European Environmental Bureau

Elena Lymberidi, M.Sc.

TOWARDS WASTE-FREE ELECTRICAL AND ELECTRONIC EQUIPMENT

EEB argumentation paper concerning the proposals for Directives on Waste Electrical and Electronic Equipment and on the Restriction of the use of certain Hazardous Substances in Electrical and Electronical Equipment

March 2001

The European Environmental Bureau (EEB)

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Editor responsible:
John Hontelez
European Environmental Bureau (EEB)
34 Boulevard de Waterloo
B-1000 Brussels
Tel.: +32 2 289 1090
Fax: +32 2 289 1099
e-mail: info@eeb.org
web-site: www.eeb.org

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Elena Lymberidi, M.Sc.
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INTRODUCTION

The production of Electrical and Electronic Equipment (EEE) is one of the fastest growing domains of manufacturing industry in the Western world. Technological innovation and market expansion accelerate the replacement process and new applications of electrical and electronic equipment are increasing significantly. Therefore the resulting rapid growth of waste from electrical and electronic equipment (WEEE) is of concern. In 1998, six million tonnes of WEEE were generated (4% of the municipal waste stream). This volume is expected to increase by at least 3 – 5 % a year.[1] Figures show that the growth of WEEE is about three times higher than the growth of the average municipal waste.[2]

The hazardous contents of EEE cause high concern when these products become waste, since they are not separately collected and pre-treated and end up in municipal waste landfills where appropriate measures for preventing hazardous substances from entering the environment are lacking. As more than 90% of WEEE is landfilled, incinerated or recovered without any pre-treatment, a large proportion of various pollutants found in the municipal waste comes from WEEE.[3]

As a response to these concerns, the European Commission adopted two proposals for directives in June 2000, one on Waste Electrical and Electronic Equipment (WEEE) and one on the Restriction of the use of certain hazardous substances in Electrical and Electronic Equipment (ROHS).

The importance of such directives needs to be underlined:

- They lead to Waste Prevention.
- They can be seen as a tool for innovation: improving durability, repair-friendliness, modular construction, the use of non-hazardous substances and the recyclability of consumer goods.
- Market failure is corrected, by making the polluter pay for the costs that are currently borne by society: the producer, and hence subsequently the consumer, has to pay the full costs of end-of-life electronics.
- They are elements in a comprehensive product policy.

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[1] Explanatory Memorandum on WEEE, European Commission, June 2000, pg.4

[2] *AEA Technology. Recovery of WEEE: Economic and Environmental Impacts*, Final report, June 1997.

[3] *Environmental Consequences of Incineration and Landfilling of Waste from Electrical and Electronic Equipment* (Copenhagen 1995), Nordic Council of Ministers. According to the study Pilotsammlung von Elektroaltgeräten in Bregenz, 95% of WEEE arising in Austria is either simply disposed of with municipal waste or introduced into the metal recycling chain without any pre-treatment.

The EEB supports the principles expressed in the proposals: the wide scope, producer responsibility, separate collection and reuse and recycling targets as well as substitution of the use of certain hazardous substances.

Furthermore, the EEB would like to see:

- Requirements for future individual producer responsibility.
- Higher reuse/recycling targets.
- Higher collection target.
- Phase-out of all halogenated flame retardants, PVC, HFCs and generally speaking, all gases which are ozone depleting or have a global warming potential above 15.
- Links between the directive and Waste Management (Prevention) Plans.

This paper focuses on the debates and arguments regarding the main points covered by the European Commission proposals for directives and will present the EEB position on the different issues at stake.

1 CLEANER PRODUCTION VIA EXTENDED PRODUCER RESPONSIBILITY

Waste: an item for producers

Following the principle of Extended Producer Responsibility (EPR), producers are financially responsible for the environmental impacts of their products through their whole life cycle, as well as when these become waste, including their collection, treatment, recovery and finally environmentally safe disposal. EPR therefore shifts the ultimate responsibility for waste management from municipalities to final producers, including importers[4]. In this way, private companies have to internalise the waste management costs relating to their product, substantially or fully. Producer responsibility therefore corrects market failure by reconverting social costs into private ones, when the polluter has to pay for the costs that are currently borne by society. The producer, and hence subsequently the consumer who buys such products and not the whole society, has to pay the full costs of end-of-life products and in this case electrical and electronic equipment.

EPR may become a tool for innovation

Full producer responsibility may increase costs in the short run – but the instrument should not be only perceived as a burden to industry. It should also be regarded as an incentive or a tool for innovation, as it creates an upstream effect, which may lead to prevention and design with a view to environmental protection. Manufacturers will be required to improve the design of their products, taking into account the potential impacts these may cause, not only during but also after the end of their life. In this way, the choice of materials, durability, repair-friendliness, modular construction, the use of non-hazardous substances and the recyclability of consumer goods may be improved. Finally, substances which cause most environmental problems will be substituted by less hazardous ones, enhancing once more the protection of the environment and human health[5].

[4] *Extended and Shared Producer Responsibility, Phase 2*, Framework Report, OECD, 11 May 1998.
[5] *EEB Comments on the WEEE and ROHS directives*, September 2000.

Additional costs are acceptable and can be reduced by innovative strategies

The economic opportunities linked to strict producer responsibility are bigger than the costs. The costs of strong recycling systems seldom exceed 5% of the product price[6]. Given that costs have to be borne by local producers and foreign producers equally, there is little threat to the competitiveness of the industry. Price elasticity of the consumption of electronic goods does not seem high enough for full producer responsibility to lead to a dramatic decline in demand. In fact, it is rather the opposite that is true: producer responsibility will create a new market, hence new employment opportunities and in the long run a push factor for product innovation, as described earlier. In addition, it has to be seen as an important element in a comprehensive ecological product policy.

Producers who redesign their products to reduce costs for final disposal of electroscrap should get a market advantage. Innovation is urgently needed for an industry that has to survive tough world market competition. Moreover, producer responsibility creates incentives to set up a take-back infrastructure, offer repair services and so on: all these are activities with local added value, creating employment in Europe. So it is a potential instrument for sustainable development, which creates synergies between economic and environmental objectives[7].

The idea of producer responsibility is not to let the industry pay more, but to have society pay less. This is only a zero game in the short term – in the long term, if industry adjusts to the new prices, both will win.

[6] *AEA Technology. Recovery of WEEE:Economic and environmental Impacts*, Final Report, June 1997.
[7] *Electronic Scrap and Producer Responsibility Principles for an EEB position*, Christian Hey, EU Policy Director, 14/05/1998.

1.1. Individual financial producer responsibility: a recipe for waste prevention

Article 7 of the WEEE proposal. Financing of WEEE from private households

1. Member States shall ensure that holders of WEEE from private households can return such waste free of charge in accordance with Article 4.
2. Member States shall ensure that, five years after the entry into force of this Directive, producers provide for the financing of the collection of WEEE from private households deposited at collection facilities, set up under Article 4(1), as well as of the treatment, recovery and environmentally sound disposal of WEEE.
3. The financing referred to in paragraph 2 may be provided by means of collective or individual systems. There shall be no discrimination between producers who opt for collective systems and those who opt for individual systems.

Brief analysis: according to the Commission's proposal, producers of EEE will be financially responsible for covering the management costs of WEEE either by paying only for the costs of their own-brand EEE when these become waste (individual responsibility), or through a collective model, where each producer will contribute to the general WEEE management costs according to his market share. Producers are therefore free to choose the way in which they will comply with their financial responsibility. Organisationally, producers are allowed to use individual or collective systems for the collection, treatment and disposal of WEEE[8].

Hot debate between individual and collective financial responsibility models

Definition and duties

Individual financial producer responsibility means that each individual producer is liable regarding the costs relating to the waste management activities which are required for its own-brand products when they become

[8] It should be noted that the above interpretation clarifies the way in which the word 'system' is being used in referring to the financial and organisational responsibility, in the first and second sentence of article 7.3 respectively.

waste. It does not relate to the organisation and logistics of take back-systems! Moreover, individual responsibility does not prohibit co-operation among producers – it maintains clear-cut ultimate responsibility by an identifiable individual producer.

As already mentioned, it needs to be made clear that under an individual financial responsibility model, companies can still gather together and form smaller groups in order to manage their waste better. The difference between a general collective financial responsibility model and many smaller groups of individually responsible producers, however, is that in the latter case, companies will really need to know about the waste from their own products and the costs corresponding to them. The whole scheme can thus improve quicker and become more competitive in a more effective and direct way.

From an organisational point of view, through an individual financial responsibility model, companies do not necessarily need to establish their own collection, recycling or treatment system. Producers can work together and current structures where municipalities play the main role in waste management should be used and improved for a better result.

According to the *collective financial responsibility* principle, all producers are jointly responsible for the total costs linked to the management of WEEE. Generally speaking, costs are shared between producers, in proportion to their market share at the time when these costs arise. The direct link between the producer and his real waste management costs is therefore missing.

Scope of EPR

In relation to the proposed directive on WEEE, producers are financially responsible for the following activities linked to WEEE from private households: collection from dedicated collection facilities, treatment, recovery and environmentally sound disposal. Financial responsibility for the collection of WEEE from other than private households is covered by agreements between the producers and users of the equipment at the time of purchase.

Full extended producer responsibility should cover costs relating to the collection of WEEE from private households. These collection costs from private households can amount to 50% of all waste management costs. Collection is a necessary step in the waste management chain, so why should the general public cover costs? This would contradict the "polluter pays" principle, even though the contribution to eco-design might be limited.

Nevertheless, on the basis of the EPR principle, producers should be responsible for all costs relating to the management of WEEE and should therefore make at least a financial contribution to collection from private households (e.g. in the setting-up of a network of collection points). In this case it will be ensured that collection systems are developed faster and become more efficient.

Why Individual Financial Producer Responsibility?

The benefits of individual producer responsibility for future waste, compared with collective responsibility, and the reasons why it should be required by the WEEE directive are the following[9]:

- **It has benefits from a legal point of view**, since an actor -and in this case a producer- can only be made responsible for costs which are under his control[10]. Therefore the responsibility for WEEE can only relate to the products he has put on the market and it is only then that he may be liable in case of breach of law. In a collective producer responsibility model, it would be unclear as to who is legally accountable, as there is no such thing as collective punishment or producers' joint prosecution. A representative of the legal entity (collective model) may have to 'go to court' if needed and any breach of law will eventually be borne by the whole scheme. As a result, the potentially strong value – pain is gain – of the effect on environmental terms, further translated into financial ones, will be undermined.

[9] Individual Financial responsibility is also supported by EACEM, *one page a clarification on the issue of individual producer responsibility, 20 February 2001, by Electrolux, Nokia, Sony, IBM, Sun Microsystems, Intel, Erikson, ICL, HP, Agilent, Gilette, BEUC (European Consumers Organisation), BEUC position paper on the WEEE directive, BEUC/279/2000, 03/11/2000, Final Draft.

[10] *Dr. Stein Torsten, Legal Opinion on the proposal of the Commission of the European Communities for a Directive of the European Parliament and of the Council on waste electrical and electronic equipment.* Saarbruecken, October 2000, p.16.

- Free riders will be avoided. Member States shall ensure that each producer/importer meets his responsibilities when placing a product on the market so that free riders can be avoided. Enforcement is a public law issue against each individual producer. In an individual producer responsibility model, each company is responsible for its own products and cannot therefore hide behind a collective model where a free-rider's share may be covered by the whole scheme. Parties responsible for the sorting, treatment and recycling of WEEE will have to allocate financial responsibility to the producers, and therefore free riding will be avoided. A slightly questionable aspect on that issue is that the administrative costs may be higher at the beginning for an individual company compared with the administrative costs that would be shared in a collective model. On the other hand, however, individual responsibility will ensure commitment to further progress, which in the long run will lead to environmental improvement and cost reduction.

  In a collective model, avoidance of free riders depends on the privately agreed internal enforcement mechanisms. It cannot be assured that the producers agree on an effective internal enforcement system. If they do, the administrative costs for ensuring that each company is well-disciplined in relation to its responsibilities and that free riding is avoided (not paying fees, not reaching the recovery targets etc.) can be shared by all participants. In case of non-compliance however, the scheme will be held liable for any participant that is not fulfilling his obligations and there are possibilities for a producer to escape responsibility since waste management costs will be covered by the pool. For a collective model to work properly, this is exactly what should not happen. In general, it is very important to ensure that each producer is either paying as a part of a collective scheme or is taking on financial responsibility for the recycling of his products in another way; in a voluntary scheme member producers cannot be made responsible for non-members[11]. Enforcement authorities will ultimately have to deal with such problems.

- Industry have been arguing that '**orphan waste**' (waste coming from companies that no longer exist on the market) is not covered in an individual responsibility model. They have been arguing that in a collective model, it can be covered through an agreement to the effect that

[11] *Extended and Shared Producer Responsibility, Phase 2*, Framework Report, OECD, 11 May 1998, pg. 36

everybody for example pays a bit more than their share to build a fund in case something goes wrong, or a similar scheme.

In an individual financial responsibility model, accounting legislation requires that reserves should be built to cover management costs for **'orphan waste'** in the future. According to the Generally Accepted Accounting Principles (GAAP) and the International Accounting Standard (IAS) #37[12]: Provisions, Contingent Liabilities and Contingent Assets that are applicable to all Member States, companies have to arrange to set financial reserves for accruals or insurance for future obligations.

In addition, the reserves that need to be built to ensure that the WEEE from a certain company will be dealt with, are exempted from tax and therefore do not have a negative financial impact for the company. These reserves will only be taxed when they need to be used for recycling or other recovery operations.
It is therefore clear that individual financial responsibility can cater for future orphan waste.

- Differentiation without physical sorting of products[13]: differentiation and tracking of products can be achieved without physically sorting them. For example, in the Netherlands, a collective recycling system using an individual financing structure has been set up by ICT manufacturers. The products are collected, handled and recycled together, but the system manages to keep track of the amounts of products from each player. One technical possibility for tracking and identifying products without physically handling them is to use smart tags[14], bar codes, etc.

- Individual responsibility, through the internalisation of external costs, creates a direct upstream effect which contributes to **designing for the environment**, considering the choice of materials, durability, reparability or upgrading, disassembly, recycling of the product, saving of resources and waste prevention. In this way, every improvement in design will have a direct effect on the costs the producer will have to bear for potential

[12] International Accounting Standard IAS 37 - http://www.iasc.org.uk/frame/cen2_137.htm
[13] Electrolux, *Producer Responsibility and recycling systems in practice (10/11/00).*
[14] Financial Times article , 25 October 2000, on 'intelligent' tags.

treatment at the end of the product's life and eventually on the price consumers have to pay for the product.

Improvements in terms of design which will have a direct effect on waste management costs can be achieved through the use of recyclate for the manufacturing of new products – which will also lead to the use of less raw materials and saving in resources. Improvements at the level of waste management costs can also be achieved by a shift in company policy by trying to sell services rather than products. This will also contribute to the idea of sustainable consumption, less use of resources, of hazardous substances, etc. as mentioned earlier.

On the other hand, collective financial responsibility does not remunerate the innovating producer. Innovation in ecodesign by one producer will probably get diluted and lost in the collective scheme. In this way such innovation will not really be promoted. Environmental improvement through a collective model may only be achieved via market forces, if the participants in a collective scheme agree on differentiated fees or if there is competition between individual and collective financial arrangements. However, producers are not likely to agree on an environmentally differentiated fee. So only competition drives innovation as it gives a company opportunities for choice and hence also for leaving a common scheme, if it prefers to do so. As a result, progress towards designing for the environment may be achieved, but only at a later stage.

In a similar way, individual responsibility is very positive for SMEs. Let us examine the following example: if a company has a 20% market share and manages to reduce its waste management costs by 50% under a collective model, the benefit to the scheme will be a 10% reduction. If an SME has a 1% market share and reduces its waste management costs by 50% under the same collective model, the benefit will be 0.5%. In this case, the benefit to the SME will therefore be much higher if it does pay for the management of its own WEEE.

A caveat: individual financial responsibility only drives eco-innovation if a very demanding framework is set, thus preventing cost reduction strategies by ecodumping. This applies especially to recycling, collection and chemicals targets. Compromises on those points create incentives to reduce costs by choosing environmentally less performing waste management options.

Compatibility with EU competition law

According to competition law, there are possibilities that an industry-wide collective model for 'new waste' may fall under the ban of Article 81 (1) of the Amsterdam Treaty[15], as it may restrict competition in the recycling market.[16] The introduction of an industry-wide model to finance the management of WEEE could clearly meet most of the conditions of Article 81 (1). An agreement between undertakings would need to take place and even if this is nation-wide only, there are high possibilities that this will affect trade between Member States. The products themselves may have been imported originally or the recycled waste may be re-exported. Furthermore, even if trade between Member States is not affected, national competition rules are all based on Article 81 and compliance is therefore necessary with these provisions.

On the other hand, under Article 81(3) or Article 86(2), there may be grounds for exemptions from Article 81(1) since environmental considerations may justify a more lenient interpretation of the provisions of that article. This possibility, however, will need to be further examined since it has to be proven that such a model is beneficial to the consumer and also indispensable to attain the environmental objectives pursued.

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[15] "The following shall be prohibited as incompatible with the common market: all agreements between undertakings […] which may affect trade between Member States and which have as their object or effect the prevention, restriction or distortion of competition within the common market, and in particular those which:
(a) directly or indirectly fix purchase or selling prices or any other trading conditions;
(b) limit or control production, markets, technical development, or investment;
(c) share markets or sources of supply;
(d) apply dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage;
(e) make the conclusion of contracts subject to acceptance by the other parties of supplementary obligations which, by their nature or according to commercial usage, have no connection with the subject of such contracts."

[16] Opinion for CECED on the *Compatibility with European Competition Law of the Financing of the Collection /Recycling of WEEE by means of a collective system*, Liedekerke Simeon Wessing Houthoff.

Council and Commission have backed the principle of individual EPR

Individual producer responsibility has been requested by the Council Resolution of 24 February 1997 on a Community strategy for waste management, where it is mentioned that the Council "*(14) CONSIDERS that waste management implications of a product should be fully taken into consideration from the conception phase onwards and that, in this context, the producer of a product has a strategic role and responsibility in relation to the waste management potential of a product through its design, content and construction*".

This wording underlines the issue of "individual responsibility" since a producer can only be responsible for the products that he puts on the market and naturally enough, not for the products that someone else has produced. The same applies to importers.

1.2 Dealing with the burden of the past: Historical Waste

> *Article 7.3 of the WEEE proposal [Financing in respect of WEEE from private households] [...]*
>
> The responsibility for the financing of the management of waste from products put on the market before the expiry of the period referred to in paragraph 2 ("historical waste") shall be shared by all existing producers. Where a producer who opts for an individual system cannot prove that he is discharging his responsibility with respect to a fair share of the historical waste, he shall contribute to the financing of an alternative system.

Historical waste according to article 7.3 is waste from products put on the market before the set period of expiry. However, we would define historical waste as waste from products put on the market before the entry into force of the directive. The reason is that from the moment of adoption of the directive, the producer may (and will (arrange for the price of the product to include the amount corresponding to the waste management cost of that product when it becomes waste. There is therefore no reason to delay the responsibility of each producer for its own WEEE coming into effect by

calling products 'historical' since legislative requirements will already be in place.

With respect to historical waste, it has been made clear that there is a need for this type of waste to be separately collected and managed in an environmentally safe way. The controversial question is who should pay for the take-back of historical waste.

Generally speaking, industry[17] has been opposing the fact that they should be responsible and pay for the management of this type of waste retroactively, since at the time when the products were put on the market, there were no calls or provisions for such a task.

We strongly believe that producers should be made financially responsible for covering the costs of WEEE which is returned independently of the date when the EEE has been produced – not only because of considerations about an environmental steering effect, but because of the "polluter pays" principle. Polluters should bear the costs of environmental protection, not taxpayers. It is a general principle in a market economy that those who participate in market transactions should cover the costs, not third parties.

Furthermore, EPR for electronics has been on the policy agenda since the beginning of the Nineties and has been delayed, among other things, because of the reluctance of industry to go for an ambitious and demanding voluntary scheme. There is no reason to give industry a dividend for strategies that delay action. Therefore, financial responsibility for the returned WEEE does not come as a surprise.

The legal issues relating to retroactive responsibility have already been extensively discussed in the case of the End-of-Life Vehicles directive[18]. The compromise which was found has not been rejected on legal grounds. A similar approach should therefore apply to the current proposal on WEEE.

This is why we support this compromise which offers a modest transitional phase (albeit considerably shorter than the five years suggested by the Commission) and allowing for a collective producer responsibility model,

[17] – *Detailed position of Orgalime's electrical and electronic liaison committee in cooperation with European Sector Committees*, 5 September 2000.
– EICTA, European Information and Communication Technology Industry Association, *Position statement*, 22 September 2000.

[18] Official Journal L 269 of 21 October 2000 (Directive 2000/53/EC).

where costs will be shared by producers in proportion to their current market share. This kind of cost sharing is preferable in this case, since a company which had a high market share some years ago would get back higher amounts of WEEE for recovery, for which it had not made sufficient financial provision.

Timetable for transition

Article 7.2 of the WEEE proposal.

Member States shall ensure that, five years after the entry into force of this Directive, producers provide for the financing of the collection of WEEE from private households deposited at collection facilities, set up under Article 4(1), as well as of the treatment, recovery and environmentally sound disposal of WEEE.

Finally, because of the reasons analysed above, the EEB suggests that individual financial producer responsibility should apply for new waste, whereas the management costs for historical waste should be covered by producers in a collective way.

However, since we are proposing two different models for the financial responsibilities relating to the management of WEEE, the timing for implementing these requirements is important.

For producers to bear the costs of historical waste, since no provisions were made before, it is very important to allow a certain amount of time – a transitional period (during which producers will make financial reserves in order to meet their financial obligations regarding the management costs of historical WEEE, through a collective financial responsibility model.

The EEB therefore proposes that the financial obligations for the management of historical waste should start three years at the latest after the adoption of the directive. During this three-year transitional period, producers should take necessary steps to meet the obligations described above, for example increasing the current price of EEE by an amount,

which will allow them to cover the cost of management of historical waste. With respect to financial responsibility for the waste from products that will be on the market after the adoption of the directive (new waste), individual financial responsibility should apply immediately.

As this paper discusses arguments which have arisen during the debate on the financial responsibility for WEEE, it should be mentioned that if both financial responsibility models are authorised for new waste (given that collective financial responsibility will be required for historical waste), in other words if producers are given the possibility to choose between joining a collective financial responsibility model or dealing individually with their waste management costs, it is especially then, that a transitional period is needed. The reason is that if a company which has decided to finance the waste-related activities deriving from its products individually, is then asked to finance historical waste at the same time, it will have a competitive disadvantage compared with the producers that join a collective scheme. This is because the individually responsible company will have to arrange for the price of a new product to include not only an amount that will cover the cost of historical waste but also an amount that will provide for the treatment of future waste. It is therefore necessary for a transitional period to be allowed in order to level up the market.

1.3. Waste management costs: visible or invisible?

[Related to Article 7 of the WEEE proposal, Financing in respect of WEEE from private households]

As it was mentioned in the previous paragraphs, producers will have to increase the current price of their products to meet their financial responsibilities for the management of historical and future WEEE. The debate is currently focused on whether this should be done in a visible or 'invisible' way.

Extended producer responsibility is about internalising external costs. However, some of the schemes currently implementing producer responsibility at national level have been introducing a visible fee on the

price of the product to cover waste management costs. But in some Member States, competition authorities do not allow for such an arrangement, which can eventually lead to a competitive disadvantage for those countries' producers. This is why discussions have started about whether a visible fee – to be invoiced to customers as a separate item (will be allowed in general or will become an obligation for the consumer to pay under the WEEE directive in order to overcome the national ban in some Member States and ensure internal market harmonisation. Moreover, it seems that a visible fee can only be jointly fixed, since if this is left to producers, some of them may probably choose not to have one (a zero fee meaning a full internalisation of costs), which will immediately give them a competitive advantage, with market forces probably preventing other producers from adding the fee.

It should also be assumed that this fixed fee would have to be passed on from the producers to the wholesalers/distributors/resellers, and then to their own customers at each level of the distribution chain.

On the whole, industry federations have been in favour of a visible fee to show the consumer that the reason for price increases has nothing to do with them wanting to make more profit, but is a charge because of environmental legislation. Another argument has also been that a visible fee will educate people since they will start being aware that the equipment in question needs special treatment for the sake of the environment and human health. However, it remains to be seen whether something like this is accepted.

The EEB believes that a visible fee contradicts the "polluter pays" principle and the principle of extended producer responsibility and externalises costs instead of internalising them. This visible fee therefore seems to apply the "consumer pays" principle instead. This has serious consequences:

- A fee undermines individual responsibility. There is no incentive for a producer to move voluntarily from a "consumer pays" approach to a "producer pays" approach.

- The fee is outside the management system of producers. Since costs can be a source of information for business management, the fee reduces the urgency to consider and change ongoing practices with respect to improving the design of the product.

  Furthermore, especially if the proposed fee is flat by category, it does not provide for incentives for better design. In the Netherlands[19], it has also been shown that waste management costs were much less in the end than expected when they had been estimated for fixing a flat fee, which means that industry and at the end the consumer have been paying much more than required. A similar case was reported in Switzerland[20]. Flat fees would needlessly increase costs, eliminate the incentives for eco-design and improved recycling, and would therefore fail to achieve one of the key objectives of the WEEE directive in adopting the principle of producer responsibility.

  There are no clear, agreed criteria for establishing common fees that make financial and environmental sense. For example, the Swiss fee is based on the price of a product, which typically bears no relation to the costs of recycling those products. This model results in market distortions because the fees collected for some products effectively subsidise recycling costs for other products. In addition, different common fees assessed in different Member States result in distortions if consumers resort to purchasing products in neighbouring Member States with lower fees.

- A fixed fee can also create market distortions, according to competition law and Article 81(1) of the Treaty as also discussed earlier for the collective model, since it will involve an agreement between undertakings, which may restrict competition as any other price-fixing agreement. This will also involve an agreement not only amongst competitors (horizontally) but also down the distribution chain (vertically)[21].

  In many cases the EU Commission[22] has considered the price-fixing element as a serious competition restriction since a fixed fee excludes

[19] *See also Dutch electroscrap treatment scheme under fire*, ENDS Daily - 22/02/01.
[20] Hewlett Packard position on a visible fee, E-mail communication, 27/11/00.
[21] *Opinion for CECED on the Compatibility with European Competition Law of the Financing of the Collection /Recycling of WEEE by means of a collective system*, Liedekerke Simeon Wessing Houthoff.
[22] VOTOB Case, 22nd Commission Report on Competition Policy [1992]; Alloy Surcharge - Commission Decision 1998/247/ECSC, Case IV/35.814, Ferry operators - Currency surcharges Commission Decision 97/84/EC Case IV/34.503.

competition on an important price component. The Commission has also mentioned in its decisions that the common, uniform charge created less incentive to make more efficient investments. If there was no horizontal fixing, manufacturers could calculate the costs of the investments necessary, and if these investments were indeed necessary, they could pass them on to their customers. The fee can also be seen as restrictive, since it ignores the environmental performance of each producer. Moreover, if there is an obligation upon wholesalers to pass on the charge to their respective customers – vertical agreement (, this is a form of "resale price maintenance", which is currently a 'blacklisted' restriction of competition.[23]

The educational side of a visible fee could be used here as an argument for exemption, as being beneficial to the consumer (see also p.7 Compatibility with EU competition law), but with respect to the fee being indispensable this may be more difficult: the Commission has hitherto never exempted the "passing-on" of environmental fees to the consumer as being indispensable to achieve the desired objectives[24]. It therefore seems to be clear that especially for new waste, such a model cannot be accepted. Whether a fixed and visible fee may be allowed for historical waste – which will be dealt with through a collective model – needs to be further investigated. As a first opinion, considering that historical waste is already on the market and that no improvement can be made in terms of design, implementation of a fixed visible fee may be justified. On the other hand, it could also be regarded as a disincentive for further improvement in the recycling/recovery techniques and also the logistics and organisation of the management of WEEE.

- Although a visible fee 'dedicated to the recovery of historical waste' could be seen as an 'educational exercise' for consumers, in the sense that 'we are paying an amount for the protection of the environment', it is likely to be regarded as an extra charge to the price. Since consumers can do little about the design of electronics, the effect on that is negative rather than positive. A visible fee would only add to the taxes that consumers are already paying for their waste through local taxes[25].

[23] Regulation No. 2790/99 of 22 December 1999 on the application of Article 81(3) of the Treaty to categories of vertical agreements and concerted practices, OJ 1999 L 336/21.
[24] Opinion for CECED on the Compatibility with European Competition Law of the Financing of the Collection /Recycling of WEEE by means of a collective system, Liedekerke Simeon Wessing Houthoff, p.34.
[25] BEUC position paper on the WEEE directive, BEUC/279/2000, 03/11/2000, Final draft.

- The fee does not necessarily create a take-back incentive (which consumers can do something about), but it would rather 'cancel' the meaning of free take-back since consumers will have to pay somehow extra when buying a product.

- A fee prevents de facto a deposit that would create effective bring-back incentives, since it would be seen once more as an extra amount to be added to the whole price of the product.

- A fee is vulnerable to anti-environmental campaigns at national levels, when its introduction is being discussed or when take-back requirements become more demanding over time.

Producers of EEE should therefore internalise waste management costs in a flexible and efficient manner. In such a way there will be a more direct effect, not only to improve the design of their own products but also to put pressure on other operators such as recyclers to improve their techniques for the benefit of the environment and of their own pocket.

From our point of view, an environmentally differentiated fee could be an interesting approach to give guidance to consumer choices, but it is not feasible in the short run because it requires prior agreement on classes of environmental performance, the degree of differentiation and other methodological questions.

INCREASED COLLECTION IS NEEDED

2

Article 4 of the WEEE proposal. Separate Collection.

1. Member States shall ensure that systems are set up so that final holders and distributors can return WEEE from private households free of charge. They shall ensure the availability and accessibility of the necessary collection facilities, taking into account the population density.
2. Member States shall ensure that distributors, when supplying a new product, offer to take back free of charge similar WEEE from private households provided that the equipment is free from contaminants, including radioactive and biological contaminants.
3. Member States shall ensure that producers provide for the collection of WEEE from holders other than private households. They shall be allowed on a voluntary and individual basis to set up and operate take-back systems for WEEE from private households.
4. Member States shall ensure that all WEEE collected is transferred to authorised treatment facilities. The collection and transportation of separately collected WEEE shall be carried out in a way which ensures the suitability for reuse and recycling of those components or whole appliances which might be reused and/or recycled.
5. Member States shall endeavour to achieve by 31 December 2005 at the latest a minimum rate of separate collection of four kilograms on average per inhabitant per year of WEEE from private households.

As soon as it is possible, on the basis of the information required under Article 11, to formulate a collection target of WEEE from private households as a percentage of the amount of electrical and electronic equipment sold to private households, the European Parliament and the Council, acting on a proposal from the Commission and taking account of technical and economic experience in the Member States, shall establish such a compulsory target.

Waste from electric and electronic equipment contains hazardous materials, which end up among municipal waste and are not treated properly. As a result, hazardous substances may leach in the soil and water and may be emitted in the air in case of landfill fires. It is therefore very important that this waste should be separately collected and treated before disposal. In addition, through the recycling and reuse of whole appliances or parts of WEEE, wasting of resources will be avoided and the resources contained in the WEEE may possibly be used. Negative impacts on the environment from the production of virgin materials as well as from landfilling and/or incineration will also be avoided.

Currently, in some Member States, formally or informally set systems allow for the separate collection of large EEE. No provisions exist, however, for small equipment; and it is precisely this type of equipment that ends up in our waste bin and among municipal waste, is not adequately treated and constitutes a potential hazard since the concentration of hazardous substances in small equipment is four times higher than in large equipment[26].

All these reasons make it clear how essential it is to have separate collection of such waste.

Considering several pilot projects and the study on Collection Targets from WEEE (May 1998), it is true that not much experience and data exist in this area. Figures show, however, that a 4kg/capita/year target could be quite feasible at the moment. Furthermore, some Member States drafting relevant national legislation have been proposing much higher targets such as 8 kg/capita/year (Finland), while awaiting developments at EU level. In the UK, 6kg/capita/year has been reached[27], a percentage already higher than the proposed 4kg/capita/year.

Given the differing levels of collection achieved throughout Europe, feasible though ambitious targets need to be set for different stages and should be legally binding. To make these targets achievable, adequate incentives should be given such as deposit schemes, especially for small appliances, and adequate monitoring schemes should be established. It is

[26] Draft Opinion of the ITRE Committee of the European Parliament on the WEEE directive, Draftsman Nuala Ahern, 14 December 2000, p.6.
[27] Confirmed through personal communication by the Environment Agency in England.

only when these are properly in place that experience and data will be available to further improve the separate collection target for WEEE.

It should also be considered that in 1998, 6 million tonnes of WEEE were generated and the expected increase of 3-5 % a year will lead to an estimate of around 7.4 million tonnes of WEEE to be generated by 2004. Furthermore, the EU project group estimated that future quantities of WEEE would be over 20 kg per person a year, of which the consumer sector would account for 12 kg, the industrial sector for 5 kg and cables for 3 kg[28].

Given these elements, we can see that by taking only 4kg per capita per year as a target for WEEE from private households (consumer), we only target one third of the amount generated, which is obviously a very low target to give any incentives for better design and a more effective EPR.

It is therefore quite clear that the first thing that should be done is to ensure that systems for separate collection of such waste are in place.

To this end, we propose that some more time should be given to the EU Member States. This transitional period can be equal to the transitional period provided for the start of financial responsibility, i.e. three years at the latest after the adoption of the directive. We believe that it is better to provide for some more time in order to have an effective system later.

Incentives to allow for the highest possible level of collection from private households should therefore be granted.

- Collection points should be set at easily accessible places according to the density of the population in the area.

- **A deposit – refund system** should be introduced, so that an amount of money is returned to consumers when they bring back their WEEE (as for glass bottles). This should preferably be applied to smaller EEE. This system could also be a refund-only system, where the 'deposit' will be internalised in the price of the product (not visible), but the consumer would get something back when returning the WEEE.

[28] AEA Technology, Recovery of WEEE: Economic and Environmental Impacts, Final report, June 1997.

- A legally binding target of **at least 6 kg per capita per year** for WEEE collected from private households should be set and achieved by 2006. Review of the target according to experience and collected data should take place by 2007, with the aim of improving environmental performance in the management of WEEE.

For EEE used for professional purposes or in very large quantities, in businesses for example, a 100% collection rate should be ensured when these become waste.

Organisational aspect

Separate collection of all WEEE is essential for many reasons, as described above, and it therefore needs to be ensured in Member States. Organisationally speaking now, systems for separate collection of different materials already exist in Member States for glass, paper, plastics, etc. It is therefore necessary to use the experience gained from existing systems and to use these systems to establish an effective scheme for the separate collection of waste electrical and electronic equipment.

It is therefore essential that all stakeholders should collaborate for a better result. This includes retailers, distributors, recyclers and of course producers. Retailers are usually the players who are the closest to consumers and the ones to receive the WEEE from private households. It is crucial that retailers should take back WEEE free of charge to ensure a high level of collection. Depending on the different types of WEEE and the storage capacities of these players, the system will have to provide for the setting-up of collection points and establishments that respect geographical distribution, which will facilitate the collaboration of smaller retailers: for example, common storage facilities, a common transportation collection system to pick up WEEE from retailers and deliver them to the storage facilities before waste is further sorted for reuse or recycling.

Financially, as we have shown earlier, we believe that producers should bear the costs of such transactions or at least contribute to them.

RECOVERY TARGETS: WASTE-FREE PRODUCTS?

Article 6 of the WEEE proposal. Recovery.

1. Member States shall ensure that producers set up systems to provide for the recovery of separately collected WEEE in compliance with this Directive.
2. Member States shall ensure that, by 31 December 2005 at the latest, the following targets for separately collected waste are met by producers:

(a) For WEEE falling under category 1 (large household appliances) of Annex I A, the rate of recovery shall be increased to a minimum of 80% by an average weight per appliance and component, material and substance reuse and recycling shall be increased to a minimum of 75% by an average weight per appliance;

(b) For WEEE falling under categories 2, 4, 6 and 7 of Annex I A, with the exception of equipment that contains cathode ray tubes, the rate of recovery shall be increased to a minimum of 60% by weight of the appliances and component, material and substance reuse and recycling shall be increased to a minimum of 50% by weight of the appliances;

(c) For WEEE falling under category 3 of Annex I A, with the exception of equipment that contains cathode ray tubes, the rate of recovery shall be increased to a minimum of 75% by weight of the appliances and component, material and substance reuse and recycling shall be increased to a minimum of 65% by weight of the appliances;

(d) For gas discharge lamps, the rate of component, material and substance reuse and recycling shall reach a minimum of 80% by weight of the lamps;

(e) For WEEE containing a cathode ray tube, the rate of recovery shall be increased to a minimum of 75% by an average weight per appliance and component, material and substance reuse and recycling shall be increased to a minimum of 70% by an average weight per appliance.

3. By 31 December 2004 at the latest, the detailed rules for monitoring compliance by Member States with the targets referred to in paragraph 2 of this Article shall be adopted in accordance with the procedure referred to in Article 14(2).
4. The European Parliament and the Council, acting on a proposal from the Commission, shall establish targets for recovery, reuse and recycling for the years beyond 2008.

Firstly, it should be mentioned that such targets can only refer to separately collected WEEE. As a consequence, the more of this waste is collected, the more is recovered in all possible ways, which will be discussed further below.

Recovery of waste means all possible ways, including reuse, recycling, and incineration with energy recovery through which materials or energy can be recovered from waste (any of the applicable operations provided for in Annex II.B to Directive 75/442).

Recycling means the reprocessing in a production process of the waste materials for the original purpose or for other purposes, but excluding energy recovery.

Reuse means any operation by which WEEE, including whole appliances or components/parts of a bigger EEE, is used for the same purpose as the one for which it was originally designed, including the continued use of WEEE which is returned to collection points, distributors, recyclers or manufacturers.

Incineration with energy recovery means the use of combustible waste as a means of generating energy through direct incineration, with or without other waste but with heat recovery.

The EEB believes that in the recovery operation as a stage in the waste hierarchy, a further hierarchy should prevail: Reuse – Recycling – Treatment with Energy recovery. It is therefore very important that targets should be set in such a way as to promote this hierarchy.

Currently, the directive proposes targets by weight and according to product group category: a recovery target and within that a combined reuse/recycling target. In the reuse/recycling targets, however, reuse only refers to components and not to whole appliances. This last issue will be discussed further below.

Reuse/recycling targets are considered necessary: first, reuse and recycling potentially save more resources than using WEEE as fuel[29]. Secondly, the

[29] See also Assessment of plastic recovery options, Dr. Ing. Volrad Wollny, Dr. Ing. Martin Schmied, Öko Institut, Darmstadt, 11 April 2000.

environmental performance of the recovery sector varies strongly across Europe and there are several very dirty industries within the recovery sector. Thirdly, recycling needs active promotion in order to strengthen its competitiveness.

A recycling share of 90% for large household appliances has been achieved in large-scale pilot tests[30] and confirmed by specialised recyclers. Pilot tests have shown that the large-scale recycling of small WEEE could on average be achieved to an extent of 70%[31]. Using the well-established "end-cut technology", at least 90% of the materials of gas discharge lamps, in particular mercury-containing lamps, could be recycled. Indaver Relight (Belgium) has reached a recycling target of up to 98% by weight for straight fluorescent tubes. Glass and other parts of the lamps are recycled into high-quality secondary materials[32]
While the recycling of new equipment containing cathode ray tubes is already feasible, the large bulk of appliances collected today are of a quality which allows 70% recycling.[33] In the medium to long term, the recycling of cathode ray tubes should aim at reusing the cone glass for new cathode ray tubes[34].

Looking at the targets proposed during the discussion on WEEE since 1998, we have drawn up the following table with targets by weight of EEE, as suggested by the Commission and also unofficially through the working group of the Council[35]:

[30] Apparetour, *Back to the beginning - National pilot project, for collecting, recycling and repairing electrical and electronic equipment in the district of Eindhoven* (Eindhoven 1997), p 52.
[31] Apparetour, p 64 and 68.
[32] Presentation on Indaver Relight premises (treatment of mercury-containing waste) by Walter van Wayenberg, Business manager, January 2001.
[33] Apparetour, p 61.
[34] Explanatory Memorandum on WEEE, European Commission, 5/7/99.
[35] Report on WEEE and ROHS from the Permanent Representatives Committee to the Council, Brussels, 14/12/00.

Appliances (number of category)	Reuse and Recycling Target by weight			Recovery target	
	Former drafts (Commission)	Current draft (Commission)	Council (14/12/00)	Current draft (Commission)	Council (14/12/00)
Large household appliances(1)	90%	75%	75%	80%	80%
Small household appliances (2), electric and electronic tools (6), toys (and leisure and sport equipment, Council) (7) (except EEE containing Cathode Ray Tubes - CRT)	70%	50%	50% (including CRTs)	60%	70% (including CRTs)
IT and telecommunication equipment (except CRTs) (3)	90%	65%	65% (including CRTs)	75%	75% (including CRTs)
Consumer equipment (4)	70%	50%	65%	60%	75%
Lighting equipment (5)	-	-	50%	-	70%
Medical devices (8), monitoring and control instruments(9), automatic dispensers (10)	-	-	50%	-	70%
All EEE containing CRTs	90%	70%	-	75%	-
Gas discharge lamps	90%	80%	80%	-	-

As is clear from the table above, there has been a considerable decrease in targets, which were initially only for reuse/recycling, and then incineration with energy recovery was promoted. The currently proposed targets have to be met by 31 December 2005.

However, discussions in different fora have brought different dimensions to the discussion on targets.

Targets per material that should be recycled could be set for example for ferrous metals, non-ferrous metals, glass, plastics, others (cardboard, wood, resins, rubber, concrete, etc). Such an approach could have many benefits, but more research is needed to ensure equivalence with the targets suggested up to now. We doubt very much that the targets suggested by Germany during the Council discussions are equivalent[36].

The benefits of such an approach are that material-related targets take more specifically into account the different technically, environmentally and economically optimal recycling potentials and they allow for greater flexibility if the material composition of products radically changes (e.g. from metals to plastics).

On the other hand, producer responsibility may be weakened. Monitoring of material-related targets does not relate anymore to individual products or

[36] Report on WEEE and ROHS from the Permanent Representatives Committee to the Council, Brussels, 14/12/00.

product groups, but to the mixture of electronics put into the shredder. Consequently, those targets may only depend on the performance of the shredding and recycling sector, and less on the design efforts of producers.

These open questions suggest that more information should be collected before material-related recycling targets may be allowed to replace those based on product groups.

Nonetheless, the importance of promoting reuse, refurbishment of whole appliances should be acknowledged. With that in mind, the reuse of whole appliances should be included in the targets and reuse/recycling targets should be increased. In case reuse of whole appliances is not incorporated into the targets, it must be ensured that effective collection and monitoring schemes are in place, so that clear priority is given to the refurbishment of whole appliances. The second-hand market will thus be promoted and employment opportunities will be created, benefiting the whole social economy. Examples in the UK show that the reuse/refurbishment target for PCs was reached up to 90%, including the whole appliances being resold or components being reused[37]. Review of the proposed targets and of the whole approach should take place after data and experience has been gained. After the system has been operational, targets for separately collecting and treating WEEE could be differentiated if need be by considering the above-mentioned proposals. At this stage, it would also be relevant to say that it is essential to promote the use of recycled material in new electrical and electronic equipment and these issues have to be taken into account in national public procurement policies.

Considering existing national experiences and past Commission proposals, the EEB has been proposing that the targets currently put forward by the Commission should be met by 31 December 2004 and the targets in the table below by 31 December 2007. Reuse of whole appliances is considered in the proposed reuse/recycling targets.

[37] AEA Technology report, 1997, p. 54.

Appliances	Reuse and Recycling Target by weight	Recovery target
Large household appliances(1) and Automatic Dispensers (10)	90%	95%
Small household appliances (2), consumer equipment (4), electric and electronic tools (6), toys (7) (except EEE containing CRTs)	70%	80%
IT and telecommunication equipment (except CRTs) (3)	90%	95%
Gas discharge lamps	90%	-
All EEE containing CRTs	70%	75%

We also suggest that targets should be set for categories 5 (lighting equipment except for gas discharge lamps), 8 (medical equipment systems), 9 (monitoring and control instruments). A minimum recovery target of 70 % and reuse/recycling target of 50%, as proposed by the Council, should be reached for those categories by 31 December 2004.

In any case, the targets should promote the waste hierarchy: first reuse, then recycling and only then incineration with energy recovery.

Given that these proposed targets were the ones mentioned in all the drafts of the WEEE directive just before adoption, and justified adequately in the explanatory memorandum of the Commission, it seems that they were only lowered for reasons of political compromise and should therefore be revived.

Further to those targets, it is necessary that new targets should be set by 2009 for the years after 2008, in view of the experience gained, technological improvements and the need to further improve environmental performance.

Treatment Facilities

Article 5 of the WEEE proposal: Treatment

1. Member States shall ensure that producers set up systems to provide for the treatment of WEEE. To ensure compliance with Article 4 of Directive 75/442/EEC, the treatment shall, as a minimum, include the removal of all fluids and a selective treatment in accordance with Annex II to the present Directive, provided that the reuse and recycling of components or whole appliances is not hindered.
2. Member States shall ensure that any establishment or undertaking carrying out treatment operations obtains a permit from the competent authorities, in compliance with Articles 9 and 10 of Directive 75/442/EEC.
   The derogation from the permit requirement referred to in Article 11(1)(b) of Directive 75/442/EEC may apply to recovery operations concerning WEEE if an inspection is carried out by the competent authorities before the registration in order to ensure compliance with Article 4 of Directive 75/442/EEC.
   The inspection shall verify:
   (a) the type and quantities of waste to be treated;
   (b) the general technical requirements to be complied with;
   (c) the safety precautions to be taken.
   The inspection shall be carried out once a year and the results shall be communicated by the Member States to the Commission.
3. Member States shall ensure that any establishment or undertaking carrying out treatment operations stores and treats WEEE in compliance with the technical requirements set out in Annex III.
4. Member States shall ensure that the permit referred to in paragraph 2 includes all conditions necessary for compliance with the requirements of paragraphs 1 and 3 as well as Article 6.
5. The treatment operation may also be undertaken outside the respective Member State or the Community provided that the shipment of WEEE is in compliance with Council Regulation (EEC) No 259/93[38].

[38] OJ L 30, 6.2.1993, p. 1.

Environmental protection does not only mean that WEEE as such should be taken out of the municipal waste stream, but that it should also be handled properly. For this reason, provisions are included in the WEEE proposal for all treatment facilities situated in the EU. It is very important, however, that treatment plants located outside the EU should in principle have at least as high standards as the ones required for establishments located in the EU, so as to avoid creating dumping countries. The pollution caused by the management of WEEE is of transboundary nature and uncontrolled emissions from such facilities may have an effect on the European environment (especially if Eastern European countries are part of it). The failure to address these concerns will therefore create an "ostrich effect" – what we don't see is not there- and will just postpone action. Since the whole purpose of this directive is prevention, such an approach is not really appropriate and a minimum set of rules should therefore be drawn up and complied with by those facilities, failing which treatment may be called illegal.

QUALITY COUNTS: EEE WITHOUT HAZARDOUS CHEMICALS

4

Article 4 of the ROHS proposal. Prevention.

1. Member States shall ensure that with effect from 1 January 2008 the use of lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ether (PBDE) in electrical and electronic equipment is substituted by other substances.
2. Paragraph 1 shall not apply to the applications of lead, mercury,

The current Commission proposal for a directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment proposes the substitution of cadmium, lead, mercury, hexavalent chromium and two groups of brominated flame retardants, PolyBrominated Diphenyl Ethers (PBDE) and Polybrominated byphenyls (PBB) by 2008. A number of exemptions from these substitutions are tabled in an annex to the directive and several product categories are exempted as well, such as medical, monitoring equipment and automatic dispensers.

The impact on the environment when WEEE is not adequately treated because of its hazardous content has been discussed on several occasions.

Lead can damage the human nervous system, may have endocrine disrupting effects, accumulates in the environment and has high acute and chronic toxic effects on plants, animals and microorganisms[39]. The main concern for lead in landfills is the possibility of leaching and contaminating drinking water supplies. Lead is used in batteries, in soldering printed circuit boards, in the glass of cathode ray tubes and in the soldering and glass of light bulbs and fluorescent tubes.

Cadmium and cadmium compounds are persistent, bioaccumulative and toxic with possible risk of irreversible effects on human health and the environment. It may cause cancer with prolonged exposure. It is used in printed circuit boards and certain components as semiconductors, as well as a PVC stabiliser.

[39] *Risk Reduction Monograph No 1 Lead - Background and national experience with reducing risk*, Explanatory Memorandum, OECD, Paris, 1993.

Inorganic Mercury in water is transformed into methylated mercury in sediments. It is bioaccumulative and persistent and causes damage to the brain. Mercury alkyls and inorganic compounds are classified as very toxic by inhalation and dangerous for cumulative effects. It is estimated that 22% of the annual world consumption of mercury is used in EEE.[40] It is used in thermostats, relays and switches, discharge lamps, printed circuit boards, medical equipment, mobile phones and other telecommunications equipment.

Chromium (VI) is easily absorbed and produces various toxic effects within the cells. It causes severe allergic reactions, asthmatic bronchitis and is considered genotoxic and potentially damaging for DNA. It can easily leach from landfills and evaporates through fly ash in case of incineration.

Brominated flame retardants are included in EEE to ensure flammability protection. They are used mainly in printed circuit boards and components like connectors, plastic covers and cables. Brominated flame retardants, Polybrominated Diphenyl Ethers (PBDE) and Polybrominated Biphenyls (PBB) impede the recycling of plastics since the respective dioxins and furans are emitted during extrusion, which is part of the recycling process. Furthermore, they can be soluble in leachate from landfills and are bioaccumulative and persistent.

Many discussions have already taken place on the technological advancement of science in replacing those chemicals in EEE without reducing the level of safety, which should accompany them. At this stage we would like to focus on some points which have been at the centre of the debate, namely the use of lead in soldering and the halogenated flame retardants .We would also propose some other substances for phasing out, such as PVC, HFCs and generally speaking, all gases which are ozone depleting or have a global warming potential above 15.

Lead free soldering

With respect to heavy metals, the most controversial issue has been the substitution of lead in solders on printed circuit boards, as this is its main

[40] Explanatory memorandum, p. 14.

application apart from its application in Cathode Ray Tubes (CRTs) and in solders and glass in light bulbs and fluorescent tubes. We will therefore focus our arguments on this point.

Industry has been arguing that there are many cases where lead in solders cannot be substituted in the short term. Some cases concern lead contained in a high melting temperature type of solder used in an electronic component for internal connection purposes between functional elements and wires, terminals, heat sinks, etc. or lead contained in bonding glass for magnetic head, and some others[41].

Nevertheless, substitution is not requested to take place immediately and alternatives for lead in solders do exist. These are application-specific and can be based on tin (Sn), silver (Ag), copper (Cu), bismuth (Bi) and zinc (Zn)[42]:

- Sn-Bi-Cu solder as main alternative;
- Sn-Bi-Ag solder for surface mount reflow;
- Sn-Cu, Sn-Ag possible for wave soldering;
- Sn-Bi for low temperature soldering;
- Sn-Zn-Bi requires more development but is already in use (company NEC).

Overall, lead-free solders have been under development for over 10 years and products are now available. They reduce toxic potential by up to 30% and have reduced environmental damage from mining. The higher value of lead-free alloys may encourage recycling and eventually conserve resources and energy.

Moreover, lead-free products have already been introduced on the market as we can see below and it is therefore essential that the directive should bring the phase-out date forward, to 2006.

[41] Japanese Business Council in Europe, items to be added in the annex to the proposal for ROHS directive.

[42] EEB reader from Workshop on Best Practices in the context of the WEEE directive, Kay Nimmo, ITRE Ltd. *Heavy metal substitution: Risk and Potential.*

Voluntary plans for elimination of lead-containing solder [43]

Companies	Products and solder alloys	Target Period
NEC	Pagers (Sn-Ag-Cu) Notebook PCs (Sn-Zn-Bi) Sn-Ag-Cu (main) Sn-Ag-Bi-Cu (sub)	December 1998 October 1999 Full adoption of lead-free solder by 2002
Fujitsu	High-end servers (step soldering) Sn-Ag-Cu (bump) Sn-Bi+Ag (main board) Requiring Pb-free finishing components All new products (Sn-Ag-Cu, Sn-Bi+Ag)	October 1999 by Oct 2001 Elimination by December 2002
SONY	Digital Video Camera (Sn-Ag-Bi-Cu) Requiring Pb-free finishing components All models, use of lead-free solder in at least one model at each business unit In models worldwide All products, electronic components and maintenance services[44]	March 2000 by Jan 2001 March 2001 Adoption by March 2002 Elimination by end of March 2006
Hitachi	Video cameras, vacuum cleaners, washing machines Sn-2Ag-2Bi-0.5Cu in audio PWB (heating method:reflow) Sn-3.2Ag-2.7Bi-2.7In (reflow) All new products Sn-Ag-Cu, Sn-Bi+Ag, Sn-Ag-Cu(+Bi/In)	Spring 1999 1999 Elimination by March 2002
Matsushita	Optical disk drivers Mini disks (Sn-Ag-Bi) All new products (Sn-Ag-Cu, Sn-Ag-Bi)	November 1996 September 1998 Elimination by March 2003
Panasonic	Full adoption of Pb-free solder (back side wave soldering Sn-Cu)	in 2001

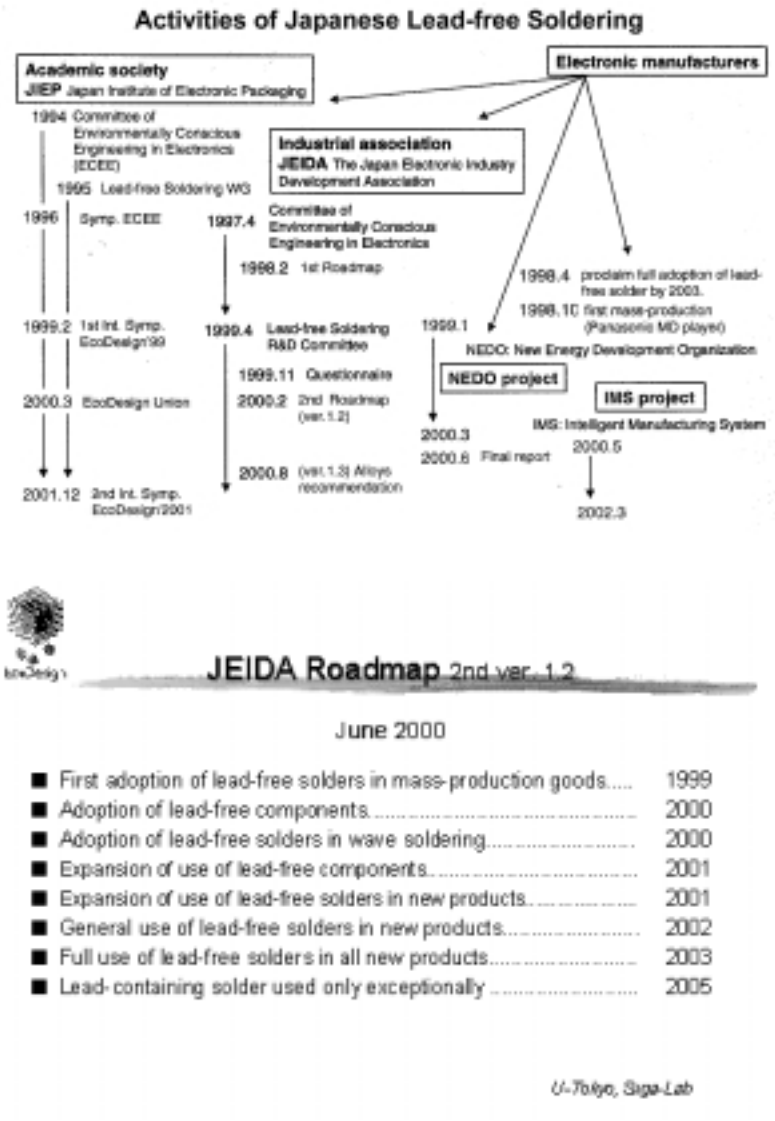
Furthermore, there are companies in Europe, which have been participating in the pan-European IDEALS project (Improved Design Life and Environmentally Aware Manufacturing of Electronic Assemblies by Lead-Free Soldering), 1996-1999[45]. Partners in the IDEALS project are Marconi Caswell Ltd., Multicore, VMRC, Philips, Siemens and Witmetaal. During the projects, the applicability and reliability of several alternatives was examined and was found better in some cases, for example regarding defect rates. Moreover, although more data are needed, the alternatives proved to be a viable option for different applications and the production rocess started running in 1999 at Marconi Communications.

[43] EEB reader from Workshop on Best Practices in the context of the WEEE directive, Tadatomo Suga, University of Tokyo, *Good practice on the substitution of heavy metals.*

[44] Lead contained in electronic components exempted. Progress at Sony about the elimination of hazardous substances from products, Letter from Sony, 7 March 2001.

[45] Green Electr(on)ics Workshop, Lead-free and Reuse/Refurbishment Possibilities, 15-16 November 2000, Vienna, Austria, James Vincent, Marconi Caswel Ltd. The IDEALS project - Implementing Lead-Free Assembly.

The activities regarding the substitution of lead in Japan are the following[46]:



[46] EEB reader from Workshop on Best Practices in the context of the WEEE directive, Tadatomo Suga, University of Tokyo, *Good practice in the substitution of heavy metals* - Trend of Lead-free soldering in Japan.

In addition, it has been proved that lead-free technology can also be applied by SMEs and can offer significant opportunities for cost savings[47].

From the examples above, we can see that suitable technology already exists. In some cases where there are still difficulties in replacing lead, research and development have already been taking place. Therefore lead-free solder is technologically feasible and possible and is a new technology driver.

Halogenated Flame Retardants

With regard to flame retardants, discussions have been focusing on whether octa-bromodiphenylether (8-BDE or OBDE) and decabro-modiphenylether (10-BDE or DeBDE) should be excluded from the PBDE group and on whether we should actually extend phase-out to all halogenated flame retardants, especially the brominated ones. Apart from the two groups already proposed for phase-out, PBDEs and PBBs, other brominated flame retardants currently in use are tetrabromobisphenol A (TBBPA), which accounts for 40% of the market share and is the most important from the BFR group, hexabromocyclododecane (HBCD) (15% market share) and other BFRs (about 24% market)[48]. Short-chain chlorinated paraffins are also used as flame retardant in rubbers and textiles, leather processing, in paints and coatings. Their use as a flame retardant/plasticiser may increase in the future as newer applications are exploited[49]. In relation to the EEE, these paraffins are used in hoses and gaskets as well as in high-density conveyor belts. Short-chain chlorinated paraffins have been shown to bioconcentrate to a large extent in fish and molluscs[50].

The EEB believes that all halogenated flame retardants should be phased out and consequently that8-BDE and 10-BDE should not be exempted under any circumstances, for the reasons below. The Commission can then be asked to come up with a list of exemptions within a year of adoption of the directive.

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[47] Green Electr(on)ics Workshop, *Lead-free and Reuse /Refurbishment Possibilities*, 15-16 November 2000, Vienna, Otto Tischler, BECOM, *Lead-free soldering from an SME point of view*, Dr. Martin Goosey, Shipley Europe Ltd. *Environmental Best Practice in the Printed Circuit Board Industry.*

[48] Risk Reduction Monograph n°3, OECD, 1994

[49] Stenhammar S. and Björndal H (1994), *Chloroparaffins in Metal Working*, Status Report No 4372. Swedish Environmental Protection Agency in co-operation with the National Chemicals Inspectorate.

[50] *EU Risk Assessment Report on alkanes*, C10-13, chloro, European Chemicals Bureau, December 2000

Nearly all flame retardants containing bromine and chlorine migrate and are volatile to a certain extent.[51] They have been found in indoor dust and air, through evaporation from end products being used, which means that they can migrate out of plastic, since most of them are added as a monomer. PBDEs and PBBs have been found in samples from living organisms in the Arctic and in remote areas like the deep sea[52]. It has also been found that these substances travel in the air over long distances. Significant losses from products being used have been observed, indicating that this is a major pathway from technosphere to environment[53]. Indications exist that these substances undergo debromination reactions to form lower brominated substances, such as tetra BDE or penta BDE which are not only persistent but also bioaccumulative and toxic[54]. Others such as TBBPA (tetrabromobisphenol A) and HBCD (hexabromocyclododecane) have been found in sewage sludge[55], fish, fish-eating birds and mammals, etc. All these substances have the potential to induce/down-regulate liver enzyme production, negatively influence the regulation of the thyroid hormone system and induce immunotoxicity (potential endocrine disrupter). They also induce neurotoxicity when administered at a sensitive period of the brain growth[56]. Exposure of neonatal mice to PBDEs causes behavioural changes in later life stages[57], e.g. hyperactivity, reduced learning and memory capacity that even worsened with age. PBDE, TBBPA and HBCD are taken up by living organisms and lower PBDE biomagnify[58]. TBBPA and PBDE and/or their metabolites have been shown to be biologically active. They can generally be persistent, bioaccumulative and toxic and also potential endocrine disrupters. In addition, dioxins and furans can be present in commercially available flame retardants and they may also be generated by recombination on the surface of ash and soot, especially when

[51] Hans Peter Hillekamps, Alusuisse Martinswerk, Letter to MEP Kathleen van Brempt, 5/12/00.
[52] Boer de, J., Wester, P. G., Rodriguez, D. P., Lewis, W. E., Boon, J. P. (1998): *Polybrominated Biphenyls and Diphenylethers in Sperm Whales and other marine mammals - a new threat to the Ocean life?* Organohalogen Compounds, Vol. 35: 383-386 (1998).
[53] Danish EPA: *Brominated Flame Retardants. Substance Flow Analysis and Assessment of Alternatives.* June 1999.
[54] Sellström, U., Kierkegaard, A., de Witt, C., Jansson, B. (1998): *Photolytic debromination of decabromodiphenylether (DeBDE)*. Organohalogen Compounds, Vol. 35: 447-450 (1998).
[55] *Brominated Flame Retardants*, Swedish Environmental Protection Agency, Cynthia de Wit, 2000.
[56] *Brominated Flame Retardants*, Swedish Environmental Protection Agency, Cynthia de Wit, 2000.
[57] Eriksson, P., Jakobsson, E., Fredriksson, A. (1998): *Developmental neurotoxicity of brominated flame retardants, polybrominated diphenylethers and tetrabromo-bisphenol* A. Organohalogen Compounds, Vol. 35: 375-377 (1998).
[58] *Brominated Flame Retardants*, Swedish Environmental Protection Agency, Cynthia de Wit, 2000.

some copper is present as a catalyst[59]. The problems caused by furans and dioxins during decontamination or incineration are examined further down.

In the end-of-life phase, all BFRs will be subject to thermal stress, smelting, grinding, etc. and during these operations, which can also reach a temperature of 200 degrees, the molecule cracks and free Br and free aromatic structures come into the environment[60] [61] [62]. These substances, together with others such as polystyrene, form dioxins and furans, which are emitted into the atmosphere (formation of PXDF/PXDD under uncontrolled pyrolysis and incineration conditions [Luijk et al, Dumler et al, Thies et al, Bahadir]. (In general, the free halogen radius (**·X**) is the trigger to all sorts of reactions.) Even controlled incineration of BFR-containing printed circuit boards in a (BAT-standard) municipal waste incineration plant leads to dioxin formation, as was observed from raised dioxin levels in incinerator fly ash[63]. In waste management, raised levels of octa and decaBDE have been detected in the blood plasma of recycling staff[64].
During the recycling process, brominated flame retardants act as a kind of plasticizer and processing aid. This could be considered as a positive effect in the recycling process. However, they are rather ineffective in this respect and can easily be replaced by cheaper and less hazardous standard oils, plasticizers and waxes.

On the contrary, brominated flame retardants, apart from the fact that they react to brominated dioxins and furans at the raised temperature of re-extruding, as mentioned above, make the recycling of plastics more difficult as they are unwanted contaminants for many potential secondary uses. If we simplify the halogenated flame retardants to R-X, they degrade to X*

[59] Hans Peter Hillekamps, Alusuisse Martinswerk, Letter to MEP Kathleen van Brempt, 5/12/00
[60] Lahl, U., Wilken, M., Wiebe, A. (1991): *Polybromierte Diphenylether in der Müllverbrennung*. Müll und Abfall 2/91.
[61] Lohse, J. (1990): *Verhütung statt Verhüttung - bei Computerschrott ist eine emissionsfreie Wertstoffrückgewinnung ausgeschlossen.* Müllmagazin 3/1990, p. 34-37
[62] Ökopol (1996): *Polybrominated Flame Retardants - a Case for Phase-out.* WWF submission to the Oslo and Paris Conventions for the Prevention of Marine Pollution (DIFF96/11/NGO.1).
[63] Joachim Lohse, Ökopol GmbH, Hamburg, *The case of flame retardants - are substitutes equally safe?*, in EEB reader from Workshop on Best Practice in the context of the WEEE directive, 20/9/2000, European Parliament.
[64] Sjödin, A., Hagmar, L., Klasson-Wehler, E., Kronholm-Diab, K., Jakobsson, E., Bergmann, C. (1999): *Flame Retardant Exposure: Polybrominated Diphenyl Ethers in Blood from Swedish Workers.* Environmental Health Perspectives, 107(8), August 1999.

(and R*) radicals. These highly reactive X* radicals react[65] with hydrogen in the hydro-carbon backbone of the polymer to form hydrogen halide: X* + R'-H -> HX + R'*. There is a good chance that this reaction takes place under normal processing conditions. This will result in discolouration and reduced properties of the plastic part, especially when the polymer is processed several times. While processing virgin polymer and in order to make it survive the above conditions, thermo-stabilisers have to be incorporated. At the end of life, the polymer and the brominated flame retardant are both damaged by ozone, UV-radiation, hot/cold stress and environmental pollution. Intensive cleaning measures and additional (expensive) stabilisers are then required to achieve a tolerably acceptable end product[66]. Furthermore, the hydrogen bromide or chloride generated by decomposition during incineration is highly corrosive for metal and concrete[67].

At this stage, we should also mention that antimony trioxide is commonly used with halogenated flame retardants as a synergist to achieve a high flame retardancy. Antimony trioxide, however, decomposes when heated, producing toxic fumes (antimony), and reacts under certain circumstances with hydrogen, producing a very poisonous gas (stibine). The substance can be absorbed into the body by inhalation, it irritates the eyes, the skin and the respiratory tract. Repeated or prolonged contact with skin may cause dermatitis. Lungs may be affected by repeated or prolonged exposure to the dust of this substance. The substance may have effects on the lungs, is possibly carcinogenic to humans and animal tests show that it may cause toxic effects upon human reproduction[68]. By replacing halogenated flame retardants, we therefore avoid its use at the same time.

These results as well as the ones that follow indicate that brominated flame retardants may be a new "PCB problem"[69]. It is therefore clear why brominated and to some extent all halogenated flame retardants should be phased out as soon as possible.
Regarding the more specific discussion on OctaBDE and DecaBDE, OBDE can be contaminated with Penta-BDE. Pe-BDE has been under risk assessment within the framework of chemicals legislation and has been

[65] Jürgen Troitzsch, *International Plastics Flammability Handbook*, p. 47, Hanser Publishers.
[66] E-mail communication with HansPeter Hillekamps, Alusuisse Martinswerk, 23 March 2001.
[67] Hans Peter Hillekamps, Alusuisse Martinswerk, Letter to MEP Kathleen van Brempt, 5/12/00
[68] International Chemicals Safety Cards, antimony trioxide, http://www.cdc.gov/niosh/ipcs/ipcs0012.html
[69] *Brominated Flame Retardants*, Swedish Environmental Protection Agency, Cynthia de Wit, 2000

restricted from marketing and use. It can cause secondary poisoning in the fish- and earthworm-based food chains. Risk assessment has identified risks associated with both polyurethane (PUR) foam manufacture and the use of foams. To this end, the Competent Authorities that met in November 1999 agreed that precautionary action should be taken to protect human health, given the increasing levels found in breast milk and the potential for bioaccumulation[70 71 72 73].

Furthermore, there are indications of accumulation and of the possible release of OBDE into milk during lactation; when milk is heated, inhalative exposures are increased. There are also possible adverse effects due to exposure to octa in utero and via milk, the endocrine disrupting activity is to be tested and there are concerns about its immunotoxic properties. These issues are being examined and are mentioned as comments for the Risk Assessment preparation from Technical Meetings under the chemicals regulation 793/93[74 75], but have not all been completely assessed yet. Nevertheless, the high level of concern is evident. It has been envisaged to have an indication/protection note addressed to female workers, warning them not to be exposed during pregnancy etc. for the above-mentioned reasons.

About DeBDE, similar effects and concerns have been shown. There are indications of accumulation in milk since small amounts were detected in fat, and when milk is heated, inhalative exposures probably increase. The metabolic conversion of Deca into Penta was checked and proven but in relatively small degree, and further testing is needed. Carcinogenic effects were seen at high dose levels and a reprotoxic potential needs to be checked further.

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[70] Draft Commission Recommendation on the results of the risk evaluation and the risk reduction strategies for the substances: diphenylether, pentabromo derivative; cumene, 2000.

[71] Darnerud, P. O., Aturna, S., Aune, M., Cnattingius, S., Wernroth, M.-L., Wycklund-Glynn, A. (1998): *Polybrominated Diphenyl Ethers in Breast Milk from Primiparous Women in Uppsala county, Sweden.* Organohalogen Compounds, Vol. 35: 411-414 (1998).

[72] Meironyte, D., Bergman, A., Norén, K. (1998): *Analysis of polybrominated diphenyl ethers in human milk.* Organohalogen Compounds, Vol. 35: 387-390 (1998).

[73] Norén, K., Meironyté, D. (1998): *Contaminants in Swedish human milk. Decreasing levels of organochlorine and increasing levels of organobromine compounds. Organohalogen Compounds*, Vol. 38: 1-4 (1998).

[74] RAR OBDE, Draft Risk Assessment Report for OctaBDE under Regulation EEC 793/93, November 2000.

[75] RAR, DeBDE, Draft Risk Assessment Report for DecaBDE under Regulation EEC/793/93, August 2000.

Moreover, for both substances, there has been evidence that they break down since the ratio of penta, octa and deca in marine environment could not be explained in many places; where a higher occurrence of OBDE and DBDE was expected, a lot of PeBDE was found, without there being any explanations by way of technological use.

Alternatives strategies with respect to the construction of EEE, the choice of materials and of course the use of substitutes for halogenated flame retardants are being developed or are already applied. In this way we not only avoid hazardous substances, but safety requirements are met. An indicative list of strategies can be found below.[76]

Constructive changes	geometric rearrangements (creating distance between heat sources and endangered materials) lower voltages & currents / miniaturisation --> less heat
Material substitution	e.g. ceramics, glass, metals instead of polymers plastics with inherently low flammability (polyamides)
chemicals substitution	organophosphorous compounds Ca, Al, Mg hydroxides

Aluminium tri hydrate (ATH) and magnesium di hydrate (MDH) are two of the substances used instead of halogenated flame retardants. These are used with a relatively higher loading level in order to achieve sufficient flame retardancy. As regards their properties, both of these minerals are more or less inert. They act as acidity scavengers and the polymer is protected to a certain extent. Due to the rather high loading level, the polymer is diluted (and protected again). All recycling methods are applicable when these flame retardants are used, and in case they end up in a landfill, it should be underlined that ATH is insoluble and MDH has a very low solubility (ten times less than CaCO3), which even has a positive influence on the acidity of the soil[77].

Industry has already started avoiding the use of BFRs. For example, the production of PBBs and PBDEs was stopped voluntarily in Germany as far back as 1986[78]. Some industry initiatives are described below[76].

[76] Joachim Lohse, Ökopol GmbH, Hamburg, The case of flame retardants - are substitutes equally safe?, in EEB reader from Workshop on Best Practice in the context of the WEEE directive, 20/9/2000, European Parliament.
[77] Email communication with HansPeter Hillekamps, Alusuisse Martinswerk, 23 March 2001.
[78] Opinion from the Economic and Social Committee on WEEE and ROHS directives, Rapporteur Mr. Colombo, Brussels, 15 November 2000, p.7.

Industry initiatives (random selection of examples)		
ZVEI Germany	Booklet on alternative strategies towards flame resistance with list of possible substitutes	1992
Siemens	Siemens Norm on product design bans PBB and PBDE from Siemens products Still problems with substitutes for certain halogen-containing components	1994 2000
German car industry	BMW ban PBB and PBDE from their products VW and Mercedes begin to use halogen-free materials for car seats and textile cover Current initiative: halogen-free cables for vehicles	1996 1996 under way
Sony	Environmental Report announces "Green Management Plan" to phase out halogenated flame retardants in European models by March 2001 and in all products sold worldwide by March 2003[79].	2001
Toshiba	Introduction of a notebook with halogen-free motherboard	1999
Motorola	"No technical hurdle to prevent implementation of materials which are free of lead and bromine"	6/2000
Fujitsu	Presentation of new halogen-free flame-retardant dielectric with improved properties at EGG2000+ conference	2000

Further examples include BAYER development of halogen-free arylphosphate-based flame retardants for PC/ABS-Polymers used in housing and TOSHIBA argument that even notebook motherboards can be protected without the use of halogens and antimony. SONY now uses a phosphorus-nitrogen-based flame retardant system for their multilayer boards in DVD players and NEC has developed halogen-free epoxy moulding resins for components used in electronic equipment. More details on alternatives to brominated flame retardants can be found in *Alternatives to Brominated Flame Retardants, Screening for environmental and health data*, Working Report No.17 2000, Danish Environmental Protection Agency.

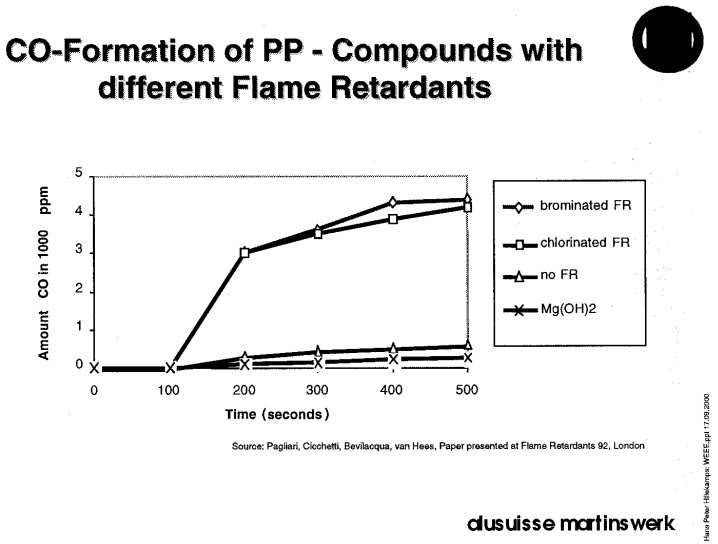
Another important aspect of using halogen-free flame retardants is their relation to the toxicity of combustion gases from the release of carbon monoxide (CO). Halogen-based flame retardants (and antimony halides) act in the gas-phase by stopping the radical reaction of the burning process. This is the main reason why much more soot and up to 10 times more CO are generated, compared with halogen-free compounds (see below). When

[79] Progress at Sony about the elimination of hazardous substances from products, Letter from SONY, 7 March 2001.

mineral-based hydroxide flame retardants are used, there are two effects that influence the generation of CO positively:

- the rather high loading level of aluminium-hydroxide or magnesium-hydroxide, which dilutes the polymer;

- the generation of water vapour through the flame retarding reaction. The cooling effect of the water vapour influences the equilibrium in the direction of CO2.[80]



Finally, as also mentioned earlier, the EEB proposes the phase-out of all halogenated flame retardants from EEE by 2006, with the provision that the European Commission should develop an exemption list, if needed, one year after the adoption of the directive.

[80] Hans Peter Hillekamps, alusuisse martinswerk, *Good practice on the Substitution of Halogenated Flame Retardants*, in EEB reader from Workshop on Best Practice in the context of the WEEE directive, 20/9/2000, European Parliament.

Other substances to be considered

PVC

PVC is another problematic material used in EEE. The European Commission adopted a Green Paper on the Environmental Issues relating to PVC in July 2000. Studies commissioned by the European Commission[81] show multiple significant environmental and/or economic problems for each of the PVC waste disposal options. They show that neither incineration nor landfills are safe and that recycling cannot solve the problem. Incineration of PVC makes the problem even worse, since apart from the risk of dioxin formation, the hazardous residues resulting from PVC incineration may even exceed the quantities of PVC put into incineration. Recycling is not a pragmatic solution, as potential recycling rates under ecological criteria are projected to reach only 5% in 2020. Most current recycling is downcycling and/or poses the problem of toxic additive transfer from old PVC products to new ones.

Companies are already heading in that direction, committing themselves to stop using PVC in their products. SONY is committed into phasing out the use of PVC in their products. By March 2001 in all products made in Japan, 50% cut in PVC used in wiring and by March 2003 in models made worldwide[82]. For the development of a halogen- and lead-free prototype refrigerator/freezer, Electrolux used ethene or ethene/propene co-polymer and a PP/SEBS[83] blend as alternatives to PVC for the different parts of the appliance, such as the wire harness, power supply cord, gasket, drain heater, etc[84]. Alternatives do exist, and consequently its manufacture and use needs to be phased out as soon as possible[85]. Therefore phasing out its application in EEE should be one step towards that direction.

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[81] The Influence of PVC on the quantity and hazardousness of flue gas cleaning residues from incineration: http://europa.eu.int/comm/environment/waste/report6.htm
Behaviour of PVC in landfill: http://europa.eu.int/comm/environment/waste/report7.htm
Mechanical recycling of PVC waste:
http://europa.eu.int/comm/environment/waste/report8.htm
Chemical Recycling of Plastics Waste (PVC and other resins):
http://europa.eu.int/comm/environment/waste/report9.htm

[82] Progress at Sony on the elimination of hazardous substances from products, Sony Letter communication, 7 March 2001.

[83] Poly propylene / styrene-ethylene-butene- styrene.

[84] *DFE of refrigerators - a cost of revenue*, Stina Sares, AB Electrolux. Presentation to Green Electr(on)ics, State of the Art in Ecodesign of Electr(on)ic products, 5 March 2001, Brussels.

[85] EEB Letter to the Members of the Environment and Industry Committees of the European Parliament on the resolution on PVC, January 2001.

HydroFluoroCarbons (HFCs)

HFCs are substances used, among other things, refrigerants, aerosol propellants, foam blowers and by products of HCFC-22 manufacture. They are also used as a cleaning and etching purposes in the semiconductor industry. HFCs were considered as replacement for the ozone depleting substances like ChloroFluoroCarbons (CFCs) and HydroChloro-FluroCarbons (HCFCs). In EEE we can find them in refrigerators, freezers, automatic dispensers which contain a refrigeration system, in air conditioning equipment (stationary or mobile) and other similar products.

HFCs are one of the compounds addressed as "new industrial gases" and also one of the six-gas basket under the Kyoto protocol. F-gas[86] emissions are projected to continue growing rapidly beyond 2010, not least because many applications like foams or refrigerants experience most of their emissions upon decommissioning after a long life of use[87]. HFCs have a high global warming potential[88] (GWP) and are being emitted at a quickly increasing rate. Left unchecked, HFCs, the most significant of the F-gases, could potentially represent 15% of all CO2 – equivalent greenhouse gas emissions by 2040[89], and 40% by 2100. The GWP of HFC could range between 140 and 11700 (!)[90], whereas for HC is below 15 e.g. for isobutane is 8[91].

Fortunately, HFCs are largely replaceable by commercially available natural compounds like hydrocarbons (HCs), ammonia, air, water and CO2, or by alternative technologies and practices. Alternatives are proving more efficient, safety can be ensured through responsible measures, and costs are rarely significantly higher, and continue to fall with wider market acceptance. In addition, these are superior products in every aspect not just in terms of climate change concerns.

[86] HFCx, PFCx, and SF6.

[87] *Keeping cool without warming the planet, cutting HFCs, PFCs, and SF6 in Europe*, Jason Anderson, Climate Network Europe.

[88] The GWP is a metric devised to compare substance impact, where that of CO2 is set equal to 1. The GWP is defined over a set time horizon - the impact relative to that of CO2 over a 100-year period (GPW-100) or a 20-year period (GWP-20) is often used. The GWP-100 is the most common metric and the one used in most documentation. From *Keeping cool without warming the planet, cutting HFCs, PFCs, and SF6 in Europe.*

[89] Maté, John, *How to limit HFC/PFC/SF6 emissions? Eliminate them*. Greenpeace position paper, February 2000.

[90] WMO (World Meteorological Organisation), *Scientific Assessment of Ozone Depletion: 1998 WMO Global Ozone Research and Monitoring Project*, Report No.44, Geneva, 1999.

[91] IPCC (Intergovernmental Panel on Climate Change), *Climate Change - the IPCC Scientific assessment*, IPCC, WMO and UNEP Cambridge University Press, Cambridge 1996.

The F-gas industry argues that alternatives are often too dangerous, too inefficient and too expensive[92]. However, all these issue are being addressed successfully. Proper safety measures in applications with HCs are routinely practised and to date there are 20 million system-years for domestic HC refrigeration in Germany alone without any accidents having been reported[93]. Natural refrigerants are themselves cheaper, but the system may cost a bit more than a similar HFC system. This cost, however, should go down with larger manufacturing capacity and new technologies. In addition, ammonia as an alternative is already used in larger systems[94]. The general claim that those alternatives result in higher electricity use has been proven wrong[95]. Alternative refrigerants are often inherently more efficient, their variety of options in foams and non-foam alternatives allows choice of efficient insulation, new refrigeration equipment is often more reliable and efficient and alternatives are competitive at this point. Electrolux has been using HC isobutane in some of their products.

HCs are already in air conditioning and refrigerators. They are cheaper, as effective as HFCs and with much less GWP. Nevertheless, HCs can cause soil pollution and summer smog, fall under workers legislation and must be handled and treated accordingly when they are present in WEEE.

Member States have already introduced national plans addressing the F-gases problem.

[92] ICI Klea, HFCs - *Facts, not Emotions*, Submission to UNFCCC, 15 July 1999.
[93] *Keeping cool without warming the planet, cutting HFCs, PFCs, and SF6 in Europe*, Jason Anderson, Climate Network Europe.
[94] Lindborgh Anders, Presentation at the workshop "Joining European Efforts to Limit Emissions of HFCs, PFCs and SF6", Luxembourg, February 1st, 2000.
[95] Maclaine-Cross, I.L and E Leonardi, "Performance and safety of LPG Refrigerants" in proceedings of the "Fuel for Change" conference of the Australian Liquified Petroleum Gas Association Ltd. Queensland, Australia, 1995.

Legislation[96] [97]

Austria	8 regions and numerous municipalities have adopted a phase-out policy on (H)CFCs and HFCs in products and appliances
Berlin (Germany)	Phase-out policy on (H)CFCs and HFCs in products and appliances in place.
Denmark	F-gas plan (above); comprehensive "refrigeration sector environment scheme;" F-gases banned in aerosols and fire fighting (except for fire departments).
Flanders (Belgium)	Refrigeration inspection; certification/registration of technicians
Finland/ Luxembourg	No specific measures, but general legislation on waste and CFCs can affect F-gases
France	National plan (above); recovery, reuse, destruction where there' s >2 Kg refrigerant.
Germany	F-gases banned in solvents
Italy	SF_6 recovery; no HFCs in fire extinguishing from 2009
Netherlands	National plan (above); recovery, reuse, destruction of gases from refrigeration; inspections; leak rates set
Sweden	Refrigeration system design, maintenance, inspections, training/certification/registration of technicians, recovery, emissions reporting. Design/recovery/handling in fire fighting. No HFCs in polyurethane in construction.
UK	Statutory pollution control reducing F-gases

The EEB therefore believes that HFCs should be included in Article 4 or the ROHS directive for phase out.

Using the HFCs analysis as an example, we would also further extend the requirement for phase-out from all EEE products to all gases, which are ozone depleting or have a global warming potential above 15.

[96] *Keeping cool without warming the planet, cutting HFCs, PFCs, and SF6 in Europe*, Jason Anderson, Climate Network Europe.

[97] Ecofys and EnvirosMarch; *Member State Policies on Mitigating Emissions of HFC, PFC and SF6 in the European Union*. D. Yellen and Harnisch J. VROM (Ministry for Spatial Planning, Housing and the Environment), Netherlands, 2000.
Finland, "Submission by Finland on behalf of the European Community and its Member States of information on available and potential ways and means of limiting HFC, PFC and SF6 emissions", Submission to UNFCCC, www.unfccc.de/program/wam, 15 July 1999.

5 SCOPE

Article 2 of the WEEE proposal. Scope.

1. This Directive shall apply to electrical and electronic equipment falling under the categories set out in Annex I A.
2. Article 4(1),(3),(4) and(5), and Articles 7 and 9 shall not apply to electrical and electronic equipment falling under categories 8, 9 and 10 of Annex I A.
3. This Directive shall apply without prejudice to Community legislation on safety and health requirements and specific Community waste management legislation.

Various studies have indicated that environmental problems linked to the waste management of small EEE also require their inclusion in the directive[98]. Present experience has shown that the type of WEEE, which is more likely to end up in the municipal waste stream is small appliances. This is why these should be covered by the directive, collected separately and treated accordingly. Separate collection has been taking place for quite some time now for large electronic goods in different Member States and there is experience enough to expand this to all electrical and electronic appliances.

On the other hand, it is important that WEEE of all sizes is separately collected and the lists of EEE in the annexes to the directive should be open in case new products are developed (e.g. electronic paper[99]).

On this basis, the definition of EEE could be widened as follows:
"An electronic product is a unit containing active and passive components that serve to create, process and/or pass on electrical signals or to create mechanical, acoustic or electrical effects, including parts and components for such a unit"[100]

[98] For example, *Sammlung von Elektroaltgeräten im Flachgau* - Wisseshaftliche Begleistudie (Wien 1997), Amt der Salzburger Landesregierung and Abschlußbericht des Arbeiteskreiese 13 "Elektronikschrott" (Niedersachesen 1998), Kommission der Niedersächsischen Landesregierung zur Vermeidung und Verwertung von Abfällen.

[99] "Le papier électronique", Park mail magazine, No. 384, 12/01/01.

[100] Danish EPA report no. 53/1995 Electrical and electronic products, p.17 in Action Plan 2000-2003, The Danish Electronics Board, October 2000.

Spare parts, consumables and cables relating to the EEE should also be covered from the scope since it is necessary for all these products to be separately collected and treated due to their hazardous content.

6 WHO IS THE MOST PROACTIVE? LEGAL STATUS

First Indent of the WEEE proposal:
"Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof (...)

First Indent of the ROHS proposal:
"Having regard to the Treaty establishing the European Community, and in particular Article 95 thereof (...)

The EEB would prefer the two proposed directives becoming one, as it used to be the case before their adoption, and it should be based on Article 175 and not Article 95 of the Treaty. This approach will provide coherence with previously adopted pieces of legislation on products (e.g. End-of-life Vehicles Directive).

According to Articles 175-176 of the Treaty of Amsterdam, Member States are allowed to adopt more stringent protective measures with respect to the environment. On the other hand, Article 95 refers to harmonisation in the European Union and protection of the internal market and does not allow Member States easily to go beyond the EU law relating to the environment and human health.

The directives on WEEE and ROHS should be seen as one and they form in essence a framework directive, which leaves Member States a considerable degree of freedom. Producer responsibility is furthermore a new and innovative policy approach, which requires sufficient scope for innovation and dynamic improvement. Any legal basis that might restrict the freedom of Member States is therefore inappropriate at this stage.

THE ELEMENT OF PREVENTION[101]

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The Commission proposal very clearly sets the objectives, background and framework, leaving no doubt as to the need for such a directive at EU level. However, a clear reference on "Prevention", a top priority in the Waste Hierarchy and management, is now completely excluded from the directive, although it is mentioned in the objectives. It is only indirectly addressed instead through the concept of extended producer responsibility and through the requirement that *"it is necessary to draw up as quickly as possible provisions concerning the design and manufacture of electrical and electronic equipment to minimise their impact on the environment during their life cycle. In the interest of overall consistency between Directives relevant to electrical and electronic equipment, those provisions should be drawn up in accordance with the principles set out in the Council Resolution of 7 May 1985 on a new approach to technical harmonisation and standards[102]."* (Recital 11 of the WEEE proposal)

In view of our proposal to merge the WEEE and ROHS directives, we would like an article on prevention to be re-included. Such elements existed in previous drafts of the proposal and this inclusion would also go along the lines of previously adopted directives on products including the End-of-life Vehicles Directive.

The DG Enterprise working paper[103] for a directive concerning the impact of electrical and electronic equipment on the environment claims to be addressing these concerns, in response to Recital 11. It suggests applying the 'new approach' of harmonisation to design for the environment. According to these ideas, a directive would only define basic environmental requirements, whereas the details should be developed by the European Standardisation Bodies such as CENELEC[104].

This proposal could be seen as an attempt to prevent bottom-up legislative innovation from Member States, while promoting a product-related environmental management system as a substitute to really harmonised prevention.

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[101] Contribution by Dr. Christian Hey, EU Policy Director, EEB, February 2001.
[102] OJ C 136, 4.6.1985, p. 1.
[103] Working paper for a directive on the impact on the environment of electrical and electronic equipment (EEE), Version 1.0, February 2001.
[104] European Committee for Electrotechnical Stadardisation.

Earlier drafts of the DG Enterprise paper even raised concerns about their legal compatibility. A study for some electronics producers claimed that Art. 95 does not entitle the Commission to draft legislation to prevent national measures, but only to harmonise these measures. However, on the issues that the DG Enterprise proposal intends to cover, there is little to harmonise now. The study also refers to the MERONI doctrine, established by the European Court of Justice, which argues that the Commission is not entitled to delegate executive tasks to bodies that the Commission cannot control properly. Since the "new approach" type of original proposals of DG Enterprise would have entrusted quite a number of genuinely political decisions to the private standardisation body CENELEC without proper political control, the Commission would violate the MERONI doctrine, claimed the authors of the study[105] .

A recently published draft of DG Enterprise partly adjusts to those criticisms, but there is still a wide area of legal uncertainty, which should be sorted out, before such an approach is applied. As a consequence, the EEB calls for a moratorium on applying the new approach to environmental policies[106].

The EEB expressed strong concerns about the conditions under which such an approach is appropriate and proposed alternatives to standardisation[107]. Such alternatives exist and have already been used in existing legislation. This is the Technical Committees approach. Different types of technical committees have been used so far, and by making use of the technical expertise available from industry, there is still room for political authorities or competent bodies to control the process and have a final say. Strongest control can be found under the comitology procedure, which gives power to the Member States to decide. In several cases, the Commission has established a mixed stakeholder, comitology type of committees (e.g. Ecolabel, EMAS, Chemicals) to mobilise expertise and consensus. Even mixed committees without an official comitology procedure (such as the information exchange on Best Available Techniques) allow for stronger political participation and control than standardisation[108].

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[105] *Legality of the Draft Directive on the Impact on Environment of EEE*, Hunton & Williams, January 2001.

[106] Cf. forthcoming EEB position on the DG Enterprise working draft on EEE.

[107] See EEB comments on the DG ENT draft proposal on the impact of EEE on the environment, May 2000.

[108] See: EEB 2000: *Towards Balancing Participation*.

To this end, given that prevention aspects referring to 'design for the environment' are also included in the End-of-Life Vehicles directive, we would propose that such requirements be included in the WEEE directive, as it was in earlier drafts.

Member States should promote design for the environment, design for durability, disassembly, recycling, etc.

In case those activities need harmonisation at EU level, the EEB would rather see one of the proposed committee schemes or another effective mechanism to guarantee environmental NGO participation and political control. The EEB calls for a moratorium on 'new approach' experiments until the following conditions are fully met:

i. Any 'new approach' directive should be embedded in a wider legal framework establishing environmental objectives, life-cycle thinking, benchmarking of environmentally best practice as points of reference for standardisation work.
ii. Taking decisions about the level of environmental protection and determining limit values and thresholds should not be entrusted to industry-dominated standardisation bodies. Assistance to setting environmental protection levels in legislation can only be accepted for monitoring, measurement and general procedures, such as environmental management systems.
iii. The directive should require direct support for environmental organisations to be able to pay the associate membership fee to CENELEC, to pay usual market fees for at least 1 expert per Technical Committee and the respective subgroups over the whole drafting process and adequate co-ordination of expert input.
iv. The directive should require Member States to provide equivalent NGO expert input at national standardisation bodies on this issue.
v. Environmental Authorities in Member States should commit themselves to play an active part in the standardisation process.
vi. The directive should strengthen the Member States' and European Parliament's rights to reject the standards and to draft legislation if the standards do not meet the general and the specified requirements.

The recent draft of DG Enterprise does not address these points.

The EEB has an alternative suggestion to promote waste prevention in the WEEE directive, through the adoption of national waste prevention plans relating to WEEE.

Waste prevention plans[109]

Waste prevention plans shall be developed by the Member States to meet the objectives of the directive and also within the framework of compliance with directive 91/156. These plans should be monitored[110].

Member States should set up a waste prevention plan (WPP) for WEEE through which the objectives of the Directive will be met. The plan will include different elements, such as:

- substitution targets;
- inventories of usage of substances, emissions, etc.;
- instruments for implementation of the targets, including for example the setting-up of a National Accreditation Recycling Board[111] as well as the development of manuals/guidelines on EEE design for durability, reuse, reparability, dismantling and recycling, etc.
- procedures for finding a balance of trade-offs between different environmental objectives, in consultation with industry, NGOs, other stakeholders;
- independent monitoring;
- reporting.

WPPs could also include an article promoting the development of the second-hand market.

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[109] EEB Comments on the WEEE and ROHS proposals, September 2000.

[110] See Second Draft for a proposal on WEEE, July 1998, Article 12.

[111] *From EEB position on WEEE of December 1999: "....a European Accreditation Recycling Board could be established. All national recyclers should then get a certificate of operation according to EU standards to be set. A requirement should also be added to waste disposal directives, according to which all waste to be disposed of in a landfill will need the approval of a certified recycler confirming that all hazardous substances and possible materials for recycling have been extracted. Although it may sound bureaucratic, the recycling system will be controlled and quantitative and qualitative data will be much easier to be provided. In this way the whole system could be monitored and during a revision phase, higher recycling and reuse targets could be set. Considering that the recyclers will also have a dismantling department, the system would contribute to the setting and monitoring of separate recycling and reuse targets at national and EU levels."*

In this way, the Directive is kept to a general level, as a framework directive, leaving freedom to the Member States to implement their own systems according to national environmental programmes, while ensuring that the objectives of the directive are met.

We also suggest including a paragraph on the instruments that Member States should consider for prevention. This is important in order to give Member States sufficient freedom for innovation. Any prevention policy on products at the national level might conflict with the internal market. There is therefore a need to clarify what may be done at the national level. Examples might be: price and tax incentives, eco-design labels, general substitution requirements of hazardous substances and respective progress reports, green product development within EMAS, promotion of the use of fewer types of plastics, trying not to mix different kinds of materials, etc.

8 CONCLUSION – EEB PROPOSALS

Considering all the arguments analysed in this paper, the EEB has concluded that the following proposals should be incorporated in the Commission proposals for the WEEE and ROHS directives:

i. **Future individual financial producer responsibility for 'new' waste to come immediately into force.**

ii. **Collective financial producer responsibility for historical waste to come into force three years at the latest after adoption of the directive.**

iii. **No mandatory request for a fixed and visible fee to cover the management costs of WEEE.**

iv. **Compulsory collection schemes to be set three years at the latest after adoption of the directive.**

v. **A compulsory deposit-refund scheme for EEE should be requested to increase collection rates from private households.**

vi. **Collection target of 6kg/capita/year (compulsory) to be achieved by 1st January 2006 and development of further compulsory targets by 1st January 2007 for the following years, on the basis of monitored results until 2006.**

vii. **Current reuse/recycling targets to be achieved by 1st January 2005 and the higher targets proposed in the present paper to be achieved by 2008.**

viii. **Targets to be set for all product categories.**

ix. **Refurbishment of whole appliances to be included in increased reuse/recycling targets.**

x. **Monitoring system to be in place to ensure potential refurbishment of whole appliances and promotion of reuse.**

xi. **Requirements for review of the recovery targets to be in place by 1st January 2009.**

xii. **Separate targets for reuse and recycling to be set and reached in the future, by a certain date.**

xiii. **Financial responsibility for collection from private households to be re-included within producer responsibility.**

xiv. **Waste Electrical and Electronic Equipment to be included in the List of Hazardous Waste.**

xv. **Treatment facilities situated in accession countries should prove compliance with the EU requirements for such operations.**

xvi. **Inclusion of the article on prevention including references to chemicals legislation, design requirements, requirements for promotion of design for the environment, waste prevention plans, in the 'joint' directive.**

xvii. **Phase-out of cadmium, lead, mercury, hexavalent chromium, all halogenated flame retardants, PVC, HFCs and, generally speaking, all gases which are ozone depleting or have a global warming potential above 15 should take place by 2006 at the latest. The European Commission should develop a list of exemptions a year after adoption of the directive**

xviii. **Review of the ROHS directive should take place after the targets have been achieved.**

xix. **Environment and Consumer NGOs should also be consulted before the annexes to the ROHS directive are amended.**

xx. **Directives on WEEE and hazardous substances should be joined in one directive, based on Article 175 of the Treaty.**

xxi. **The scope of the directive should be extended to allow for inclusion of new EEE as well as spare parts, consumables (e.g. diskettes, CD-ROMs, cartridges) and cables.**

xxii. **In case standards need to be developed at EU level, the EEB would rather see one of the proposed committee schemes or another effective mechanism to guarantee Environmental NGO participation and political control.**

xxiii. **A requirement should be added to the effect that Member States should draw up Waste Management (Prevention) Plans.**