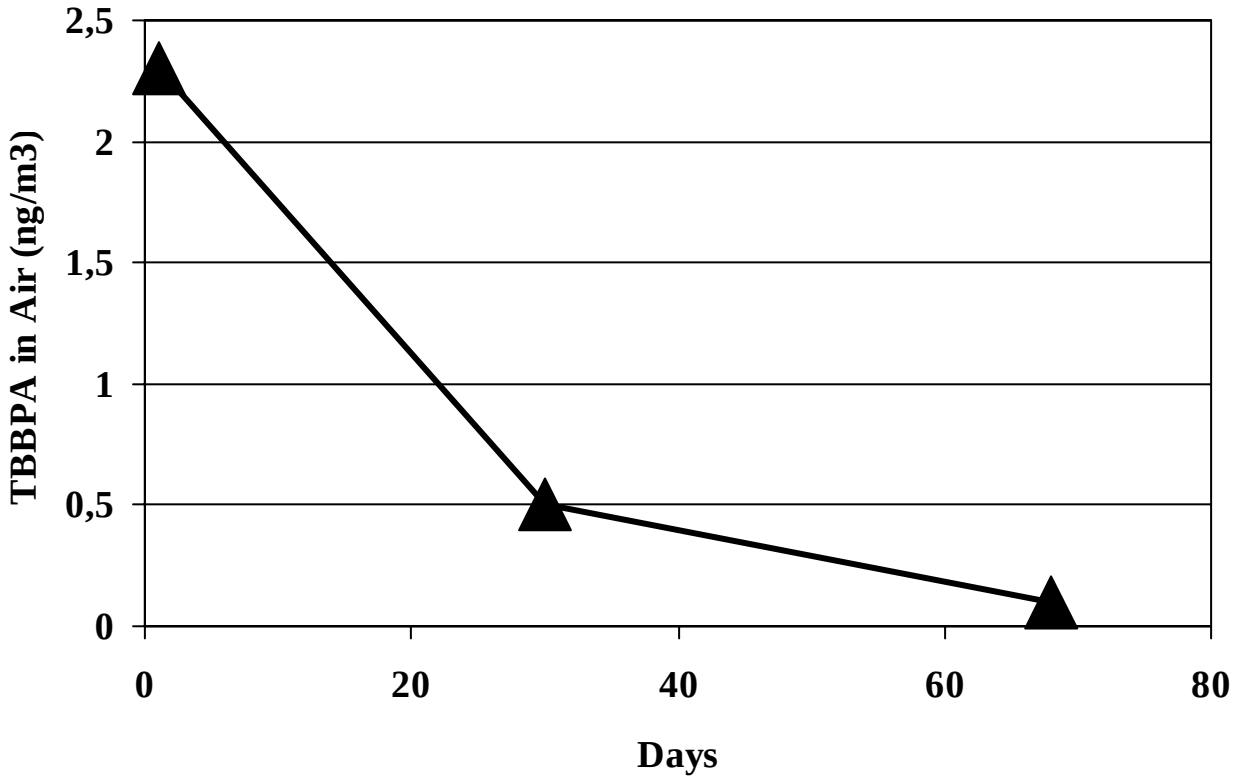
III.c CONSUMER EXPOSURE

Test Chamber Experiment



III.d CONSUMER EXPOSURE

Real Office Experiment



III. ABS plastics : Essential applications

***Essential applications include*:**

- Consumer goods
- Automotive interior and grillwork
- Telephone Housings
- Audio and Electrical Housings
- Major Appliance Components
- High Performance Toys
- Plated Applications
- Medical Applications
- For drinking water

III. ABS plastics: The need for flame retardancy in ABS plastics

- Information systems
  - Personal Computers
  - Monitors - Larger, hotter
  - Notebooks - Thin wall
- Document Management
  - Photocopiers - Large parts
  - Ink Jet Printers - Chemical resistance
  - Laser Jet Printers- Thin wall, large parts
  - Scanners / FAX Machines
- Telecommunications
  - Cellular Phones - Thin wall
  - Industrial And Life Safety Applications
  - Battery Housings - Heavy Duty
  - (Smoke) Alarms, Safety Lighting

III. ABS plastics: socio-economic importance

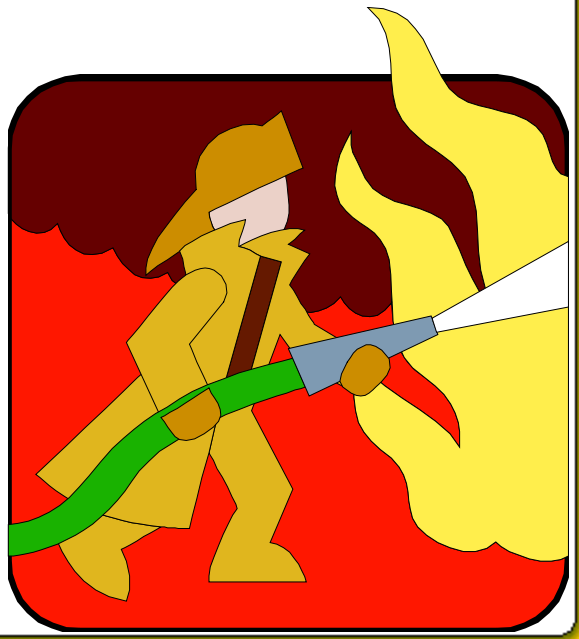
Socio-economic importance:

Overall sales in 2003 (all producers)

- Germany 139230 million (m)tons
- France 49933 mtons
- Italy 103750 mtons

Globally more than 300 different commercial ABS grades available (standard, high impact, high UV resistance grades etc)

Used in a wide range of applications; E&E, Transport, IT & Medical equipment

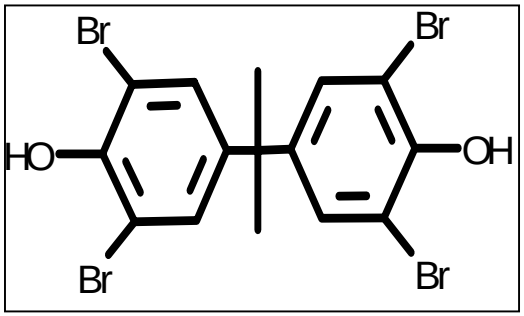


IV. TBBPA as intermediate

- used in FR systems for rigid PU Foams (insulation purposes; providing a significant contribution to energy savings and reduction of CO_2 release)
- used in production of brominated Epoxy Oligomers; alternative to Octa-BDE in FR-ABS additive application
- used in production (outside the EU) of a number of other proprietary BFRs

V. TBBPA: characteristics

What is TBBPA?



IUPAC: 2,2',6,6'-Tetrabromo-4,4'-Isopropylidendiphenol

CAS registry number:	79-94-7
Chemical formula:	C15H12Br4O2
Relative molecular mass:	543.7
Melting point:	179 – 182
Flash point:	N.A. (Bromine Cmpds 1999)
Specific gravity:	2.2 @ 25 0C, g/ml
Solubility:	pH5 – 0.148 mg/l at 25°C pH7 – 1.26 mg/l at 25°C pH9 – 2.34 mg/l at 25°C (Wildlife International 2002)
Vapour pressure:	<1.33 mbar at 20 °C
Use	as Flame Retardant

V. TBBPA: unique properties

Benefits

- TBBPA enables high global fire safety standards to be met in the applications where it is used

Alternatives

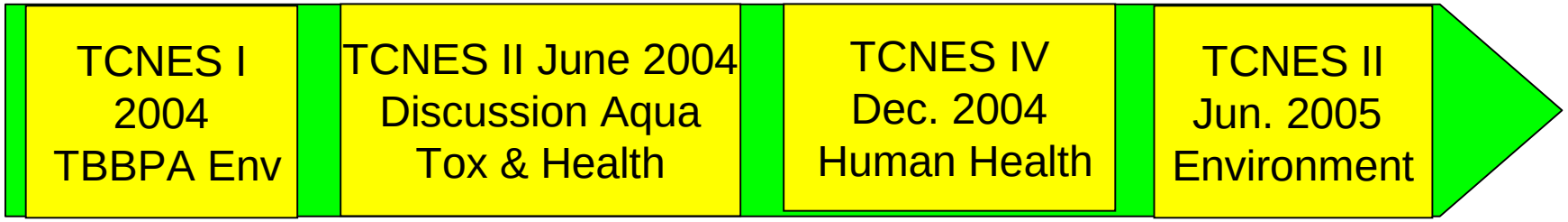
- Main alternatives are “halogen free” alternatives
- Swedish IVF institute states that halogen-free PWBs do not have any better environmental properties than TBBPA-based PWBs*

*“Environmental and economic implications of a shift to halogen free printed wiring boards”. C. G. Bergendahl, K. Lichtenvort,

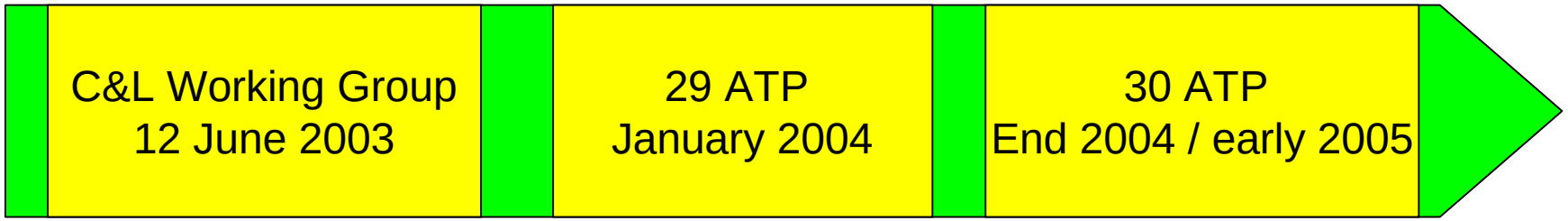
G. Johansson, M. Zackrisson, J. Nyyssönen, IVF Industrial Research and Development, Mölndal, Sweden – Technical University of Berlin – Aspocomp Oy, Salo, Finland.

V. TBBPA: Relevant Political Processes

1.) EU Risk Assessment Process – 2004



2.) Classification and Labeling Process - Outlook



V. Timing

EU Risk Assessment

- has addressed TBBPA concerns
- approaching completion:
  - Technical discussion: mid - 2005
  - Political decision: 2006

V. TBBPA EU Risk Assessment

Addressing the remaining scientific questions:

A) Human health risk assessment report

B) Environment risk assessment report

C) Risk Phrases N-R50 - 53

V. TBBPA EU Risk Assessment

A: Human Health risk assessment report

– Conclusion (ii) for all scenarios (no further risk reductions measures required)

Further studies volunteered by industry**:**

– Measure workplace exposure

– Measure dermal absorption rate

V. TBBPA EU Risk Assessment

C: TBBPA emissions to the environment

- Outstanding studies:
  - Potential degradation to Bisphenol A (BPA)
  - Soil compartment
  - Water
  - Sediment

VI. Addressing TBBPA concerns

- TBBPA not widespread in the environment, only found near point sources
- Industry Product Stewardship programme will achieve emission control in user industries

VI. TBBPA EU Risk Assessment

C: Risk Phrases

- Will be classified N-R50/53 = Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
- Risk manageable through industry product stewardship

VII. Voluntary Emission Control Programme

1. Environmental Monitoring (2002)
2. Plant Emission Monitoring (2004)
3. Developing Good Industry Practice Guidance Document (product stewardship- 2005)

VII. Voluntary Emission Control Programme: 1. Environmental Monitoring

- **Dutch Fishery Research Institute RIVO took environmental samples in the Netherlands, Belgium, Germany, Ireland and UK in 2001**
- Results published in 2002
  - TBBP-A was detected in some biota
  - Detected mean range in biota n.d. level to 136 p.p.b.
  - For sediment 1 p.p.b to 451 p.p.b.
  - Levels in final effluents from sewage treatment works were below detectable level

  Further Environmental Monitoring ongoing to define trend analysis
  - Sediment and Sludge
  - Biota

VII. Voluntary Emission Control Programme: 2. Plant Emission Monitoring

- Independent German institute Gesellschaft für Arbeitsplatz und Umweltanalytik (GfA) sampling representative sites in all known applications

- ➢Reactive - PWB
- ➢Reactive - Intermediate (raw material for other FR Systems)
- ➢Additive - FR-ABS

- Being done in close coordination with relevant CEFIC sector groups (user industries)
- GfA results on user site emissions end of 2004

VII. Voluntary Emission Control Programme: 3. Code of Good Industry Practice

- Based on GfA data Industry (producers and users) in consultation with IPPC regulators will develop a Code of Good Practice Guidance document for known applications (available 2005)
  - Focus on powder handling and waste control
- Code will support users in implementing responsible handling of all chemicals in use and reducing water emissions to close to zero levels

VIII. Conclusions

- Why do we need TBBPA?

  - Essential to respect fire safety regulations
  - Essential in certain applications such as printed circuit boards in consumer electronics and office equipment
  - Product Stewardship would ensure voluntary emissions control all over EU by 2007