




### WEEE: Selective Treatment

- Mercury-containing components
- Batteries
- PWB's
- Toner cartridges
- Plastics containing BFRs
- CRTs
- External electrical cables
- others

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**European Commission  
DG Environment**  
Sustainable Resources, Consumption and Waste

Implementation scenarios:

- Dec 2002 Adoption by Council and Parliament
- Mar 2003 Publication and entry into force
- Sep 2004 Deadline for transposition in Member States
- Sep 2005 Collection systems must be operational; treatment and financing obligations enter into force
- Dec 2006 Collection and financing targets to be attained

↓ How the Directive is going to be implemented in detail is a matter for the Member States

*Courtesy of Aaron McLoughlin, European Commission DG Environment*

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### European RoHS

- Phase out lead, mercury, cadmium, hexavalent chromium, and certain PBB/PBDE brominated flame retardants
- Phase-out date 1 Jan 2006
- Broad coverage, but with specific exemptions

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### Brominated Flame Retardants

- PDBE's :Polybrominated diphenyl ethers
  - Incl. Deca-, Octa- and Penta- congener blends
  - Octa and Penta risk assessments complete, conclusion to phase-out
  - Deca risk assessment not complete, may be exempt from RoHS
- PBB's: Polybrominated biphenyls (no longer produced)

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### RoHS Exemptions

- Mercury in fluorescent lamps
- Lead in CRTs
- Lead as alloying element in small %
- Lead solder:
  - high melting point solder
  - In servers, storage, network infrastructure
- Some anti-corrosion applications of hex-Cr and Cd

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### Where is Lead Used in Electronics?

- PWB manufacture
  - etch resist, surface finish, (finished boards are typ. 1% lead)
- Update** • PWB assembly
  - through hole and surface mount soldering, component attachment
- CRT manufacture
- Other:
  - coating of lead on components,
  - shielding,
  - cable coating, stabilizers and pigments in plastics

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### Lead-Free Electronics – R&D

- UML Lead-Free Electronics Consortium
  - Phase II Test Program
    - Test matrix: 5 surface finishes, 3 SnCuAg solder pastes, Air vs. Nitrogen, many different components and finishes
    - Visual inspection complete
    - Next: pull testing of component leads
    - Thermal cycling and further testing



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### Lead-Free Electronics – Supply Chain

- TURI Lead-Free Electronics Supply Chain Workgroup
  - Next meeting this spring
    - Tin whiskers
    - EPA/IPC Substitution Assessment
    - Consortium update



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### Wire and Cable

- Conductor
- Insulation
- Jacketing



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### Wire and Cable Coating Materials

Resins + Additives = f (cost, performance)

#### Resins

- PVC, PE, Polyurethane, PP, FEP, CSPE
- EPDM, EPR, etc.

#### Update ~ Additives

- Flame, heat, plasticizers, fillers, lubricants, colorants



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### Materials of Concern

- Update ~* • Heat Stabilizers (PVC, rubber elastomers)
  - Lead and Lead compounds
- Update ~* • Fire Retardants
  - Antimony and Antimony compounds
  - Brominated compounds (decabromo DBDPO, etc.)
- Plasticizers (PVC)
  - Phthalates –DIDP, DEHP, DINP
- Colorants
  - Heavy metals (Pb, Cr, Co, Ni, Cd)
- Halogens in Resins – Cl in PVC, F in fluoropolymers

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### Lead in Plastics – California Proposition 65

- Wire and Cable manufacturers worked through NEMA to agree on settlement
  - Limits % lead for different applications to avoid labeling requirements
  - Protects NEMA parties from suits for past violations of Prop 65



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### PVC Lead Substitutes

- Challenges
  - cost, processability, formulation changes, wet applications
  - Calcium/zinc soaps
  - Magnesium-aluminum carbonates
  - Barium/zinc combinations
  - Organotin derivatives
  - Organic compounds (completely metal-free)
- Suppliers have many products already on market
  - MA OTA working with companies to switch where possible

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### Lead Substitutes - Research

- Research at UML sponsored by TURI and OTA to determine mechanism of lead stabilizers in wet applications.

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### Fire Retardants

There are a number of different "families" of flame retardants:

- Phosphorous-containing
- Nitrogen-containing
- Chlorinated
- Inorganic

*Update - Brominated*

flame retardant depends on application.

- subject to variables such as the material to be flame-retarded
- fire safety standards with which the product must comply, cost considerations, etc.

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### Focus on BFRs

- Fire safety vs. health risk (EU vs US)
- Focus on brominated flame retardants
  - PBTs
  - 1998 Swedish PBDE breast milk study: 20yrs exponential growth, double 5 yrs
  - Many questions about BFR persistence, toxicity and risk

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### Brominated Flame Retardants

- Br bisphenols (Tetrabromobisphenol-A TBBPA)
- Polybrominated diphenyl ethers (PBDEs)
  - Incl. Deca-, Octa- and Penta- congener blends
- Hexabromocyclododecane (HBCD)
- Polybrominated biphenyls (no longer produced) (PBBs)
- others

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### Major BFR Uses

Source: McDonald - Cal EPA

BFR	Consumer materials (% of product)	Reactivity in matrix
PBDE penta-BDE	polyurethane foam (<30%)	not bound
PBDE octa-BDE deca-BDE	plastics (<20%), rubbers (6%), textiles	not bound
TBBPA	plastics, resins, textiles	covalently bound
HBCD	plastics, polystyrene padding (1%), textiles, latex	not bound

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Summary of International PBT Materials  
Restrictions

- Europe is moving
- Japan is trying to get ahead
- US recognizes the inevitable
- OEMs are passing on requirements to suppliers
- Suppliers which can meet those requirements will be in a good competitive position

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