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Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on waste electrical and electronic equipment

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on the restriction of the use of certain hazardous substances in electrical and electronic equipment

(presented by the Commission)

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EXPLANATORY MEMORANDUM

1. INTRODUCTION

The production of electrical and electronic equipment is one of the fastest growing domains of manufacturing industry in the Western world. Both technological innovation and market expansion continue to accelerate the replacement process[1]. New applications of electrical and electronic equipment are increasing significantly. There is hardly any part of life where electrical and electronic equipment are not used. This development leads to an important increase in waste electrical and electronic equipment (WEEE).

The WEEE stream is a complex mixture of materials and components. In combination with the constant development of new materials and chemicals having environmental effects, this leads to increasing problems at the waste stage. The WEEE stream differs from the municipal waste stream for a number of reasons:

- The **rapid growth** of WEEE is of concern. In 1998, 6 million tonnes of waste electrical and electronic equipment were generated (4% of the municipal waste stream). The volume of WEEE is expected to increase by at least 3-5% per annum. This means that in five years 16-28% more WEEE will be generated and in 12 years the amount will have doubled. The growth of WEEE is about three times higher than the growth of the average municipal waste[2].

- Because of their **hazardous content,** electrical and electronic equipment cause major environmental problems during the waste management phase if not properly pre-treated. 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 stream comes from WEEE[3].

- The environmental burden due to the production of electrical and electronic products (**"ecological baggage"**) exceeds by far the environmental burden due to the production of materials constituting the other sub-streams of the municipal waste stream[4]. As a consequence, enhanced recycling of WEEE should be a major factor in preserving resources, in particular energy.

In view of the environmental problems related to the management of WEEE, Member States began drafting national legislation in this area. The Netherlands, Denmark, Sweden, Austria, Belgium and Italy have already presented legislation on this subject. Finland and Germany are expected to do so soon. The Member States which have so far not drafted national legislation

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1 The first computers in the 1960s were used for an average period of 10 years.Today, that period is to 4.3 years and, for the most innovative products, already less than 2 years. (Umweltverträgliche Produktgestaltung (München 1998), Ferdinand Quella/Siemens (editor) Publicis MCD Verlag.).

2 AEA Technology, Recovery of WEEE: Economic and Environmental Impacts, 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 the municipal waste or introduced into the metal recycling chain without any pre-treatment.

4 Compare, for example, Malley "Schwergewicht" c't 1997, Vol. 5, p. 170.

expressed their concern about the lack of harmonised European legislation for this waste stream during various consultation meetings preceding the present initiative.

In view of the Internal Market, national approaches to the subject of WEEE give rise to various problems:

- Different national policies on the management of WEEE **hamper the effectiveness of national recycling policies** as cross-border movements of WEEE to cheaper waste management systems are likely.

- Different national applications of the principle of producer responsibility lead to **substantial disparities in the financial burden for economic operators.**

- Diverging national requirements on the the phasing-out of specific substances, could have implications on **trade in** electrical and electronic equipment.

In order to address adequately the environmental problems associated with the current methods for the treatment and disposal of WEEE, it is considered appropriate to introduce measures at Community level that aim, firstly, at the prevention of WEEE, secondly at the re-use, recycling and other forms of recovery of such wastes and, thirdly, at minimising the risks and impacts to the environment from the treatment and disposal of WEEE. It is also the aim of this initiative to contribute to the harmonisation of national measures on the management of waste electrical and electronic equipment in order to ensure the functioning of the internal market. These measures are being proposed in two separate Directives. The first – the draft Directive on WEEE – deals with the management of waste and is based on Article 175 of the Treaty. The second, which seeks to harmonise national measures on the restriction of the use of certain hazardous substances in electrical and electronic equipment, is based on Article 95 of the EC Treaty. These two Directives will be accompanised by a further proposal on the design and manufacture of electrical and electronic equipment later this year.

2. POLICY CONSIDERATIONS

Article 174 of the Treaty establishing the European Community (EC Treaty) states that Community policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Community. It shall be based on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay.

The Community programme of policy and action in relation to the environment and sustainable development ("Fifth Environmental Action Programme")[5] states that the achievement of sustainable development calls for significant changes in current patterns of development, production, consumption and behaviour. Furthermore, it advocates, *inter alia*, a reduction in wasteful consumption of natural resources and the prevention of pollution.

More specifically, the "Fifth Environmental Action Programme" contains an entire chapter dedicated to waste management issues, in which WEEE is mentioned as one of the target areas to be regulated by application of the principles of prevention, recovery and safe disposal of waste.

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5 OJ C 138, 17.5.1993.

The Council, in its Resolution of 7 May 1990[6] on Waste Management Policy, invited the Commission to establish action programmes for particular types of waste. Member States identified, *inter alia*, end-of-life electrical and electronic equipment as a waste stream to be addressed in this respect.

The Council, in its Resolution of 24 February 1997[7] on a Community strategy for waste management, invited the Commission to develop, as soon as possible, an appropriate follow-up to the initiative on waste electrical and electronic equipment.

The European Parliament, in its Resolution of 14 November 1996 (A4-0364/96), asked the Commission to present proposals for directives on a number of priority waste streams, including electrical and electronic waste, and to base such proposals on the principle of producer responsibility. The European Parliament, in the same Resolution, requests the Council and the Commission to put forward proposals for cutting the volume of waste as well as reducing the presence of hazardous substances in waste such as chlorine, mercury, polyvinyl chloride (PVC), cadmium and other heavy metals.

3. OBJECTIVES AND MAIN ELEMENTS OF THE PROPOSAL

The proposed Directive on Waste Electrical and Electronic Equipment will contribute to the protection of human health and the environment as required by Article 174 of the Treaty. The principal objectives of this Proposal are to protect soil, water and air from pollution caused by current management of WEEE, to avoid the generation of waste, which has to be disposed of and to reduce the harmfulness of WEEE. It seeks to preserve valuable resources, in particular energy. Another objective of the proposed Directive is the harmonisation of national measures on the management of WEEE.

The objectives are to be achieved by means of a wide range of measures, including measures on the separate collection of WEEE, the treatment of WEEE and the recovery of such waste.

- Producers should take the **responsibility for certain phases of the waste management** of their products. This financial or physical responsibility creates an economic incentive for producers to adapt the design of their products to the prerequisites of sound waste management. The financial responsibility of economic operators should also enable private households to return the equipment free of charge

- **Separate collection of WEEE** has to be ensured through appropriate systems, so that users can return their electrical and electronic equipment. In order to create a common level playing field between the Member States, a "soft" collection target is provided for.

- In order to ensure **improved treatment and re-use/recycling of WEEE**, producers have to set up appropriate systems. Certain requirements are prescribed as a minimum standard for the treatment of WEEE. Treatment plants must be certified by the Member State. Targets are laid down for the obligation to re-use, recycle WEEE and recover energy thereof.

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6 OJ C 122, 18.5.1990.
7 OJ C 76, 11.3.1997.

- In order to achieve high collection rates and to facilitate recovery of WEEE, **users of electrical and electronic equipment must be informed** about their role in this system. The proposed Directive contains a labelling requirement for equipment which might easily end up in a dustbin. In addition, it will be necessary for producers to inform recyclers about certain aspects of the content of such equipment.

The proposed Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment will contribute to the same objectives by ensuring that substances causing major problems during the waste management phase, such as lead, mercury, cadmium, hexavalant chromium and certain brominated flame retardants are substituted.

4. ENVIRONMENTAL PROBLEMS ADDRESSED IN THE PROPOSALS

In general terms, all equipment which needs electricity to work properly is either electrical or electronic. Each electrical or electronic product consists of a combination of several basic building blocks. The basic building blocks common to electrical and electronic equipment are printed circuit boards/assemblies, cables, cords and wires, plastics containing flame retardants, mercury switches and breakers, display equipment, such as cathode ray tubes and crystal liquid displays, accumulators and batteries, data storage media, light generating devices, capacitors, resistors and relays, sensors and connectors. The most environmentally problematic substances contained in these components are heavy metals, such as mercury, lead, cadmium and chromium, halogenated substances, such as chlorofluorocarbons (CFCs), polychlorinated biphenyls (PCBs), polyvinyl chloride (PVC) and brominated flame retardants as well as asbestos and arsenic[8].

4.1. Current management of WEEE

The environmental risks associated with the waste stream are not properly dealt with by current waste management practice. Today, more than 90% of WEEE is landfilled, incinerated or recovered without any pre-treatment[9]. This leads to a considerable input of hazardous materials into the disposal or recovery routes.

4.1.1. Incineration of WEEE

It is estimated that emissions from waste incineration account for 36 tonnes per year of mercury and 16 tonnes per year of cadmium in the Community[10]. Furthermore, the incineration of non-hazardous wastes has been identified as the largest source of emissions of dioxins and furans to air in Europe[11]. The WEEE stream contributes significantly to the heavy metals and halogenated substances contained in the municipal waste stream. In addition,

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8 More detail on this in "Waste from electrical and electronic products – a survey of the contents of materials and hazardous substances in electric and electronic products" (Copenhagen 1995), Nordic Council of Ministers.

9 Environmental Consequences of Incineration and Landfilling of Waste from Electr(on)ic Equipment (Copenhagen 1995), Nordic Council of Ministers. According to the study "Pilotsammlung von Elektroaltgeräten in Bregenz" 95% of the WEEE arising in Austria are either simply disposed of with the municipal waste or introduced into the metal recycling chain without any pre-treatment.

10 The European Atmospheric Emission Inventory of Heavy Metals and Persistent Organic Pollutants for 1990, Umweltbundesamt, Germany, 1997.

11 Identification of Relevant industrial Sources of Dioxins and Furans in Europe, Landesumweltamt Nordrhein-Westfalen, 1997.

specific adverse effects could occur during incineration due to the variety of different substances found together in WEEE. Copper works like a catalyst, thereby increasing the risk of formation of dioxins when flame retardants are incinerated. This is of particular concern as the incineration of brominated flame retardants at a low temperature (600-800°C) may lead to the generation of extremely toxic polybrominated disbenso dioxins (PBDDs) and polybrominated disbenso furans (PBDFs)[12].

On 7 October 1998, the Commission adopted a proposal for a Council Directive on the incineration of waste[13]. This proposal provides for stringent emission limit values, which should lead to a significant reduction of emissions of various pollutants into the atmosphere. It replaces Directive 89/369/EEC of 8 June 1989 on the prevention of air pollution from new municipal waste incineration plants[14] and Directive 89/429/EEC of 21 June 1989 on the reduction of air pollution from existing municipal waste-incineration plants[15]. However, for a number of reasons end-of-pipe technology could not be considered as the only method to avoid emissions from waste management operations. Separate collection and treatment of waste streams, such as WEEE, contributes to a cleaner municipal waste stream and thereby a reduction in the emissions caused by the incineration or the smelting of WEEE containing heavy metals and halogenated substances. This is of particular importance in cases where the respective stringent emission standards are not implemented or are not applicable as in the case of metal smelters.

Significant quantities of PVC are contained in WEEE[16]. There is substantial evidence supporting the view that PVC is not suitable for incineration, particularly in view of the quantity and the hazardous nature of the flue gas residues resulting from incineration.[17] In addition, losses of plasticizers, especially phthalates, from the landfilling of PVC are widely recognised and can have potential adverse effects on the human health and the environment.[18]. It should also be noted that very little PVC waste, in particular in WEEE, is currently recycled[19].

Apart from the air emissions, two other aspects linked to the incineration of WEEE are of importance. These concern both installations complying with the provisions of the proposal for a Council Directive on the incineration of waste and installations not complying with those provisions.

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12 "Bestimmung von polybromierten und plychlorierten Dibenzofioxinen und –furanen in verschiedenen umweltrelevanten Materialien" U. Schacht, B. Gras und S.Sievers in Dioxin-Informationsveranstaltung EPA Dioxin-Reassessment, edited by Otto Hutzinger und Heidelore Fiedler containing further references on this subject.

13 COM(1998)558 final.

14 OJ L 192, 7.7.1989.

15 OJ L 203, 15.7.1989.

16 According to M. Rohr, Umwelt Wirschaftsforum, No 1, 1992, more than 20% of the plastic used in electrical and electronic equipment is PVC.

17 Environmental aspects of PVC (Copenhagen 1996), Danish Environmental Protection Agency Position Paper of the Netherlands on PVC (The Hague 1997), Ministry of Housing, Spatial Planning and the Environment. The influence of PVC on quantity and hazardousness of flue gas residues from incineration, Study for DG ENV, Bertin Technologies, 2000.

18 The Behaviour of PVC in Landfill, Study for DG ENV, Argus in association with University Rotstock, 1999.

19 Prognos, Study for DG XI, Mechanical recycling of PVC wastes, January 2000.

(1) Pilot tests[20] have revealed that common appliances such as TV sets yield a negative energy output throughout the incineration process. As an example, the energy loss resulting from feeding glass - such as cathode ray tubes - into an incinerator has been calculated to be -400 kj/kg.

(2) The introduction of (small) WEEE into incinerators results in high concentrations of metals, including heavy metals, in the slag, in the flue gas or in the filter cake[21]. According to a Dutch study[22], almost all of the bottom ash produced in the Netherlands (around 600.000 tonnes in 1995) is disposed of in the road building sector where it is used as filling material. To be used in an environmentally safe way, the bottom ash has to meet physical and technical requirements, in particular leaching requirements. Even where bottom ashes containing certain concentrations of heavy metals are specifically cleaned, they can only be used as construction material with additional environmental requirements. It has been calculated that if small white and brown goods were no longer incinerated with the rest of the waste, the content of copper, lead, nickel and other metals could be reduced to such an extent that the bottom ashes would fall within the Dutch leaching requirements.

4.1.2. Landfilling of WEEE

Due to the variety of different substances contained in WEEE, negative environmental effects occur during landfilling of these wastes. Significant impacts could be prevented where WEEE is put on controlled landfills which respect environmentally sound technical standards. Nevertheless, as no landfill is completely watertight throughout its lifetime, a certain leaching of metals and chemical substances cannot be excluded. It goes without saying that environmental impacts are considerably higher when WEEE is put on uncontrolled landfills, which still takes place to a significant extent in certain Member States[23] and in most candidate countries for accession to the European Union[24].

The risks relating to the landfilling of WEEE are due to the variety of substances contained in WEEE. The main problems in this context are the leaching and evaporation of hazardous substances. Leaching of mercury takes place when certain electronic devices, such as circuit breakers, are destroyed. The same is true for PCBs from condensers. When brominated flame retarded plastic or cadmium containing plastics are landfilled, both polybrominated

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20 Report of C. Voûte, Recycling and Waste Control Officer, Corporation of London, on "Electrical/Electronic products recycling in Germany" to Industry Council for Electronic Equipment Recycling (ICER).

21 As an example small WEEE are the source of 40% of the copper content of Municipal Solid Waste Incineration bottom ash (Compare Modelmatige analyse van integraal verbranden van klein chemisch afval en klein wit- en bruingoed (Netherlands 1996), TNO rapport voor VROM/DGM (Directie Afvalstoffen)). One of the main problems linked to an increased copper content of the slag of incinerators is the difficulty to recover these slags as a secondary building material in an environmentally responsible way. Further data on the content of heavy metals in the slag, flue gas, filter cake and fly ash are given in "Messung der Güter- und Stoffbilanz einer Müllverbrennungsanlage" (Wien 1994), Umweltbundesamt and MA 22.

22 Netherlands 1996, TNO rapport voor VROM/DGM (Directie Afvalstoffen).

23 As an example the total number of landfills in Greece is approximately 5,000. It is estimated that around 70% of the landfills are considered to be uncontrolled (Conference for the planning of waste management, Greece 16-17 January 1997). In Portugal the number of uncontrolled landfills is approximately 300 (Conference for the planning of waste management, Portugal 23-24 January 1997).

24 The screening of the respective legislation revealed that nearly all of their landfills are uncontrolled without any technical provisions to prevent leaching of hazardous substances to the groundwater or emissions to the atmosphere.

diphenylethers (PBDEs) and cadmium may leach into the soil and groundwater. It had been found that significant amounts of lead ions are dissolved from broken lead containing glass, such as the cone glass of cathode ray tubes, by the acidic groundwater often found in landfills. Therefore, pollution from cone glass in landfills is likely[25].

Not only the leaching of mercury poses specific problems. The vaporisation of metallic mercury and dimethylene mercury, both part of WEEE, is also of concern. In addition, uncontrolled fires may arise at the landfills. In such fires, both metals and other chemical substances, such as the extremely toxic dioxins and furans including tetrachloro-dibenzo-dioxin (TCDD) and polychlorinated and polybrominated dioxins and furans (PCDDs, PBDDs and PCDFs) from halogenated flame retardant products and PCB containing condensers may be emitted.

4.1.3. Recycling of WEEE

One of the main objectives of the present initiative is to increase the recycling of WEEE. In general, increased recycling preserves resources and disposal capacities, in particular landfill. In spite of the positive effects, the recovery operation might add to environmental pollution if the waste is not properly pre-treated.

Both dioxins and furans are generated as a consequence of recycling the metal content of WEEE, which also contain halogenated plastics[26]. Halogenated substances contained in WEEE, in particular brominated flame retardants, are also of concern during the extrusion of plastics, which is part of the plastic recycling[27]. Due to the risk of generating dioxins and furans, recyclers usually abstain from recycling flame retarded plastics from WEEE[28]. In view of the lack of proper identification of plastic containing flame retardants and the inherent difficulty in distinguishing flame retardant plastic from ordinary plastic, most recyclers do not process any plastic from WEEE[29].

Environmental problems during the recycling of WEEE are not only linked to halogenated substances. Hazardous emissions to the air also result from the recycling of WEEE containing heavy metals, such as lead and cadmium[30]. These emissions could be significantly reduced by replacing the respective materials by less polluting substances in new electrical and electronic equipment and by means of proper pre-treatment of WEEE. Another problem with heavy

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25 Environmental Consequences of Incineration and Landfilling of Waste from Electr(on)ic Equipment (Copenhagen 1995), Nordic Council of Ministers.

26 As an example, the case of the metal reclamation plant Brixlegg/Austria ("Comparison of PCDD/PCDF levels in soil, grass, cow's milk, human blood and spruce needles in an area of PCDD/PCDF contamination through emissions from a metal reclamation plant" Riss, Hagenmaier, Chemosphere, Vol. 21, No 12, pp. 1451-1456, 1990).

27 See "Formation of Polybrominated Dibenzofurans (PBDF's) and –Dioxins (PBDD's) during extrusion production of a Polybutyleneterephtalate (PBTP)/ Glassfibre resin blended with Decabromodiphenylether (DBDPE)/Sb2O3; product and workplace analysis" Brenner, Knies, BASF 1986.

28 According to the report "Brominated flame retardants – Substance Flow Analysis and Assessment of Alternatives" of the Danish EPA (1999), no recycling activities are taking place for materials containing brominated flame retardants.

29 Compare the example given on page 18 of the report of C. Voûte, Recycling and Waste Control Officer, Corporation of London, on "Electrical/Electronic products recycling in Germany" to ICER (Industry Council for Electronic Equipment Recycling).

30 The case of the Austrian copper recycler in Brixlegg is well documented and confirms this situation (compare "Montanwerke Brixlegg – Wirkungen auf die Umwelt"; Umweltbundesamt, Monographien Bd. 25, Wien, Juni 1990).

metals and halogenated substances in untreated WEEE occurs during the shredding process. As WEEE is in most cases shredded without proper disassembly, hazardous substances, such as PCBs contained in capacitors, may be dispersed into the recovered metals and the shredder waste[31].

4.2. Resource aspects

Through the present WEEE management, valuable materials are disposed of and lost for future generations. Along with the loss of resources, substantial pollution of the environment through mining is of concern. It is not possible to give exact figures on the environmental impact of the extraction of all the materials contained in electrical and electronic equipment. This depends very much on the site and region where the materials are extracted. However, the processes leading to the extraction of these metals and their general impact on the environment are well known and documented[32].

4.3. The principle of producer responsibility

The polluter pays principle is laid down in Article 174 of the EC Treaty. The idea behind this principle is to make those persons responsible for environmental pollution who have the possibility to improve the situation. Producers of electrical and electronic equipment design the product, determine its specifications and select its materials. Only producers can develop approaches to the design and manufacture of their products to ensure the longest possible product life and, in the event that it is scrapped, the best methods of recovery and disposal.

At the moment there is hardly any economic incentive for the producer to take waste management, in particular recycling aspects, into consideration at the design stage. In this context, producers who have invested in design for recycling complain about the lack of financial incentives to maintain this product policy. As a result such actions run the risk of being discontinued. Therefore, the Proposal for a WEEE Directive seeks to extend the traditional role of producers by making them responsible for the management of electrical and electronic products at end-of-life. The creation of a link between the producers and waste management contributes to an improved product design with a view to facilitating recycling and disposal of products once they reach their end of life. Specialised recyclers confirm the practical relevance of improved design for the recycling of electrical and electronic equipment.

In order to reduce costs for producers resulting from the management of waste from products put on the market before entry into force (historical waste) of this legislation, a transition period of five years after entry into force of the Directive is granted. While the concerns of most sectors of the electronics industry will be met by this transition period, producers of products with longer lifetimes might need further assistance to address the problem of historical waste. In this context, Member States, without prejudice to Community competition law, would remain free to allow producers to cover these costs through a visible, fixed fee on the price of new products.

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[31] Due to the lack of proper dismantling of WEEE, shredder waste of white goods has a high concentration of lead, ranging from 940 to 9,400 mg/kg. Around 95% of the PCB contained in condensators (617,500 mg/kg) ends up in the shredder dust. Therefore, the contaminated shredder has to be dealt with as dangerous waste. Compared to the incineration of ordinary wastes the incineration of dangerous waste is an expensive process. As a consequence the PCB contamination of shredder waste entails an enormous increase in costs.

[32] Malley “Schwergewicht” c’t 1997, Heft 5, p. 170.

For electrical and electronic equipment not used by private households, the financing of the waste management will need to be agreed between the producer and the user of the equipment at the time of purchase. This is in line with conventional business practice.

5. LEGISLATION ON HAZARDOUS SUBSTANCES

5.1. Policy considerations

In line with the Communication on the review of the Community strategy for waste management from 1996, the Proposal for a Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment provides for the reduction of the content of certain hazardous materials in WEEE, including lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenylethers (PBDEs). In this respect, the Proposal follows the principles of existing Community waste legislation, which already included restrictions on the marketing of hazardous substances. Examples can be found in the European Parliament and Council Directive 94/62/EC on packaging and packaging waste[33] and the Council Directive 91/157/EEC on batteries and accumulators containing certain dangerous substances as amended by Commission Directive 98/101/EC adapting to technical progress Directive 91/157/EEC[34].

Various health and environmental problems linked to the current management of WEEE could be reduced by means of a diversion of these wastes away from landfills and incinerators. This could be achieved by setting up separate collection, treatment and recovery schemes for WEEE. However, at this stage it is unclear when collection rates can be achieved, which represent a substantial part of electrical and electronic equipment put on the market. In the meanwhile, in particular small WEEE will continue to be found in the current disposal routes. In addition, even if WEEE were collected separately and submitted to recycling processes, their content of hazardous substances, poses risks to the health or the environment. Therefore, the substitution of those substances, which are most problematic in the waste management phase, is the most effective way of ensuring a significant reduction of risks to the health and the environment related to these substances. However, where substitution is not feasible due to the lack of suitable alternatives, exemptions from the requirement to substitute should be granted. These exemptions should be listed in an Annex to the Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment and should be regularly amended in the light of technical progress and new scientific evidence.

The strategy of substituting substances is based on the most current scientific knowledge, taking in particular acount of the specific problems caused by these substances in the waste stream. These substances are well known and have already been subject to a range of different control measures both at Community and national level. However, scientific work on these substances is ongoing and in particular comprehensive risk assessments under Regulation (EC) 793/93 are currently under way for cadmium and three types of PBDE. Although the information emerging to date from these risk assessments gives no reason to believe that the measures foreseen in this Proposal are disproportionate, the scientific work and other work will be kept under review and if necessary this Proposal will be adjusted in accordance with the conclusions of this work.

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33 OJ L 365, 31.12.1994, p. 10.

34 OJ L 1, 5.1.1999, p. 1.

5.2. Risks posed by the targeted substances

Lead

Lead can damage both the central and peripheral nervous systems of humans. Effects on the endocrine system have also been observed. In addition, lead can adversely affect the cardiovascular system and the kidneys. Lead accumulates in the environment and has high acute and chronic toxic effects on plants, animals and micro-organisms[35].

Under Council Directive 67/548/EEC on the classification and labelling of dangerous substances, as amended[36], lead compounds are classified:

- R20/22 Harmful by inhalation and if swallowed,

- R33 Danger of cumulative effects.

The relative importance of any single source of exposure is difficult to predict and will vary with geographic location, climate and local geochemistry. In any case, consumer electronics constitute 40% of lead found in landfills. The main concern in regard to the presence of lead in landfills is the potential for the lead to leach and contaminate drinking water supplies.

Cadmium

Cadmium compounds are classified as toxic with a possible risk of irreversible effects on human health. Cadmium and cadmium compounds accumulate in the human body, in particular in the kidneys which in time may lead to damage. Cadmium is adsorbed by respiration but is also taken up with food. Due to its long half-life (30 years), cadmium can easily be accumulated in amounts that cause symptoms of poisoning. With prolonged exposure cadmium chloride may cause cancer. Cadmium shows a danger of cumulative effects in the environment due to its acute and chronic toxicity[37].

Under Council Directive 67/548/EEC on the classification and labelling of dangerous substances cadmium compounds are classified:

- R23/25 Toxic by inhalation, if swallowed.

- R33 Danger of cumulative effects.

- R40 Possible risks of irreversible effects.

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35 Compare Risk Reduction Monograph No 1 Lead – Background and national experience with reducing risk, OECD Paris 1993.

36 OJ L 196, 16.8.1967, p. 1.

37 This information is based on the risk reduction monograph no 5, CADMIUM, Background and national experience with reducing risk (OCDE/GD894) 97; Health effects of cadmium exposure-a review of the literature and a risk estimate (Lars Järup and others) Scand J. Work Environ Health 98; Environmental impacts of cadmium, Gerrit H. Vonkeman 1995; Cadmium in Sweden-environmental risks, Helena Parkman and others 1997 and other research on this issue.

Mercury

Inorganic mercury spread in the water is transformed to methylated mercury in the bottom sediments. Methylated mercury is easily accumulated in living organisms and concentrates through the food chain via fish. Methylated mercury has chronic effects and causes damage to the brain.

Under Council Directive 67/548/EEC on the classification and labelling of dangerous substances, as amended, mercury is classified:

- R23/24/25 Toxic by inhalation, in contact with skin and if swallowed.

- R33 Danger of cumulative effects.

Under Council Directive 67/548/EEC on the classification and labelling of dangerous substances, as amended, mercury alkyls and inorganic compounds of mercury are classified:

- R26/27/28 Very toxic by inhalation, in contact with skin and if swallowed.

- R33 Danger of cumulative effects.

It is estimated that 22% of annual world consumption of mercury is used in electrical and electronic equipment.

Hexavalent chromium (**Chromium VI**)

Chromium VI can easily pass through cell membranes. Accordingly, chromium VI is easily absorbed and produces various toxic effects within the cells. Therefore, chromium VI is considered an important risk for the environment in industrialised countries. Furthermore, chromium VI causes severe allergic reactions. Small concentrations of chromium VI in the environment might lead to an increase of allergies. Asthmatic bronchitis is another allergic reaction linked to chromium VI. Chromium VI is also considered genotoxic, potentially damaging the DNA.

In addition, hexavalent chromium compounds are assumed to be toxic for the environment.

As regards possible exposure, chromium VI contained in wastes can easily leach from landfills which are not appropriately sealed. During incineration of chromium VI contaminated wastes the metal evaporates through fly ash. Chromium VI in the fly ash is easily soluble. There is agreement among scientists that wastes containing chromium should not be incinerated.

Brominated flame retardants

Brominated flame retardants are regularly designed into electronic products today as a means of ensuring flammability protection. The use is mainly in four applications: in printed circuit boards, components such as connectors, plastic covers and cables. 5-, 8- and 10-BDE are mainly used in printed circuit boards, plastic covers of TV sets and domestic kitchen appliances.

One of the main objectives of the present Proposal is to divert WEEE from disposal operations and to increase recycling of this waste. This is in particular true for plastics, which constitutes 20% of the composition of WEEE. One of the main impediments to the recycling of this fraction is the risk of dioxin and furan generation by certain brominated flame retardants during the recycling of the respective plastic. In particular, it has been shown that polybrominated diphenylethers (PBDEs) formed the toxic polybrominated disbenso furans (PBDF) and polybrominated disbenso dioxins (PBDD) during extrusion, which is part of the plastic recycling process. As a consequence, the German chemical industry stopped the production of these chemicals in 1986[38].

In addition, high concentrations of PBDEs have been found in the blood of workers in recycling plants[39]. Various scientific observations indicate that PBDEs might act as endocrine disrupters.

The presence of polybrominated biphenyls (PBBs) in Arctic seal samples indicates a wide geographical distribution. The principal known routes of PBBs from point sources into the aquatic environment are PBBs plant areas and waste dumps. PBBs are almost insoluble in water and are primarily found in sediments of polluted lakes and rivers. PBBs have been found to be 200 times more soluble in landfill leachate than in distilled water. This may result in a wider distribution in the environment. Once PBBs have been released into the environment, they can reach the food chain, where they are concentrated. PBBs have been detected in fish from several regions. Ingestion of fish is a source of PBB transfer to mammals and birds. Neither uptake nor degradation of PBBs by plants has been recorded. In contrast, PBBs are easily absorbed by animals and although they have been found to be very persistent in animals, small amounts of PBB metabolites have been detected[40].

6. INTERNAL MARKET ASPECTS – SITUATION IN THE MEMBER STATES

6.1. Situation in the Member States

In view of the environmental problems linked to the management of WEEE, Member States started drafting national legislation. The Netherlands, Denmark, Sweden, Austria, Belgium and Italy have already presented legislation on WEEE. Finland and Germany are expected to do so soon. Those Member States which have so far not drafted national legislation expressed their concern about the lack of harmonised European legislation for this waste stream during various consultation meetings preceding the present initiative.

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38 See "Formation of Polybrominated Dibenzofurans (PBDF's) and –Dioxins (PBDD's) during extrusion production of a Polybutyleneterephtalate (PBTP)/Glassfibre resin blended with Decabromodiphenylether (DBDPE)/Sb2O3; product and workplace analysis" Brenner, Knies, BASF 1986. Further information to be found in "Polybrominated Diphenyl Ethers in the Swedish Environment", Ulla Sellström, Stockholm 1996.

39 Flame retardant exposure – Polybrominated diphenyl ethers (PBDEs) in blood from Swedish workers, Sjödin et al. Stockhom 1999.

40 Information and recommendation from the risk reduction monograph no 3, selected brominated flame retardants – Background and national experience with reducing risk, OECD Paris 1994.

Since the mid-1990s Austria has had legislation on the take-back and recovery of lamps and white goods. Initially, the recovery systems for both product groups were financed through a fee on the price of new products. Due to competitive disadvantages suffered by the Austrian retailers of white goods compared with competitors in Germany and Italy, an end-of-life fee was introduced and the fee on the product price was reduced accordingly. A draft ordinance on the overall WEEE stream was published in March 1994, but further discussions were suspended pending the entry into force of EU legislation.

A regulation covering brown and white goods in the Flemish Region of Belgium was adopted in 1998. Manufacturers, importers, distributors and retailers are obliged to take back free of charge all kinds of white and brown goods as well as Information Technology (IT) equipment. Recycling targets for ferrous and non-ferrous metals and for plastics are included in the regulation.

According to the Danish statutory order, from January 1999 Danish local authorities have been will be responsible for the collection and recovery of brown and white goods, IT and telecommunication equipment, monitoring equipment, equipment for medical and laboratory use and other electrical and electronic equipment. To fund this, end-users are charged through local taxes or collection fees.

In Germany an ordinance on the take-back and recycling of WEEE is in the final stages of the legislative procedure. The draft provides for the responsibility of local municipalities to collect WEEE and producers to treat, recover and dispose of this waste.

An Italian decree on waste management of December 1997 lays down take-back and recovery obligations for several kinds of durable goods in domestic use, such as white goods, TVs and certain IT equipment. On the basis of agreements with industry a nationwide network of collection centres and recovery facilities is to be set up. End-users have to deliver this equipment to an authorised dealer or to public or private waste management organisations.

On 1 June 1998 a regulation establishing rules for taking back and processing white and brown goods after use came into force in the Netherlands. According to this legislation consumers can return WEEE free of charge to the supplier or to the local authority. Subsequently, manufacturers and importers must process the items concerned. The landfilling or incineration of WEEE collected separately will be prohibited.

In April 2000 Sweden adopted an ordinance for WEEE allowing consumers to bring back their waste to retailers or municipal collection points. Costs of recycling will be borne by either the municipalities or the manufacturers. WEEE may not be landfilled, incinerated or shredded without treatment by a certified operator. This ordinance is expected to come into effect on 1 July 2001.

There are many examples of the regulation of lead-containing products and of particular uses of lead[41] such as:

– In Austria, there are restrictions on the lead content of fertilisers and on the use of sewage sludge if the heavy metal content in the soil or the sludge exceeds certain limits. Similar ordinances have been adopted by Finland and drafted by the German government.

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[41] Compare Lead risk management activities in OECD Member Countries (1993-1998), OECD, Paris 2000.

– In Denmark, a regulation on lead-containing products is under way. The draft regulation contains a general prohibition (with exemptions) on the sale of products containing lead substances. The sale of a range of specified products containing lead is also prohibited.

– In Sweden, there are initiatives to phase out lead use in many products including cables, solder, light bulbs, cathode rays and keels.

Examples of legislation on other heavy metals are the Dutch Cadmium Decree 1999 prohibiting the use of cadmium as pigments, dyes, stabilisers and plating. A similar ordinance was adopted by the Austrian government in 1993. In Austria the content of mercury in lamps is limited to 15 mg per lamp. In 1998 the Netherlands also enacted a general phase-out of mercury in products.

The Swedish National Chemicals Inspectorate proposed a ban of PBDE and PBB, which is currently being considered by the Swedish government, while Austria banned the use of PBB as early as 1993. Factually, the use of PBDE is prohibited in Germany as certain limit values for brominated furans and dioxins may not be exceeded according to the national Chemicals Prohibition Ordinance. This is in line with a voluntary commitment to discontinue the use of PBDEs given by the German chemicals industry in 1989.

6.2. The Internal Market

With regard to the Internal Market, three main problems resulting from different national approaches to the management of WEEE can be identified:

- Different national applications of the principle of producer responsibility might lead to **substantial disparities of financial burden** for the economic operators

- Different national policies on the management of end-of-life electrical and electronic equipment could **hamper the effectiveness of national recycling policies**, as transboundary movement of WEEE to cheaper waste management systems could occur

- Diverging requirements on the phasing-out of specific substances could have implications on **trade in** electrical and electronic equipment.

In view of the developments in the Member States, it is necessary to clarify the environmental objectives and the responsibilities of the various actors as regards the management of WEEE at Community level.

7. INTERNATIONAL ASPECTS

7.1. International developments

The Organisation for Economic Cooperation and Development (OECD) considers the concept of Extended Producer Responsibility (EPR) a policy tool to minimise waste. In the course of the year 2000 the OECD envisages to publish a guidance document as a basis for governments wishing to implement EPR. In this context, WEEE was identified as one of the priority areas for action.

Apart from a voluntary system on "Extended Product Responsibility" no legislative action on waste from electrical and electronic equipment is envisaged at Federal level in the United States. Contrary to that, various US States have introduced a landfill disposal ban on white goods and equipment containing cathode ray tubes, including an advanced disposal fee on new appliances.

A draft Recycling Law for Domestic Electric Appliances was adopted by the Japanese Parliament (Diet) in May 1998. According to the law, retailers have to collect television sets, refrigerators, washing machines and air conditioners from consumers. These items will be transferred to the manufacturers who are responsible for further treatment, in particular recycling. Retailers and manufacturers will collect charges necessary to cover the cost of recycling the waste. A similar ordinance has been adopted in Taiwan and entered into force on 1 March 1998.

In Switzerland, an ordinance on the take-back and disposal of electrical and electronic appliances entered into force on 1 July 1998. In Norway, an ordinance on the acceptance, collection, recycling and disposal of discarded electrical and electronic equipment was adopted in March 1998.

7.2. Trade aspects

Both proposed Directives will uniformly apply to all electrical and electronic equipment on the EU market, independently from where these products have been manufactured. The proposed measures are necessary to fulfil the objectives of the Directives. As regards the Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment although various health and environmental problems linked to the current management of WEEE could be reduced by means of a diversion of these wastes away from landfills and incinerators, it is unclear when collection rates can be achieved, which represent a substantial part of electrical and electronic equipment put on the market. In the meanwhile, in particular small WEEE will continue to be found in the current disposal routes. In addition, even if WEEE were collected separately and submitted to recycling processes, their content of hazardous substances, poses risks to the health or the environment. Therefore, the substitution of those substances, which are most problematic in the waste management phase, is the most effective way of ensuring a significant reduction of risks to the health and the environment related to these substances. In this light, the substitution requirement as set out in Article 4 of the Proposal for a Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment can be considered to be the best means of tackling health/environmental effects arising from substances scientifically recognised as dangerous. In addition, all measures in the proposed Directive have been designed in such a way so as to meet international obligations and to minimise potential trade impacts. The need to avoid unnecessary obstacles to trade has been duly taken into account. This was particularly kept in mind when defining the implementing modalities of the substance ban and notably when setting the time schedule (2008), providing with a list of exemptions and allowing for a possibility of derogation under specific circumstances (review clause). Furthermore, it is ensured that these derogations will be kept under review in the light of technical progress and new scientific evidence.

8. LEGAL BASIS

Most of the measures set out in the WEEE Directive focus on the improvement of WEEE management. Therefore, this Directive is based on Article 175 of the EC Treaty. The aim of the Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment is to approximate the laws of the Member States on the restrictions of the use of hazardous substances in electrical and electronic equipment. Accordingly, the legal basis for this measure is Article 95 EC Treaty.

9. SUBSIDIARITY AND PROPORTIONALITY

9.1. Subsidiarity

Environmental protection measures and measures with an impact on the internal market fall within both the competence of the Community and the Member States. Measures on WEEE constitute a clear example of this competence-sharing. In accordance with the principle of subsidiarity (Article 5 of the Treaty), the Community shall take action in areas which do not fall within its exclusive competence only if and insofar as the objectives of the proposed action cannot be sufficiently achieved by the Member States and can therefore, by reason of the scale or effects of the proposed action, be better achieved by the Community:

- The **pollution** caused by the management of WEEE is **of a transboundary nature**. This is in particular true for the pollution of the air or water resulting from the incineration, landfill or improper recycling of WEEE.

- For various parts of WEEE, recycling is economically viable only if large quantities of waste are processed. According to the principle of **economies of scale** only a few centralised installations in Europe would process these wastes. Cathode ray tubes are an example of this situation. Sufficient quantities of this equipment could only be processed if WEEE were collected in several European countries

- Individual national approaches to WEEE, in particular with regard to restrictions of the use of hazardous substances in electrical and electronic equipment, lead to various **problems for the Internal Market** as described in the chapter "The Internal Market". These problems could only be addressed by Community measures.

When devising collection, treatment and financing systems for the management of WEEE, national and regional conditions have to be taken into account. The present initiative leaves sufficient flexibility to the Member States to take these aspects into consideration. The proposed Community legislation is limited to the prescription of the main principles of WEEE management and financing and to the establishment of principles at Community level which are needed to avoid the distortion of the Internal Market. Along these lines, the restrictions on the use of hazardous substances in electrical and electronic equipment have been integrated into the Proposal for a Directive, which is based on Article 95 EC Treaty.

9.2. Proportionality

Both proposals focuse exclusively on the key elements for actions to be taken with regard to waste electrical and electronic equipment, such as prevention, collection, treatment and recovery as well as financing. In addition, they only introduce obligations which are necessary to achieve the environmental objectives, in accordance with the proportionality principle.

It has been argued that the substitution of hazardous substances in new electrical and electronic equipment might be redundant as WEEE would be collected separately, thereby removed from the general waste stream and treated separately. However, various estimates of the quantity of WEEE indicate that the "soft" collection target of 4 kg per inhabitant, as set out in Article 5 of the WEEE Proposal, constitutes only 25% of the overall annual generation of this waste. Although the appropriateness of the indicated target was confirmed by the experience with Dutch WEEE legislation, it remains to be seen whether other Member States attain the collection target in the medium term. As a consequence, the substitution of the hazardous substances, as laid down in Article 4 of the Proposal on the restriction of the use of certain hazardous substances in electrical and electronic equipment, is the most effective way to reduce the presence of these substances in the waste stream.

It has been demonstrated that attributing the economic responsibility for the treatment, recovery and disposal of WEEE to producers constitutes an important incentive to improve the design of electrical and electronic equipment which takes waste management aspects into account. Contrary to that, there is no evidence that attributing the collection of WEEE from private households to producers would have an impact on the design of the equipment. Therefore, the responsibility of producers is limited to the actual treatment, recovery and disposal of this waste. For practical reasons producers will have to pick up the waste from designated collection points.

10. CONSISTENCY WITH OTHER COMMUNITY POLICIES

The objectives of the Proposals are fully in line with the Treaty requirements for environmental protection and the rights of consumers and also contribute to the elimination of obstacles to the free movement of goods and services as well as the elimination and prevention of distortions of competition. As regards Community waste management policy, the present initiative complements legislation on the disposal of waste (i.e. landfill and incineration of waste) as well as legislation on specific waste streams, such as batteries.

Landfilling of waste

Directive 1999/31/EC on the landfill of waste provides that only treated waste can be landfilled. It falls into the scope of the present initiative to complement the Landfill Directive by stipulating concrete requirements as regards the treatment of WEEE.

Incineration of waste

Waste going to incinerators has to be pre-treated for various reasons. All residues from the incineration process, including slags, fly ash and filter cake are used in other processes, for example as construction material. The recoverability of these residues depends on their (heavy) metal content, which is linked to the quality of the material introduced in the incineration process. As a consequence, a treatment operation as foreseen in the present initiative contributes to a reduction of various metals in the respective residues. In addition,

both investments and operating costs of the flue gas cleaning could be reduced if wastes put to incineration contained less heavy metals or halogenated substances.

Batteries

A large proportion of heavy metals, such as lead and cadmium, in the municipal waste stream comes from batteries. As a consequence, Directive 91/157/EEC on batteries and accumulators containing certain dangerous substances[42] requires these batteries to be collected. However, as up to 90% of consumer batteries are integrated in electrical and electronic equipment without being removed by the consumer prior to disposal of the equipment, the separate collection of these equipment – as foreseen under the WEEE Proposal – constitutes an indispensable part of an efficient collection scheme for batteries.

Climate change and legislation on ozone depleting substances

The present initiative is explicitly recognised as a useful vehicle for reducing halogenated fluorocarbons (HFC) emissions in the EU's post-Kyoto strategy. Furthermore, the present Proposal defines the general stipulations on the recovery of used controlled substances contained in Council Regulation (EC) 3093/94[43] on substances that deplete the ozone layer.

Primary production of metals accounts for 10% of global CO_2 emissions. Depending on the metal, 70% to 95% of the energy used for the primary extraction of metals could be saved through enhanced recycling. In view of the fact that more than 3.5 million tonnes of metals are contained in the WEEE generated annually, the WEEE Proposal contributes significantly to the CO_2 reduction required to achieve the Kyoto targets.

Research policy

For several years the Community Research Framework programme has supported activities to stimulate the industrial change necessary to design, manufacture and use a new generation of electrical and electronic equipment that is more respectful for the environment, in line with the terms of the proposed Directives. The GROWTH programme in particular, in coordination with the EUREKA initiative "CARE", is stimulating industry to take the environmental impact of their products more seriously into account and to address the recycling and reduction of waste aspects from the design stage. European actions support also the substitution of harmful materials by less toxic ones. Such activities encompass not only RTD projects but also co-ordination networks, concerted actions and training activities.

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42 OJ L 78, 26.3.1991.

43 OJ L 333, 22.12.1994.

11. ECONOMIC ASSESSMENT

11.1. Implementation costs

11.1.1. Separate collection and re-use/recycling

On the basis of available information[44], the total net costs[45] of meeting the collection and re-use/recycling requirements for household WEEE of the proposed draft Directive on WEEE are likely be in the range of EUR 500-900 million/yr for the EU15. The requirements for commercial equipment might, according to a rough estimate, add around 20% to this figure. An extrapolation of Dutch figures, derived from the practical experience with national WEEE legislation in 1999, indicates costs for public relations, consultancy, overhead costs of collection and recovery systems etc. of around EUR 100 million in the first year with a downward trend over time. If all these costs were passed on directly to the consumer through the product price, this would lead to an average price increase of 1% for most electrical and electronic goods, but could be as much as 2-3% for some product categories, such as refrigerators, televisions and other monitors.

It is, however, likely that these costs are overestimated when allowance is made for economies of scale, disposal costs avoided, etc[46]. Furthermore, these costs are based on the assumption that Member States are not undertaking their own initiatives. However, 10 of the current 15 Member States have already implemented or intend to implement separate collection and recycling schemes for WEEE. Therefore, the incremental costs of the EU Proposal will be substantially lower than the abovementioned figures.

Collection costs for household equipment

Assuming collection of 4 kg per inhabitant, the total collected quantity of waste electrical and electronic equipment under the Directive will be 1.5 million tonnes. The average reported collection costs are in the range of EUR 200 to 400/t. Taking these figures, overall collection costs for the EU 15 would be between EUR 300 and 600 million/yr. It is, however, likely that these costs will come down over time once the basic investments for the collection infrastructure have been made, logistics have been optimised and consumer awareness has led to higher collection rates.

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44 The main sources of information for the assessment of costs for separate collection and recycling are the following WEEE collection and recycling pilot projects: Bregenz, Weiz, Flachgau, Apparetour, LEEP, Lower Saxony, RDE, DSD, Swedish Ecocycle Commission, Rhône-Alpes; information provided by stakeholders concerned (producers, recyclers, etc.), the studies "Recovery of WEEE: Economic and Environmental Impacts" (European Commission 1997) and Life Cycle Assessment and Life Cycle Financial Analysis of the Proposal for a Directive on Waste from Electrical and Electronik Equipment (UK DTI 1999) and the report on Priority Waste Streams Waste From Electrical and Electronic Equipment (ENEA 1995).

45 Costs of collection and recycling minus revenues from the sale of secondary material; the calculation is based on figures including investment costs needed for the purpose of the pilot schemes.

46 This is confirmed by preliminary results concerning the implementation of the Dutch WEEE ordinance: Initial contracts between producers and recyclers have been concluded at half the costs predicted by the Apparetour Pilot Project.

Recycling costs for household equipment

Recycling costs differ largely according to the equipment types. Costs for large household equipment typically range from around EUR 10 to 80/t. Costs for refrigerators are usually in the area of EUR 200 to 300/t, for equipment containing monitors EUR 100 to 800/t and small household equipment EUR 200 to 500/t. On the basis of various pilot projects and assuming a waste composition of 70% large household goods, 15% equipment containing monitors and 15% small household equipment, a rough range of EUR 200 to 300 m/yr has been calculated as recycling costs according to the requirements of the Directive.

This estimate is confirmed by the initial results from the Dutch recovery system for waste electrical and electronic equipment. In 1999, the recycling costs per million inhabitants were EUR 695 000[47]. Extrapolated to the total EU population, this would amount to a cost of EUR 258 m/yr[48].

11.1.2. Hazardous substance reductions in new equipment

A number of manufacturers have already phased out lead, mercury, cadmium, hexavalent chromium and halogenated flame retardants in various applications. This suggests that the costs of doing so are quite limited.

The only issue where more substantial costs have been claimed by industry is lead in solders. According to calculations by the Commission, the additional operational costs of using tin-based solders are roughly estimated to be about EUR 150 million/yr. Annualised investment costs are thought to be relatively low. On this basis, the total price increase would remain very small for most products (e.g. EUR 0.0006 to 0.003 per telephone, EUR 0.003 to 0.017 per calculator and EUR 0.03 to 0.17 per television). In conclusion, the issue of replacement of lead in solders is thought to be more an issue of fine-tuning alternative technologies than a cost question.

11.2. Benefits of the proposed Directives

11.2.1. Financial benefits

From a purely financial point of view, there are three main types of benefits:

- **Production costs** for the virgin material which is replaced by secondary material **can be saved**. This is the reason for existing re-use and recycling. Since secondary materials are in competition with virgin materials, the price difference will determine which source producers will use. This is, however, already taken into account in the above cost figures, which are net costs.

- **Disposal costs can be saved** through re-using/recycling higher levels of waste electrical and electronic equipment. Assuming that the majority of WEEE would go to landfills with higher standards than today (at a cost of EUR 50/tonne), cost savings due to reduced

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47 Transport, sorting, logistics and treatment; communication by the Dutch Environment Ministry.

48 This figure should, however, be seen as indicative only and needs to be adjusted to higher quantities to be expected (the Dutch figures are for 2.1 kg WEEE/inhabitant collected and treated within the framework of NVMP; these 2.1 kg, however, do not cover WEEE outside the NVMP system, e.g. equipment resold directly by municipalities at positive market prices), optimized system conditions and country specific costs.

landfill space would be around EUR 50 million for EU15[49]. Further financial cost reductions may be achieved due to the reduced amount of hazardous components going into shredders.

- Finally, the **costs for re-use and recycling will be lowered** in future through better design of new equipment due to the feedback mechanism of producer responsibility and through additional instruments such as design standards and general obligations for Member States to encourage eco-design.

11.2.2. External benefits

The main reason for the need to legislate in this field is the existence of externalities, i.e. environmental impacts that are not integrated in the price of the product and that are usually paid for by society via cleanup costs or environmental degradation. Although there is general awareness about the problems associated with waste electrical and electronic equipment, very little research exists that could give a monetary evaluation of the externalities arising from current management practices with this waste[50]. The absence of such an analysis, for what is a politically pressing issue, cannot however be construed as a reason for inaction.

The external benefits of separate collection and recycling

The main benefits of separate collection and recycling are:

- the avoidance of external costs due to the possible use of the resources contained in the waste electrical and electronic equipment which would otherwise go to disposal (around 6 million tonnes annually). At a collection rate of 4 kg per inhabitant, more than 1 million tonnes of materials could be diverted and reintroduced into the economic cycle. It is difficult to evaluate how far the true costs of using resources today instead of leaving them for future generations and/or distributing them in a more equitable way among the world´s population are reflected in the price of virgin material. Sustainable resource use is, however, one of the questions at the core of the principle of sustainable development

- the avoidance of external costs caused by negative impacts on the environment from incinerating and/or landfilling waste electrical and electronic equipment. After treatment of collected equipment, only 10-30% of the original weight would be sent to final disposal. The remaining fraction after treatment (around 100 000 tons) can be sent to specialised installations, if necessary for hazardous waste. Waste fees usually do not distinguish between waste materials causing different environmental impacts since they are usually based on weight or flat rates. The external costs caused by current management of waste electrical and electronic equipment are without any doubt higher than for average types of waste, due to the content of hazardous materials in WEEE. These external costs will

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49 This amount does not, however, take account of mining waste from the use of virgin material that can be replaced by recycled substances. It is likely that the landfill capacity needed for this type of waste is at least several times as high as the described landfill capacities for municipal waste which can be avoided by the proposal.

50 The absence of a quantified systematic analysis in this document reflects the current state of waste management in Europe. Scientific and statistical data, whether relating to pollution pathways, dose response relationships, the value that society puts on the absence of risk from such pollution, etc is not known. Even exact data on waste quantities going to different forms of disposal and the state of the art of many waste management processes is lacking in most Member States. Valuation of external effects, while not conceptually problematic is therefore rendered impossible by the absence of basic scientific information.

therefore be particularly high for refrigerators containing CFCs or equipment containing cathode ray tubes

- the avoidance of external costs caused by negative impacts on the environment from the production of virgin materials. *Inter alia*, the recycling of WEEE is estimated to contribute to energy savings in the order of 120 million Giga Joule (equivalent to about 2.8 million tonnes of oil) annually. An estimated 60% to 80% saving in energy can be obtained by using the materials recycled under the WEEE Proposal as compared to the use of virgin materials[51] (compare Annex I).

The external benefits of better design and the reduction of hazardous substances

- The effects of producer responsibility and other measures aimed at better design of new equipment are likely to reduce not only the financial costs of re-use and recycling but also the impact on the environment of the waste management of the equipment. It is, however, difficult to give a quantitative evaluation of these effects since they will depend on the design of national implementation measures and the reaction of the market to these measures.

- The risks of the substances targeted by the Proposal on the restriction of the use of certain hazardous substances in electrical and electronic equipment have been described in chapter 5.2 and Annex IV. The absence of specialist knowledge about specific pollution pathways, dose-response functions on living organisms, risks of potential incidents and the value that society puts on the absence of these risks makes it, however, impossible to put a clear monetary value on these externalities. Due to the inherent toxicity of these substances and the fact that they may reach the environment in a bioavailable form, associated risks are indeed substantial. Whenever more environmentally friendly substitutes exist at a reasonable price, prevention at source therefore is likely to be preferable to endofpipe solutions.

11.2.3. Life cycle assessment and life cycle financial analysis

A 1999 study for the United Kingdom's Department of Trade and Industry investigated in detail the environmental and financial balance of re-use and recycling activities according to the proposed targets including alternative costs for disposal and the production of virgin materials[52]. The study shows that even today relatively high rates of re-use and recycling are achieved for many equipment types[53]. These activities seem to be profitable even from a purely financial perspective. Increasing the levels will raise costs. Markets for the re-used/recycled equipment need to be created. However, the study concludes that the scenario according to the targets of this Proposal can be seen as cost-effective from a financial point of view.

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51 Calculated on the basis of: P.R. White, M. Franke, P. Hindle, Integrated Solid Waste Management: A lifecycle inventory, 1995, in: European Commission, Recovery of WEEE: Economic and Environmental Impacts, 1997.

52 Life Cycle Assessment and Life Cycle Financial Analysis of the Proposal for a Directive on Waste from Electrical and Electronic Equipment (UK 1999), Ecobalance UK and DMG Consulting Ltd for UK Department of Trade and Industry.

53 For washing machines the rate is 62%, for Personal Computers 60%, for telephones 62%, for kettles 58%, for refrigerators 60%, for televisions 42.2%.

An increase of re-use and recycling up to the targets of the WEEE Proposal will result in lower environmental impacts except for refrigerators and television sets. The study, however, does not attempt to value certain effects which are particularly serious such as the release into the environment of CFCs from refrigerators and heavy metals from monitors.

11.3. Macroeconomic effects

A key factor when considering the possible effects of a change in product price is whether the demand for the goods in question is elastic or inelastic. A Dutch study[54] on this subject suggests that the demand for a number of electronic goods, especially large white goods and several types of brown goods can be qualified as inelastic (refrigerators, washing machines, heating boilers, televisions and computers) given the types of prices changes[55] that are likely to be involved (1-3%). In other words, over the long term the level of sales is not likely to be affected by these types of price changes.

For certain other products, mainly consumer electronics such as hi-fis or shavers, demand might be regarded as partially elastic. The maximum calculated loss of sales is 1-2% assuming an average price increase of 1%. This effect and the associated indirect cost is, however, likely to diminish as economies of scale and innovation bring down the costs of separately collecting and treating WEEE.

Consequently, the measure will have some effect on prices, inflation, aggregate demand etc. These effects are, however, likely to be relatively limited.

12. CONSULTATION OF STAKEHOLDERS

In 1994 and 1995 representatives of Member States, all relevant economic operators and environmental NGOs participated in a Project Group which worked out an information and recommendation document on the management of WEEE. Subsequently, all stakeholders were consulted on discussion papers preceding the present Proposal.

In general, all Member States welcome the European Commission's initiative. On various occasions Member States expressed the opinion that at least a legally binding framework at Community level had to be created. With regard to the collection of WEEE, the majority of Member States favoured a system where both local municipalities, retailers and producers share financial and technical responsibility. Responsibility for treatment, recovery and disposal of WEEE should be given to producers. Flexibility for national solutions was advocated for any financing scheme on WEEE.

- In the consultation meetings with industry, support for a harmonised European approach in the area of WEEE was expressed in order to avoid a distortion of the Internal Market. Furthermore, the objectives of the Proposal were welcomed by industry. The phasing-out requirement in a waste management Directive, based on Article 175 EC Treaty, was considered inappropriate although in substance the need for minimisation of the use of the concerned substances was widely accepted. Industry accepted a certain involvement in the recycling of their products. In this context, part of industry favoured a transparent payment system which would not influence the relationship between producers and distributors.

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54 Economische effecten verwijderingsbijdrage wit- en bruingoed (Den Haag 1995), KPMG.

55 The indicated percentages refer to the sum of collection and recovery costs.

Other parts expressed their interest in a competitive financing system without transparent fees put on the product price.

- In June 1999 a draft Proposal for a WEEE Directive Directive, including the restrictions for certain hazardous substances, was submitted to the business test panel as a pilot project[56]. Out of the 611 businesses consulted, 188 were affected by the Proposal. Several businesses which participated in the consultation exercise suggested that responsibility for the waste from electrical and electronic equipment should be shared. In particular, municipalities, retailers, distributors, manufacturers and recyclers should work together to take back and recycle the electrical and electronic equipment from private households. In addition, some businesses advocated the removal or delay of the material bans.

- The Commission initiative on WEEE was welcomed by the environmental NGOs, which favoured the principle of producer responsibility. According to the NGOs the prevention of WEEE should be stressed. This means encouraging producers to produce products with longer lifetimes. The provision on the substitution of substances was supported by NGOs, which asked for an extension of this requirement to additional halogenated substances, in particular PVC.

13. DATA/SCIENTIFIC BASIS

The proposed Directives are based on scientific evaluations of the impacts of the current methods of management of WEEE in various Member States. More than a dozen collection and recovery pilot projects undertaken throughout the European Union provided data on this issue. The studies listed in Annex III are examples of the scientific basis for the proposed Directive.

[56] This Panel is part of a consultation exercise specifically aiming at Small and Medium Sized Enterprises (SMEs) set up through Communication COM(98) 197 final.

Contents of the Proposal for a Directive on Waste Electrical and Electronic Equipment

Article 1 sets out the objective of the Directive.

Article 2 sets out the scope of the proposed Directive. The proposed Directive applies to all categories of electrical and electronic equipment listed in Annex I A. This list is exhaustive. Examples of equipment falling under each of these categories are given in Annex I B. In view of the rapidly changing market in electrical and electronic equipment, it was considered useful to avoid an exhaustive list of equipment. It follows clearly from national experience that an exhaustive product list would be subject to permanent updating.

Due to the specific distribution of products, such as medical equipment systems, monitoring and control equipment and automatic distributors, it was not considered necessary to apply the same collection, financing and user-information provisions to these products as to equipment mainly or exclusively used by consumers.

As regards medical equipment systems, implants are not covered by the scope of the proposed Directive.

Article 3 contains the definitions for the purposes of this Directive.

The definition of electrical and electronic equipment (**Article 3(a)**) comprises all appliances run by electricity and included in the categories set out in Annex I A of the Proposal. The purpose of the indicated voltage limits is to ensure that large industrial equipment, which might be construed as falling under one of the categories of Annex I A, is not covered by the Proposal. The voltage limits are the upper limits set out in Article 1 of Council Directive 73/23/EEC of 19 February 1973 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits[57]. Voltage ratings refer to the voltage of the electrical input or output, not to voltages, which may appear inside the equipment.

Components are parts of electrical and electronic equipment, such as housings, screens, keyboards, electric motors, circuit boards, capacitors, rectifiers, transistors, tubes, etc. Sub-assemblies are parts of the equipment - not necessarily parts of the electricity flow - without which the original piece of equipment could not operate as intended by the manufacturer. Examples of sub-assemblies are shelves in a refrigerator. Consumables are short-term replaceable/disposable parts of the equipment, such as toner cartridges or batteries. The provisions regarding waste electrical and electronic equipment apply only to components, sub-assemblies and consumables when these materials are part of the product at the time of discarding.

Article 3(j): With a view to avoiding discrimination against EU manufacturers, the provisions of this Directive should apply to products and producers irrespective of the selling technique, including distance and electronic selling; Producers for the purposes of this Directive are not suppliers or manufacturers of individual components, subassemblies or consumables. Where companies market products under their own brand which were originally manufactured by other companies, the definition of producer applies to the companies marketing the products rather than to the original manufacturers.

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[57] OJ L 77, 26.3.1973, p. 29.

According to the definition of waste electrical and electronic equipment from private households (**Article 3(l)**), special equipment, such as radio therapy equipment, would – due to its nature - not fall under the requirements of the Proposal applying to equipment from private households. Computer systems of a kind, however, which would be suitable for use by private households as well as small companies e.g. a law firm, would fall under the definition of WEEE from private households. If the law firm used several computers which clearly exceeded the number usually found in private households, the end-of-life computers would – in view of the number concerned - not fall under the definition of WEEE from private households.

Article 4 provides for the separate collection of WEEE. One of the main problems regarding current waste management practice with WEEE is the lack of collection which would enable recyclers to obtain sufficient material for large-scale production[58]. This is in particular true for electrical and electronic equipment used in private households. As a consequence, Member States have to ensure that collection systems are set up.

The main challenge to create efficient collection systems is to motivate consumers to participate. However, in view of the principle of subsidiarity, only general requirements for collection systems could be set in the proposed Directive. Measures ensuring an efficient collection system may vary according to the different product groups of this waste stream and the specific features of the different regions within the EU and should therefore be taken at national or regional level[59]. The main principles set out in the present Proposal include the requirement of setting up collection points, which are easily accessible for consumers, the possibility for consumers to return their equipment free of charge and the involvement of distributors in the collection system.

In order to avoid substantial disparities in the financial burden due to WEEE management, a harmonised standard needs to be established for collection to be a success. However, at this stage it is not possible to give a legally binding collection target in view of the absence of precise data on the annual arisings of WEEE from private households. Therefore, a "soft" collection target has been given as a guide for the Member States. The indicated amount of 4 kg of WEEE per inhabitant is an average amount which should be achieved per inhabitant. It represents a typical average collection yield that has been achieved by several countries of the European Union in the course of pilot collection schemes[60] and corresponds to the collection achieved in practice under the Dutch WEEE legislation. At a later stage, after experience has been gathered during the implementation of the WEEE Directive, compulsory targets will be formulated.

Article 5.1 in connection with Annex II specifies the necessary treatment measures. These include the removal of substances which cause the main difficulties at the various stages of the management of WEEE[61]. In any case, the possibilities of re-use and recycling are to be considered when these treatment operations take place. In the context of setting up the list of

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58 AEA Technology, Recovery of WEEE: Economic and Environmental Impacts, June 1997, p. 84.

59 These measures include financial encouragement to return equipment, such as deposits, information of the consumers, including public awareness campaigns, and a consumer friendly orientation of collection facilities, including convenient opening hours, accessibility of the facilities and efficient service provided at the collection points.

60 Collection targets for waste from electrical and electronic equipment (Germany 1998), European Commission DG XI, p. 13.

61 Detailed explanations and descriptions of the background to the required measures are found in the study "Pilotsammlung von Elektroaltgeräten in Bregenz – Wissenschaftliche Begleitstudie" (Bregenz/Österreich 1996), Bundesministerium für Umwelt, Jugend und Familie.

Annex II extensive discussions on the inclusion of Liquid Crystal Displays (LCDs) in this list took place. Research shows that LCDs contain a number of substances, some of which are suspected to be cancerogenic. In addition, it was shown that the thermal treatment of LCDs might lead to the formation of toxic compounds. While some large manufacturers of liquid crystals made considerable efforts to prove that the waste management of their LCDs does not lead to risks for health or the environment, doubts remain regarding the composition of certain imported LCDs.

The Proposal introduces a permit requirement for establishments or undertakings carrying out treatment operations. This permit includes the treatment requirements and the requirements with regard to the treatment site. In addition, compliance with the re-use and recycling targets set out in **Article 6** is part of the permit.

Producers should have the possibility to set up centralised large-scale treatment plants in order to make recycling economically viable. As a consequence, **Article 5.5** stresses the possibility of undertaking treatment operation outside the Member State where the WEEE is generated.

Article 6 sets a standard for the recycling of WEEE. In general, recycling targets are considered necessary to avoid the limitation of recovery to incineration or the removal of a few valuable materials only, with the rest going to disposal operations. All targets foreseen in Article 6 reflect the state of the art of recyclers. This has been proven in a large pilot test[62] and was confirmed by specialised recyclers. In the course of the above mentioned pilot project, specific consideration was given to the assessment of the cost implications of achieving the recycling targets. For all concerned categories of WEEE, the respective costs corresponded to the average recycling costs generated in the other European Pilot Projects. This indicates that the achievement of the recycling targets does not involve specific extra costs.

The recycling targets of Article 6 merely refer to waste equipment which has been separately collected according to Article 4 of the Proposal. The re-use of components, not the re-use of whole appliances, contributes to the achievement of these targets.

In line with the principle of producer responsibility, producers of electrical and electronic equipment have the obligation to recycle as well as to dispose of the non-recoverable fractions. Producers could discharge their respective responsibility by leaving the actual work to third parties, which might be local municipalities or private enterprises.

Article 7 establishes the financing system for the management of WEEE. One aim of the financing system is to encourage consumers to return their equipment to collection points, rather than disposing of it through the ordinary municipal waste collection or other channels resulting in inappropriate treatment. It is clear from the pilot projects on WEEE that charging consumers with disposal costs at the point of return would have negative repercussions on the collection results[63]. Therefore, and in line with the principle of producer responsibility, producers have to finance the treatment, recovery and environmentally sound disposal of waste electrical and electronic equipment from private households. Their responsibility should start from designated collection points onwards.

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62 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.

63 Experience from all Austrian and German pilot projects ("Collection targets for waste from electrical and electronic equipment", European Commission 1998, p. 10.

In order to reduce costs for producers resulting from the management of waste from products put on the market before entry into force (historical waste) of this legislation, a transition period of five years after entry into force of the Directive is granted.

Important benefits might arise from financing systems, set up by companies individually for their products. However, it needs to be ensured that producers, engaged in individual systems, share the responsibility for the financing of the management of waste from products put on the market before entry into force of the financing obligation (historical waste). Therefore, it will be necessary that those producers, which are opting for an individual system, contribute a fair share to the financing of the management of historical waste in general.

Article 8: As regards electrical and electronic equipment not used by private households, the financing of the waste management needs to be agreed between the producer and the user of the equipment at the time of purchase.

Article 9 provides for information to be given to consumers, whose participation is of paramount importance for the functioning of collection schemes. A specific means of information is the marking of certain items of small electrical and electronic equipment to avoid disposal via the ordinary rubbish bin or a similar means of municipal waste collection.

Article 10 ensures that producers provide treatment facilities with information on the content of electrical and electronic equipment in order to facilitate the recycling of these appliances and to prevent negative impacts on the health of workers or the environment due to hazardous substances contained in electrical and electronic equipment. The information needed by treatment facilities should be provided on request of the recycler and might take the form of databases, manuals or information on the internet.

Article 11 stipulates that Member States have to provide the information needed to assess the success of this legislation and to estimate future arisings of WEEE.

Annex IA contains an exhaustive list of the categories of electrical and electronic equipment which are covered by the present Proposal.

Annex IB contains a list illustrating, for each of the categories, examples of products covered by the respective category.

Annex II lists the substances or preparations which have to be removed from separately collected WEEE for environmental reasons.

Annex III lays down certain minimum requirements as regards the conditions of WEEE storage and treatment sites.

Annex IV provides for the mark to be put on equipment which fits into dustbins or similar means of household waste collection.

Contents of the Proposal for a Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment

Article 1 sets out the objective of the Directive.

Article 2 sets out the scope of the present Directive. This scope corresponds to the scope defined by Article 2 of the WEEE Directive.

Article 3 contains the definitions for the purposes of this Directive. The definition for electrical and electronic equipment is identical to the respective definition of the Directive on Waste Electrical and Electronic Equipment (WEEE). Also the definition of producer follows the concept of the above-mentioned Directive although it was adapted to the purposes of the term producer as used in Article 4.

Article 4 lays down the requirement to substitute the heavy metals – lead, mercury, cadmium and hexavalent chromium – as well as the brominated substances – PBDE (polybrominated diphenyl ethers), including in particular 5-BDE, 8-BDE and 10-BDE, and PBB (polybrominated biphenyls), as these substances cause significant environmental problems during the waste management phase. Exemptions for applications of these substances are granted in those cases where substitution is not feasible or the potential negative environmental and/or health impacts caused by substitution outweigh the environmental benefits of the substitution. The exemptions from the substance phase-out are listed in the Annex to the Directive.

Article 5 provides that the inserts included in this Annex should be modified by the Commission, assisted by the Article 18 Committee of Directive 75/442/EEC, according to technical progress and new scientific evidence. The Commission is to consult producers of electrical and electronic equipment before taking decisions on amendments of the Annex.

The Annex contains the list of applications, which are exempted from the substitution requirement in Article 4 of the Directive. The list needs to be regularly updated according to technical progress and new scientific evidence.

ANNEX I

Material specific reductions of environmental impacts through reprocessing[1]

	Process Energy saved (recycling vs. production of virgin material; GJ/tonne)	Air Emissions	Water Emissions	Solid Waste reduced (increased) (kg/tonne)	Comments
Glass	3.8	Generally lower	Generally lower	(25)	Process to finished container. Data for 100% virgin extrapolated as all glass-making uses some cullet.
Ferrous metal (tinplate)	13.5	Generally lower	Generally lower	278	Data for tinplate recycling up to production of new tinplate.
Aluminium	156	Generally lower (except HCl)	Generally lower	639	
Plastic LDPE	15.4	Generally lower (except CO_2)	little data	(93)	Incomplete data for reprocessing of LDPE; additional inherent energy saving of 47.7 GJ/tonne
Plastic HDPE	25.6	Generally lower	poor data, but may be higher	(184)	Incomplete data for reprocessing of HDPE; additional inherent energy saving of 47.7 GJ/tonne

[1] P.R. White, M. Franke, P. Hindle, Integrated Solid Waste Management: A lifecycle inventory, 1995, in: AEA Technology, Recovery of WEEE: Economic and Environmental Impacts, June 1997; The figures are indicative only and will vary with processes and equipment used. Results are per tonne of recycled material produced. The burdens of collecting and sorting the recovered material, and transporting it to reprocessors, are not included. Similarly, the diversion of the recovered material from landfill is not included in the solid waste savings.

ANNEX II

The impact of the Proposal on business - with special reference to small and medium-sized enterprises (SMEs)

Who will be affected by the Proposal?

Which sectors of business?

The sectors most likely to be affected by the proposed Directive are electronic component suppliers, equipment producers, electrical repairers and the waste collection and treatment industry. The effects on the waste collection and treatment industry will almost certainly be positive. The Directive will force an expansion of the treatment and recycling market and consequently boost the number of jobs in the sector. Depending to some extent on how the financing mechanism is set up, there is, however, the risk that producers will decide to establish their own collection and/or recycling systems to the detriment of the existing traditional recycling companies.

Which sizes of business (concentration of SMEs)?

Sectors such as producers of domestic appliances (Nace 29.7), computers and office equipment (Nace 30), telecom equipment (Nace 32.2), consumer electronics (Nace 32.3) and light bulbs (Nace 31.5) are dominated by just a few firms that typically account for 80% of turnover and jobs in the sector. Nevertheless, there are still over 100 000 companies in the electronics industry that employ less than 20 people each but account for 180 000 jobs out of total of 1.4 million jobs in the sector. The electronic components sub-sector (Nace 32.1) is less concentrated than the other sub-sectors with a substantial proportion of jobs and turnover accounted for by SMEs.

Are there particular geographical areas of the Community where these businesses are found?

Metal recyclers are located in all Member States.

Manufacturers of electrical and electronic equipment are mainly located in Germany, the United Kingdom, France, Italy, the Netherlands and Sweden.

What will business have to do to comply with the Proposal?

The measure is addressed to the Member States. Business will have to comply with the national legislation implementing this measure.

Business involved in the production of electrical and electronic equipment will have to include waste management considerations into the design and production of the equipment. These waste management considerations include the use of easily recyclable/recoverable materials, the control of hazardous substances, the use, where feasible, of recycled materials and of common component and material coding standards. In certain cases they will have to substitute heavy metals, such as mercury, lead, cadmium and hexavalant chromium as well as certain brominated flame retardants.

Undertakings or enterprises involved in the treatment of WEEE will have to fulfil a number of technical requirements laid down in Article 5 of the proposed WEEE Directive and the Annexes. Although it is difficult to predict precisely where investment will have to be concentrated across the sectors since there are vast differences in the structures and in the geographical location of the businesses, in some cases it is estimated that the investments to be made in order to comply with these requirements may be considerable. The real extent of these investments will also depend on whether national or regional legislation is already in place. Where such legislation exists, industry will more easily be able to comply with the requirements of the Proposal.

Establishments and operators carrying out treatment operations will also be required, in order to operate, to obtain an authorisation from public authorities.

What economic effects is the Proposal likely to have? (in particular on employment, investment and the creation of new businesses)

The internalisation of the waste management costs in the price of electrical and electronic products may lead to:

(1) changes in the sales of products;

(2) other effects, such as changes in the time of purchase, moves within price segments or loss of spending power.

Changes in the sales of products

A key factor when considering the possible effects of product price changes is whether the demand for the goods in question is elastic or inelastic. The work done by the consultancy KPMG suggests that the demand for a number of electronic goods, especially large white goods and several kinds of brown goods can be considered inelastic (refrigerators, washing machines, heating boilers, televisions and computers) given the types of price changes[1] that are likely to be involved (1-3%). In other words, over the long term the level of sales is not likely to be affected by these types of price changes.

For certain other products, mainly consumer electronics such as hi-fis or shavers, demand might be qualified as partially elastic. The maximum calculated loss of sales is 1-2% assuming an average price increase of 1%. This effect and the associated indirect cost is likely to diminish as economies of scale and innovation bring down the costs of separately collecting and treating WEEE.

Some other potential indirect costs

Increasing the product price may also lead to either an advanced or a postponed purchasing decision. The latter is likely, although probably only to a relatively small extent. Similarly, consumers might choose to shift between product price categories opting for cheaper and less performing models, thus lowering the standard of living of these consumers.

[1] The indicated percentages refer to the sum of collection and recovery costs.

Employment

Recycling of WEEE is labour-intensive. This has impacts on the costs of managing WEEE but produces significant benefits in the area of job creation. Accordingly, national governments presented their WEEE legislation as part of both environmental and social policy. In this context, various projects have shown that dismantling of WEEE is particularly suitable for the integration of the long-term unemployed and disabled people into the work force.

According to German practice, an annual turnover of €5 million should enable recycling companies to employ 30 people on a permanent basis and around 70 further people in associated enterprises. Based on a minimum collection amount of 4 kg WEEE per inhabitant a year, the overall recycling costs amount to €525 Mio throughout the EU. Accordingly, around 10 500 jobs could be created by recycling alone. Many more jobs will be created through the collection and the transportation of WEEE. On the basis of US studies on recycling and employment, an average of one job is created for 465 tonnes of processed material. Accordingly, the job-creation potential for recycling 6 million tonnes of WEEE is approximately 13 000 new jobs.

Does the Proposal contain measures to take account of the specific situation of small and medium-sized enterprises (reduced or different requirements)?

From the consultations with European associations of SMEs involved in the management of WEEE, the most important variable to take into consideration seems to be the time-span necessary to make the investments and develop the necessary environment-related skills. This time-span is estimated to be approximately six months for dismantling operators. The Proposal provides for a sufficient transitional period, since the Directive will have to be transposed by Member States 18 months after its entry into force.

Organisations consulted

List of business organisations consulted

Several international, European and national business organisations were consulted between 1994 and 1999 before finalising this Proposal. The international and European organisations include:

AEA (American Electronics Association)
AIE (Association Internationale des Entreprises d'Equipement Electrique)
APME (Association of Plastics Manufacturers in Europe)
CECED (Conseil Européen de la Construction Électrodomestique)
CEFIC (European Chemicals Industry Council)
CELMA (Federation of National Manufacturers Associations for Luminaires and Electrotechnical Components for Luminaires)
CPIV (Standing Committee of the European Glass Industries)
EACEM (European Association of Consumer Electronics Manufacturers)
ECTEL (European Telecommunications and Professional Electronics Industry)
EECA (European Electronic Component Manufacturers Association)
ELC (European Lighting Companies Federation)
EUROMETAUX (Association Européenne des Métaux)
EPTA (European Power Tool Association)
ETNO (European Public Telecommunications Network Operators' Association)

EUCOMED (European Confederation of Medical Devices Associations)
EUPC (European Plastics Converters)
EUROBIT (European Association of Manufacturers of Business Machines and Information Technology Industry)
EUROM (European Federation of Precision Mechanical and Optical Industries)
EUROPACABLE (European Conference of Associations of Manufacturers of insulated wires and cables)
EUPC (European Plastic Converters)
EURO COMMERCE (European Association of Consumer Electronics Manufacturers)
EVA (European Vending Association)
FEAD (Fédération Européenne des Activités du Déchet)
GPRMC (Groupement Européen des Plastiques Renforcés/Matériaux Composites)
ISWA (The International Solid Waste Association)
JBCE (Japan Business Council Europe)
ORGALIME (Liaison of European Mechanical, Electrical and Electronic Engineering and Metalworking)
TIE (Toy Industries of Europe)
UEAPME (Union Européenne de l'Artisanat et des Petites et Moyennes Entreprises)
UGAL (Union des Groupements de Commerçants Détaillants Indépendants de l'Europe)

ANNEX III

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ANNEX IV

Memorandum on scientific evaluation

regarding the substitution requirement set out in Article 4 of the Proposal for a European Parliament and Council Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment

The objective of this Memorandum is to present in summary form the hazard characteristics, the dose-response, the main routes of exposure, as well as the general estimates of risks of the substances falling under the requirement set out in Article 4(4) of the proposed Directive. The Memorandum presents also the contribution of WEEE to the general risks and the proposed strategy to reduce or eliminate such risks.

The substances under consideration have been evaluated by a number of national authorities or competent international institutions, like the WHO, IARC, OECD, etc. The risk assessment of the Commission is based on the risk assessments as well as scientific evaluation carried out by the responsible national and/or international authorities or institutions, adapted to the factual situation in the European Community and its Member States. It also takes into account the latest scientific information available on risks posed by these substances.

1. HAZARD IDENTIFICATION

Cadmium

Classification of cadmium and cadmium compounds is the following under Council Directive 67/548/EEC on the classification and labelling of dangerous substances:

R20/21/22: Harmful by inhalation, ingestion or in contact with skin (most cadmium compounds).

R23/25: Toxic by inhalation and if swallowed (certain cadmium compounds).

R33: Danger of cumulative effects (certain cadmium compounds).

R40: Possible risks of irreversible effects (certain cadmium compounds).

R45: May cause cancer (cadmium chloride).

R49: May cause cancer by inhalation (cadmium oxide).

Lead

Classification of lead and lead compounds is the following under Council Directive 67/548/EEC on the classification and labelling of dangerous substances:

- R20/22 : Harmful by inhalation and if swallowed

- R33 : Danger of cumulative effects

- R 61: May cause harm to the unborn child

- R 62: Possible risk of impaired fertility

- Toxic to reproduction, category 1 under Council Directive 67/548/EEC (Annex 6)

Mercury

Classification of mercury and mercury compounds is the following under Council Directive 67/548/EEC on the classification and labelling of dangerous substances:

Mercury compounds are classified as:

- R23/24/25: Toxic by inhalation, in contact with skin and if swallowed

- R33: Danger of cumulative effects

Mercury alkyls and inorganic compounds of mercury are classified as:

- R26/27/28: Very toxic by inhalation, in contact with skin and if swallowed

- R33: Danger of cumulative effects

Chromium VI

Classification of chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex, is the following under Council Directive 67/548/EEC on the classification and labelling of dangerous substances:

– Carcinogenic, Category 2 under Council Directive 67/548/EEC (Annex 6)

– R49: May cause cancer by inhalation

– R43: May cause sensitisation by skin contact

– R50/53: Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

PBB and PBDE

PBB, penta-, octa- and decaBDE are not classified under Council Directive 67/548/EEC on the classification and labelling of dangerous substances.

2. DOSE (CONCENTRATION) - RESPONSE (EFFECT) ASSESSMENT

2.1 Adverse effects on human health

Scientific evidence suggests that cadmium, lead and mercury do not have any known useful function in biological organisms.

Cadmium

Cadmium bioaccumulates in the human body and especially in the kidneys, bones and blood, thereby reinforcing its inherent toxicity. It has an elimination half-live of 10-30 years. The main reported health effects are renal dysfunction, growth disturbances, skeletal damage and reproductive deficiencies. Cadmium is also suspected to cause liver, lung and prostate cancer. The International Agency for Research on Cancer ("IARC") has classified cadmium as a human carcinogen (category I under IARC).

The World Health Organisation (WHO) has established a provisional tolerable weekly intake for cadmium of 7µg/kg body weight (approximately 70 µg per day for an adult).

Lead

Lead is a cumulative general poison with pregnant women, the foetus, infants, and children up to 6 years of age being the most susceptible subgroups to adverse health effects (WHO 1995, WHO 1996). Lead can cause damage to both the central and peripheral nervous systems of humans. Effects on the endocrine system have also been observed. Lead can have negative effects on several systems in the human body, especially the nervous system, blood system and kidneys. Furthermore, lead is a probable human carcinogen as there is sufficient evidence from experiments on animals.

In 1986, the WHO established a "*Provisional tolerable weekly intake*" (PTWI) for children of 25 µg/kg body weight. Children having a lead intake exceeding this value are therefore exposed to a concentration likely to cause health injuries. The PTWI for adults was in 1992 reduced by the WHO from 50 µg/kg body weight to 25 µg/kg body weight (as for children) based on the objective of protecting children at the embryonic stage.

As stated in the opinion of the Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) dated 5 May related to the "lead Danish notification", there is inadequate scientific data to demonstrate conclusively what is a safe blood level for lead. Young children are considered at risk. In young children, subtle effects have been reported below 100 µg/l blood. The CSTEE will review this further in a subsequent opinion.

Mercury

In humans mercury may affect especially the brain, such as those parts that control sight, co-ordination and balance. It has been shown that in pregnant women methylated mercury can be transmitted through the placenta to the embryo, whereby the child may in serious cases be born with brain injuries and be mentally disabled.

The WHO has established a "*Provisional tolerable weekly intake*" (PTWI) at 5 µg/kg body weight for mercury, of which not more than 3.3 µg may be methylated mercury.

PBB and PBDE

The lower brominated technical PBDE compounds show effects above all on the liver but also on thyroid hormone and affect the behaviour of experimental animals. They occur widely in the environment, in human blood and in mother's milk. The highly brominated compounds included in technical octaBDE and decaBDE are persistent, have effects on reproduction and can cause tumour formation in the liver. There are scientific data which support the assumption that these compounds can be transformed into lower-brominated compounds.

Lower brominated PBB compounds are highly toxic and produce effects resembling those of chlorinated dioxins and PCB. Just as with PBDEs, there are grounds to believe that decaBB, the technically used PBB compound, can be transformed into lower-brominated biphenyls, which are equally toxic. It has been demonstrated that PBDEs may also act as endocrine disrupters.

In the case of pentaBDE and octaBDE, the highest exposure in animal experiments which has not given rise to harmful effects (NOAEL) is, for rats and rabbits, 1-2 mg/kg per day.

2.2 Adverse effects on the environment

Cadmium

The effects of cadmium on terristica and aquatic animals include acute as well as chronic toxicity. The most important signs of cadmium poisoning of mammals are anaemia, reduced productivity, enlarged joints, shabby fur, reduced growth along with lever and kidney injuries. Fish exposed to high concentrations of cadmium quickly develop lack of calcium and low haemoglobin concentration in the blood. Toxic effects on micro-organisms with growth inhibition are found for cadmium concentration down to approximately 0.25 mg/l.

Lead

Lead accumulates in the environment and has high acute and chronic toxic effects on plants, animals and micro-organisms. Toxic effects on micro-organisms are observed down to lead concentration of approximately 1 mg/l. Lead does not appear to bioconcentrate significantly in fish but does so in some shellfish, such as mussels.

Mercury

Animals regularly used in the food chain may be specially exposed to mercury poisoning due to the ability of mercury to accumulate in organisms through the food chain. The risk has in particular been high for birds. Mercury poisoning is considered to be the reason that several species of birds were close to extinction. Birds feeding in aquatic environments will probably be exposed to critical loads of mercury. A Swedish scientific study concludes that mercury concentrations in soil 2-10 times the present level is likely to affect the biological decomposition activity in the soil.

Brominated Flame retardants

The lower brominated technical PBDE compounds, containing mostly pentaBDE, are persistent, bio-accumulative and toxic in the aquatic environment. PentaBDE are persistent, both microbially and abiotically in water and air. Tetra- and pentaPBDEs in particular have a high potential for bio-accumulation, with a bio concentration factor of between 5,000 and 35,000. No significant bio-accumulation has been demonstrated regarding octaBDE and decaBDE. Octa- and decaBDE are persistent, both microbially and abiotically in water and air. Successive debromination in UV light and sunlight has, however, been demonstrated for decaBDE.

3. EXPOSURE ASSESSMENT

It should be underlined that scientific data on exposure is not always available for all of the Community. However, there is no indication of significant differences of exposure to human health and the environment.

Cadmium

People are exposed to cadmium by intake of contaminated food or inhalation of cadmium particles. The latter is especially known to happen during occupational exposure. Industrialised countries have particularly high cadmium intake among the general population. Studies have shown that in some countries, such as Belgium, approximately 10% of the general population have body concentrations of cadmium sufficient to cause renal dysfunctions. Studies have shown that cadmium concentrations in agricultural soil, wheat and human bones and kidneys have increased significantly during the last century. Lower cadmium concentrations with longer periods of exposure can cause chronic cadmium poisoning, resulting in a series of physiological dysfunctions. Based on surveys which have involved more than one thousand persons during a 10 years period, a recent study (Staessen et alter, April 1999) has confirmed that *low to moderate exposure* to cadmium is associated with *skeletal demineralisation***.** This leads to increased bone fragility and risk of fractures.

Lead

The major sources of lead intake for humans are food, soil and dust. Food receives lead mainly by atmospheric deposition of lead on plants, but to a minor extent also by plant absorption of lead from the soil. Soil will naturally contain low levels of lead, but lead emissions of many years have added to the levels observed.

Lead may enter the environment during its mining, ore processing, smelting, refining use, recycling or disposal. Generally, the initial means of entry is via the atmosphere. Lead may also enter the atmosphere from the weathering of soil and volcanoes, but these sources are minor compared with anthropogenic ones. The form of lead that enters the atmosphere is not determined. However metallic lead may be released from smelting and refining plants. If released or deposited on soil, lead will be retained in the upper 2-5 cm of soil, especially soils with at least 5% organic matter or a pH 5 or above. Leaching is not important under normal conditions although there is some evidence to suggest that Pb is taken up by some plants. Generally, the uptake of Pb from soil into plants is not significant. It is expected to slowly undergo speciation to the more insoluble sulphate, sulphide, oxide, and phosphate salts. Lead enters water from atmospheric fallout, runoff or wastewater; little is transferred from natural ores. Lead is a stable metal and adherent films of protective insoluble salts form that protect the metal from further corrosion.

In its recent opinion, the CSTEE notes that the progressive ban on the use of lead in petrol has reduced the airbone lead and is considered to be a primary reason for the lowering in lead blood levels in children and adults.

Mercury

Environmental methylmercury arises largely, if not solely, from the methylation of inorganic mercury. Inorganic mercury spread in the water is transformed to methylated mercury in the bottom sediments. Methylated mercury compounds are liposoluble and are therefore easily accumulated in living organisms and concentrated through the food chain. The general

population is primarily exposed to methylmercury through the diet. Methylated mercury accumulates in the body. Air and water, depending upon the level of contamination, can also contribute significantly to the daily intake of total mercury. Fish and fish products are the dominant source of methylmercury in the diet. The content of methylated mercury in fish varies with the position of the species in the food chain and the mercury contamination of the habitat of the individual fish. Levels greater than 1200 μg/kg have been found in the edible portions of shark, swordfish, and Mediterranean tuna. Similar levels have been found in pike, walleye, and bass taken from polluted fresh waters. The level of mercury in fish, even for humans consuming only small amounts (10-20 g of fish/day) can increase the intake of methylmercury. The consumption of 200 g of fish containing 500 μg mercury/kg will result in the intake of 100 μg mercury. This amount is half of the recommended provisional tolerable weekly intake (WHO 1989).

PBB and PBDE

The presence of Polybrominated Biphenyls (PBBs) in Arctic seal samples indicates a wide geographical distribution. The principal known routes of PBBs from point sources into the aquatic environment are PBBs plant areas and waste dumps. PBBs are almost insoluble in water and are primarily found in sediments of polluted lakes and rivers. Once they have been released into the environment, they can reach the food chain, where they are concentrated. PBBs have been detected in fish from several regions. Ingestion of fish is a source of PBB transfer to mammals and birds. Neither uptake nor degradation of PBBs by plants has been recorded. In contrast, PBBs are easily absorbed by animals and though they have been found to be very persistent in animals, small amounts of PBB metabolites have been detected.

Just as with PBDEs, human and environmental exposure can occur in connection with the use of products, in the recycling of plastics containing PBBs and after disposal to landfills. Emission is probably slow, but PBBs can be released after degradation of PBB-bearing material.

PentaBDE occur widely in environmental samples from sediment and biota. Monitoring data from the Baltic and elsewhere suggest higher concentrations of lower-brominated PBDEs higher up in the food chains.

Generally, humans are most probably exposed to PBDEs through similar exposure routes as many neutral lipophilic organohalogen compounds, such as PCB congeners and DDT-related compounds, with food as the major source. Inhalation of particulate bound PBDEs in certain occupational settings may, however, also contribute to human exposure, whereas gaseous phase exposure to PBDEs probably is of minor importance because of the low vapour pressures of these compounds. There are indications that diet is another exposure source for PBDEs.

Chromium VI

Less information is available on exposure from chromium (VI) compared to the targeted heavy metals (lead, cadmium, mercury). However, the hazard profile of chromium (VI) raises even more concerns than those related to lead, cadmium and mercury. It is, therefore, suggested to adopt for chromium (VI) the same risk reduction approach as for the other targeted substances.

4. RISKS CHARACTERIZATION

Cadmium

The World Health Organisation (WHO) has established a provisional tolerable weekly intake for cadmium of 7µg/kg body weight (approximately 70 µg per day for an adult). Average daily intakes vary considerably, from 10 to 40 µg to several hundreds of µg in highly polluted regions. This level of exposure does not appear to be acceptable according to a Scandinavian study (Health effects of cadmium exposure – a review of the literature and a risk estimate, 1998). In the Swedish study it is stated that an average intake of 70 µg per day would have the following effects: 7% of the adult general population and up to 17% of high risk groups, such as women with low iron stores, would be expected to develop cadmium-induced kidney lesions. Even 30 microgram as an average daily intake could provoke renal tubular damage to 1% of the population and up to 5% of special groups at risk. According to that study, about 10-40% of Swedish women of child-bearing age are reported to have empty iron stores (S-ferritin<12 µg/l) and would thus fall under special population groups at risk.

Lead

In 1986, the WHO established a "*Provisional tolerable weekly intake*" (PTWI) for children of 25 µg/kg body weight. Children having a lead intake exceeding this value are therefore exposed to a concentration likely to cause health injuries. The PTWI for adults was in 1992 reduced by the WHO from 50 µg/kg body weight to 25 µg/kg body weight (as for children) based on the objective of protecting children at the embryonic stage. In addition, it can not be demonstrated that there is a safe blood level for lead, in particular for children.

In the general non-smoking adult population and older children, the major source of lead is food with an estimated intake of around 10 µg/day (WHO 1995). In Denmark, the estimated average dietary intake for adults (1988-1992) was 27 µg/day with the 95 percentile being 46 µg/day (LST 1995). The dietary intake has decreased during the recent 5-year period (1993-1997) (VFD unpublished results) but it can not be excluded that certain groups stay at risks.

The CSTEE notes, in its recent opinion, that recent blood lead level measurements in children in the Netherlands indicate that for approximately 3.3% of children between 1 and 12 years the 100 µg/l value is exceeded. In addition, the CSTEE has stated that there are epidemiological data on health effects of lead in children indicating that even below a blood lead level of 100 µg/l, adverse effects might occur. The CSTEE will review in the future the appropriateness of the existing WHO value.

Mercury

The WHO has established a "*Provisional tolerable weekly intake*" (PTWI) at 5 µg/kg body weight for mercury, of which not more than 3.3 µg may be methylated mercury. The intake of mercury by food has been estimated by the Danish National Food Agency at approx. 55 µg/week (about 0.8 µg/kg body weight) for the average Dane. Although this means that the average Dane would not be at risk, it has been estimated that for pregnant women the margin of safety is not sufficient.

PBB and PBDE

High concentrations of tetra- and pentaBDEs have been observed in freshwater fish, such as pike, perch and eel. In Swedish mother's milk the concentration has been rising exponentially since the 1970s. OctaBDE have been measured in indoor air on premises containing flame-retarded electronic apparatus such as computers and television receivers. Elevated blood concentrations of OctaBDE have been shown in occupational categories of people handling computers.

In the case of pentaBDE and octaBDE, the highest exposure in animal experiments which has not given rise to harmful effects (NOAEL) is, for rats and rabbits, 1-2 mg/kg per day. It has to be noted, however, that these experimental animal data are not based on lifetime exposure, which would be a more realistic scenario to take into account for comparison with human exposure.

5. CONTRIBUTION OF WEEE TO THE GENERAL RISKS

5.1 Current use in EEE of the substances under examination

Cadmium

It is known that in Printed Circuit Boards cadmium occurs in certain components, such as SMD chip resistors, infrared detectors and semiconductors. Older types of Cathode Ray Tubes contain cadmium. Furthermore, cadmium has been used as stabiliser in PVC.

Lead

Between 1.5% and 2.5% of all lead applications are used in electrical and electronic equipment (EEE). Other main uses are batteries (63%), extruded products, such as pipes or construction products (9%), gasoline additives (2%), pigments, stabilisers in PVC and others. The main applications of lead in EEE include soldering of printed circuit boards, glass of cathode ray tubes, soldering and glass of light bulbs and fluorescent tube.

The cathode ray tubes of a personal computer contain about 0.4 kg lead in glass, a TV set about 2 kg lead. The lead oxide in these tubes constitutes the largest share of lead in WEEE. In cathode ray tubes lead is present in the form of silicates. A light bulb contains between 0.3 and 1 g of lead in lead-tin solder and 0.5 to 1 g of lead silicates in the glass (on average 1.5 g lead in solder and glass). In Sweden this application amounts to the use of about 100 t of lead annually. Solders in printed board assemblies contain about 50 g/m^2.

Mercury

The global man-made release of mercury to the atmosphere is approximately 2000-3000 tonnes per year. It is estimated that of the yearly world consumption of mercury 22% is used in EEE. Mercury is basically used in thermostats, sensors, relays and switches (e.g. on Printed Circuit Boards and in measuring equipment and discharge lamps). Furthermore, it is used in medical equipment, data transmission, telecommunications, and mobile phones. In the EU, 300 tons of mercury are used in position sensors alone.

PBDE and PBB

Brominated flame retardants are today regularly designed into electronic products as a means for ensuring flammability protection, which constitutes the main use of these substances. Polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs) account for approximately 1% and 9% respectively. The three groups of PBDEs, which are commercially available are penta-, octa- and decabromodiphenylether. The use is mainly in four applications: in printed circuit boards, in components, such as connectors, in plastic covers and cables. According to a Danish estimation, WEEE represents about 78% of the total content of brominated flame retardants in waste.

5.2 Problems associated with current management of WEEE

Hazardous substances in EEE will probably remain bound in the equipment during the use phase and, thus, will not contribute significantly to exposure. A potential contamination of the environment by use of these hazardous substances in EEW can take place during the production and waste phase.

During the production phase, a number of protection measures will need to be taken in order to reduce the exposure of workers to heavy metals.

Today, more than 90% of WEEE is landfilled, incinerated or shredded without any pre-treatment. This leads to a considerable emission of the targeted substances into the environment. Usually small WEEE, which can be disposed of with the ordinary household waste, goes directly to incineration or landfill. The share of these waste management options differs largely between the Member States (Denmark 90% incineration, 10% landfill; Greece 100% landfilling).

Incineration of WEEE

The incineration of WEEE makes a large contribution to the total lead emissions from incinerators. Lead from WEEE represents about 50% of the lead input in incinerators.

After incineration, 65% of the lead is found in the slags, 35% in the residues and 1% in the air.

- Recent studies estimate that emissions from waste incineration account for 36 tonnes per year of mercury and 16 tonnes per year of cadmium in the Community.

- Due to the heavy metal content of WEEE significant amounts of slags have to be qualified as hazardous. Consequently, the slag has to be landfilled in hazardous waste landfills. Non-contaminated slag could be used as construction material.

- Due to a high contamination with heavy metals, fly ashes and residues, which are generally mixed, have to be disposed of in controlled landfills. A dispersion of heavy metals into the environment is therefore possible.

The upcoming Directive on the incineration of waste (Common Position 7/2000 of 25 November 1999) provides for stringent emission limit values, which should lead to a significant reduction of emissions of various pollutants into the atmosphere. It replaces Directive 89/369/EEC of 8 June 1989 on the prevention of air pollution from new municipal waste incineration plants and Directive 89/429/EEC of 21 June 1989 on the reduction of air

pollution from existing municipal waste-incineration plants. However, the more emissions are reduced the more the concentration of pollutants in the bottom ash, the fly ash and the flue gas cleaning residues will increase. The presence of these pollutants in the residues create both waste management problems as well as a possible dissemination of the pollutants in the environment increasing therefore the risks of exposure to these substances. In its recent opinion, the CSTEE notes that the lead contaminated slags and bottom ash may be required to be landfilled. This creates the potential for slow leaching. Although impacts are likely to be small, they can influence attainment of sustainability goals. The CSTEE point also out that the question of sustainability with regard to fly ashes must be tackled.

The introduction of (small) WEEE into incinerators results in high concentrations of metals, including heavy metals, in the slag, in the flue gas or in the filter cake[1]. According to a Dutch study[2], almost all of the bottom ash produced in the Netherlands (around 600 000 tonnes in 1995) is disposed of in the road building sector where it is used as filling material. To be used in an environmentally safe way, the bottom ash has to meet certain technical requirements, in particular leaching requirements. Even where bottom ashes containing certain concentrations of heavy metals are specifically cleaned, they can only be used as construction material with additional environmental safety requirements. It has been calculated that if small white and brown goods were no longer incinerated with the rest of the waste, the content of copper, lead, nickel and other metals could be reduced to such an extent that the bottom ashes would fall within the Dutch leaching requirements and could therefore be recycled in construction works.

Brominated Flame Retardants

There is a large body of literature that shows that polybrominated dibenzofurans and dibenzo-p-dioxins can be formed from PBDEs and PBBs under certain combustion/pyrolysis conditions. At temperatures of about 300˚C the dioxin formation is maximal. However, data from municipal waste incinerators in the Netherlands did not show any significant relationship between dioxin formation and the bromine content of the waste. However, further research is necessary in order to assess this issue. In particular, further assessment should be carried out in order to assess the threshold above which the content of halogenated substances would influence the formation of dioxins. In addition, the issue of dioxins formation during the recycling of brominated flame retardants is described later in this document.

Landfilling of WEEE

Due to the variety of different substances contained in WEEE, adverse environmental effects occur during landfilling of these wastes. The above pollutants disposed of with municipal waste under the condition of entering rainwater as well as the various chemical and physical processes are potentially leached out. It goes without saying that environmental impacts are

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1 As an example small WEEE are the source of 40% of the copper content of Municipal Solid Waste Incineration bottom ash (Compare Modelmatige analyse van integraal verbranden van klein chemisch afval en klein wit- en bruingoed (Netherlands 1996), TNO rapport voor VROM/DGM (Directie Afvalstoffen)). One of the main problems linked to an increased copper content of the slag of incinerators is the difficulty to recover these slags as a secondary building material in an environmentally responsible way. Further data on the content of heavy metals in the slag, flue gas, filter cake and fly ash are given in "Messung der Güter- und Stoffbilanz einer Müllverbrennungsanlage" (Wien 1994), Umweltbundesamt and MA 22.

2 Netherlands 1996, TNO rapport voor VROM/DGM (Directie Afvalstoffen).

considerably higher when WEEE is put on uncontrolled landfills, which still takes place to a significant extent in certain Member States[3].

Leaching of mercury takes place when certain electronic devices, such as circuit breakers, are destroyed. When brominated flame retarded plastic or cadmium containing plastics are landfilled, both polybrominated diphenylethers (PBDEs) and cadmium may leach into the soil and groundwater. PBBs have been found to be 200 times more soluble in a landfill leachate than in distilled water. This may result in a wider distribution in the environment. It had been found that significant amounts of lead ions are dissolved from broken lead containing glass, such as the cone glass of cathode ray tubes, by the acidic groundwater often found in landfills. Therefore, contamination by lead from cone glass in landfills is likely. As regards mercury, not only the leaching of mercury poses specific problems. The vaporisation of metallic mercury and dimethylene mercury, both part of WEEE, is also of concern. In this context, it had been calculated that the total annual emissions of mercury from landfills in Sweden are about 9 tonnes. This represents more than 10% of the total air mercury emissions and therefore contributes significantly to the exposure to mercury.

Leachate collection and treatment of controlled landfills respecting environmentally sound technical standards, such as those set out in Directive 99/31/EC, does not completely eliminate exposure nor does it solve all the problems either. High standard landfills dispose of leachate collection and bottom sealing systems. In these cases the leachate is collected and sent to treatment plants on site or to municipal sewage treatment plants. In the worse case the heavy metals may disturb the cleaning process, but in any case they will mainly end up in the sewage sludge and in smaller but uncontrollable amounts in surface waters. The sewage sludge will either be used on agricultural land (if, among other conditions the limit values of the EC sewage sludge Directive - Council Directive 86/278/EEC of 12 June 1986- are not exceeded) or go to landfill or incineration. As regards the landfilled sewage sludge, similar problems regarding the emissions of landfill will occur since exposure from landfills can not be completely eliminated.

Apart from the situation relating to the management of controlled landfills, it has to be underlined that a number of landfill sites do not apply best available technologies concerning emission controls. It is not likely that the majority of uncontrolled landfill sites is completely replaced, in the short and middle term, by high standards landfill sites in all parts of the Community.

In the case of uncontrolled landfills contaminated leachate goes directly to the soil, groundwater and surface water. Leachate containing the above pollutants from uncontrolled landfills might contaminate water to an extent that its use as drinking water is impossible on the basis of the limits set out in Council Directive 80/778/EEC relating to the quality of water intended for human consumption.

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[3] As an example the total number of landfills in Greece is approximately 5,000. It is estimated that around 70% of the landfills are considered to be uncontrolled (Conference for the planning of waste management, Greece 16-17 January 1997). In Portugal the number of uncontrolled landfills is approximately 300 (Conference for the planning of waste management, Portugal 23-24 January 1997). It should also be noted that the situation is even more critical in most candidate countries for accession to the European Union.

Brominated Flame Retardants

Although leaching of the compounds from plastics on a short-term scale is small, the compounds will sooner or later be released from the plastic, at least at the rate the plastic is degraded. The time scale of the exposure scenario can therefore reach hundreds of years. In the context of this long-term exposure scenario, the key question is whether the compounds are degraded before they will end up in the leachate. As some of the compounds are persistent in the environment long term diffuse emissions from landfills are likely. It is important to note that PBBs have been found to be 200 times more soluble in a landfill leachate than in distilled water; this may result in a wider release into the environment.

Recycling of WEEE

Heavy metals

Hazardous emissions to the air result from the recycling of WEEE containing heavy metals, such as lead, mercury and cadmium, in steelworks and lead-copper smelters. Contaminated metal scrap increases significantly the emissions of these heavy metals, in particular mercury and cadmium, which are highly volatile. Filters, which might prevent such emissions are not technologically the state of the art, in particular as regards steelworks.

Brominated Flame Retardants

Both dioxins and furans are generated as a consequence of recycling the metal content of WEEE, which also contain halogenated plastics. Halogenated substances contained in WEEE, in particular brominated flame retardants, are also of concern during the extrusion of plastics, which is part of the plastic recycling. This is due to the fact that during recycling of plastics containing brominated flame retardants, brominated dibenzofurans and brominated dibenzo-p-dioxins may be formed. Various studies suggest that the risk of generation of dioxins is a reason for the complete lack of recycling of plastics containing brominated flame retardants.

It has been demonstrated that personnel at an electronics-dismantling plant showed significantly higher levels of all PBDE congeners in their serum compared to a control group. The results of a Swedish study showed that decaBDE is bioavailable and that occupational exposure to high levels of PBDEs occurs at the electronics-dismantling plant. It could be argued that special protective measures could be implemented in order to address these occupational health problems. It is unlikely, however, that such measures sufficiently eliminate the exposure of workers. In addition, the coherent enforcement of such measures in all parts of the Community cannot be ensured.

6. RISK REDUCTION STRATEGY BY SUBSTITUTION

This strategy is based on the current scientific risk assessments available and will be reviewed on the basis of future scientific developments.

Alternatives to the substitution

Various health and environmental exposure problems linked to the current management of WEEE could be reduced by means of a diversion of these wastes away from landfills and incinerators. This could be achieved by setting up separate collection, treatment and recovery

schemes for WEEE. However, at this stage, it is unclear when collection rates will be achieved, which represent a substantial part of electrical and electronic equipment put on the market. In the meanwhile, in particular small WEEE will continue to be found in the current disposal routes. In addition, even if WEEE were collected separately and submitted to recycling processes, their content of heavy metals, PBB and PBDE poses risks to the health or the environment. Therefore, the substitution of those substances, which are most problematic in the waste management phase, is the most effective way of ensuring a significant reduction of risks to the health and the environment related to these substances.

It has been suggested by producers of brominated flame retardants that the health risks related to the extrusion of plastics containing PBB and PBDE could be avoided by strengthened worker protection measures in the recycling installations. As an example it was recommended that workers carry protection masks. While these kind of measures should be supported in any case, there are experiences which show that such measures cannot be strictly applied throughout the recycling installations in the European Union and that these measures could not substantially reduce or eliminate the possible adverse effects related to brominated flame retardants. Clearly, the substitution of the concerned substances would provide the best protection of the concerned workers.

Proportionality

The substitution of the targeted substances lead to clear positive environmental effects. A number of manufacturers have already phased out lead, mercury, cadmium, hexavalent chromium and halogenated flame retardants in many uses. This suggests that the costs of doing so are - at least for applications not contained in the exemption list - quite limited. Acceptance for the substitution of PBB and pentaBDE was even marked by the producers of these substances, united in the European Brominated Flame Retardant Industry Panel (EBFRIP). In addition, the members of the German Association of Chemical Industries voluntarily stopped the production of PBDE s and PBBs as early as 1986, while leading European companies in the electric and electronic industry have proclaimed an official policy of avoiding PBDEs and PBBs in their products. Along these lines the last European manufacturer of PBB stopped its production in the year 2000.

The only area where substitution problems have been claimed by the industry concerns lead in solders. The technical and economic viability of substitution of lead in solders has been confirmed by practical experience of manufacturers who have already started to substitute lead in solders of their products. It is therefore the opinion of the Commission that a phase out of lead-containing solders is possible at reasonable cost within the given time frame of 1 January 2008.

For reasons of proportionality, applications of the targeted substances, where substitutes are not yet available or where the negative environmental impacts caused by substitution outweigh the possible environmental benefits derived thereof, are exempted from the substitution requirement or could be exempted by way of a committee procedure.

Substitutes

The targeted hazardous substances are already competing against other safe or less dangerous materials for a large number of applications. Substitutes of these hazardous substances already exist for most applications.

Substitutes to the targeted hazardous substances do have a less hazardous profile than these substances. Technical reasons (product quality, standards, testing requirements, etc.) and economic grounds (higher costs) currently prevent their general substitution.

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2000/0158 (COD)

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on waste electrical and electronic equipment

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

Having regard to the proposal from the Commission[1],

Having regard to the opinion of the Economic and Social Committee[2],

Having regard to the opinion of the Committee of Regions[3],

Acting in accordance with the procedure laid down in Article 251 of the Treaty[4],

Whereas:

(1) The objectives of the Community's environment policy are, in particular, to preserve, protect and improve the quality of the environment, protect human health and utilise national resources prudently and rationally. That policy is based on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay.

(2) The Community programme of policy and action in relation to the environment and sustainable development ("Fifth Environmental Action Programme")[5] states that the achievement of sustainable development calls for significant changes in current patterns of development, production, consumption and behaviour and advocates, *inter alia*, the reduction of wasteful consumption of natural resources and the prevention of pollution. It mentions waste electrical and electronic equipment (WEEE) as one of the target areas to be regulated, in view of the application of the principles of prevention, recovery and safe disposal of waste.

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1 OJ C

2 OJ C

3 OJ C

4 Opinion of the European Parliament of ... . (OJ C ....), common position of the Council of ... ... (OJ C ...) and Decision of the European Parliament of ... ... (OJ C ...), ...

5 OJ C 138, 17.5.1993, p. 5.

(3) The Commission Communication of 30 July 1996 on review of the Community strategy for waste management[6] states that, where the generation of waste cannot be avoided, it should be reused or recovered for its material or energy.

(4) The Council, in its Resolution of 24 February 1997 on the Community strategy for waste management[7], invited the Commission to develop, as soon as possible, an appropriate follow-up to the projects of the priority waste streams programme, including WEEE.

(5) The European Parliament, in its Resolution of 14 November 1996[8] asked the Commission to present proposals for Directives on a number of priority waste streams, including electrical and electronic waste, and to base such proposals on the principle of producer responsibility. The European Parliament, in the same Resolution, requests the Council and the Commission to put forward proposals for cutting the volume of waste.

(6) Council Directive 75/442/EEC of 15 July 1975 on waste[9], as last amended by Commission Decision 96/350/EC[10], provides that specific rules for particular instances or supplementing those of Directive 75/442/EEC on the management of particular categories of waste may be laid down by means of individual Directives.

(7) The amount of WEEE generated in the Community is growing rapidly, the content of hazardous components in electrical and electronic equipment is a major concern during the waste management phase and recycling of WEEE is not undertaken to a sufficient extent.

(8) The objective of improving the management of WEEE cannot be achieved effectively by Member States acting individually. In particular, different national applications of the producer responsibility principle lead to substantial disparities in the financial burden on economic operators. Having different national policies on the management of WEEE hampers the effectiveness of national recycling policies.

(9) The provisions of this Directive should apply to products and producers irrespective of the selling technique, including distance and electronic selling.

(10) This Directive should cover all electrical and electronic equipment used by consumers and electrical and electronic equipment intended for professional use which are likely to end up in the municipal waste stream. This Directive should apply without prejudice to Community legislation on safety and health requirements and specific Community waste management legislation, in particular Council Directive 91/157/EEC of 18 March 1991 on batteries and accumulators containing certain dangerous substances[11], as amended by Commission Directive 98/101/EC[12].

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6 COM(96) 399 final.
7 OJ C 76, 11.3.1997, p. 1.
8 OJ C 362, 2.12.1996, p. 241.
9 OJ L 194, 25.7.1975, p. 39.
10 OJ L 135, 6.6.1996, p. 32.
11 OJ L 78, 26.3.1991, p. 38.
12 OJ L 1, 5.1.1999, p. 1.

(11) 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[13].

(12) Separate collection is the precondition to ensure specific treatment and recycling of WEEE and is necessary to achieve the chosen level of protection of human and animal health and the environment in the Community. Consumers have to actively contribute to the success of such collection and should be encouraged to return WEEE. For this purpose, convenient facilities should be set up for the return of WEEE, including public collection points, where private households should be able to return their waste free of charge.

(13) A collection target for WEEE used by private households should be fixed in order to attain the chosen level of protection and harmonised environmental objectives of the Community and more specifically to ensure that Member States strive to set up efficient collection schemes.

(14) Specific treatment for WEEE is indispensable in order to avoid the dispersion of pollutants into the recycled material or the waste stream. Such treatment is the most effective means of ensuring compliance with the chosen level of protection of the environment of the Community. Recycling facilities should comply with certain minimum standards to prevent negative environmental impacts associated with the treatment of WEEE.

(15) A high level of recovery, in particular re-use or recycling, should be achieved and producers encouraged to integrate recycled material in new equipment.

(16) Basic principles with regard to the financing of WEEE management have to be set at Community level and financing schemes have to contribute to high collection rates as well as to the implementation of the principle of producer responsibility. In order to achieve the benefits of the producer responsibility concept most efficiently, producers should be encouraged to fulfil their responsibility individually, provided that they contribute to the financing of the management of waste from products put on the market before the entry into force of the financing obligation introduced by this Directive.

(17) Users of electrical and electronic equipment from private households should have the possibility of returning WEEE free of charge. Producers should therefore finance the treatment, recovery and disposal of WEEE. In order to reduce costs for producers resulting from the management of waste from products already on the market ("historical waste"), a transitional period should be laid down. The responsibility for the financing of the management of historical waste should be shared by all existing producers and fulfilled through either individual or collective systems. Collective systems should not have the effect of excluding niche and low-volume producers, importers and new entrants.

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13 OJ C 136, 4.6.1985, p. 1.

(18) Information to users about the collection systems and their role in the management of WEEE is indispensable for the success of WEEE collection. Such information implies the proper marking of electrical and electronic equipment which could end up in rubbish bins or similar means of municipal waste collection.

(19) Information on treatment facilities provided by producers is important to facilitate the management, and in particular the treatment, of WEEE.

(20) Information about the numbers and weight of items of electrical and electronic equipment put on the market in the Community and the rates of collection and recycling of WEEE is necessary to monitor the success of collection schemes.

(21) Since the measures necessary for the implementation of this Directive are measures of general scope within the meaning of Article 2 of Council Decision 1999/468/EC of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission[14], they should be adopted by use of the regulatory procedure provided for in Article 5 of that Decision,

HAVE ADOPTED THIS DIRECTIVE:

Article 1

Objectives

The purpose of this Directive is, as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste. It also seeks to improve the environmental performance of all economic operators involved in the life cycle of electrical and electronic equipment and in particular operators directly involved in the treatment of waste electrical and electronic equipment.

Article 2

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.

[14] OJ L 184, 17.7.1999, p. 23.

Article 3

Definitions

For the purposes of this Directive, the following definitions shall apply:

(a) “electrical and electronic equipment” means equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields falling under the categories set out in Annex I A and designed for use with a voltage rating not exceeding 1000 Volt for alternating current and 1500 Volt for direct current;

(b) “waste electrical and electronic equipment” or “WEEE” means electrical or electronic equipment which is waste within the meaning of Article 1(a) of Directive 75/442/EEC, including all components, sub-assemblies and consumables, which are part of the product at the time of discarding;

(c) “prevention” means measures aimed at reducing the quantity and the harmfulness to the environment of WEEEand materials and substances contained therein;

(d) “re-use” means any operation by which WEEE is used for the same purpose for which it was conceived, including the continued use of WEEE which is returned to collection points, distributors, recyclers or manufacturers;

(e) “recycling” means the reprocessing in a production process of the waste materials for the original purpose or for other purposes, but excluding energy recovery;

(f) "energy recovery" means the use of combustible waste as a means of generating energy through direct incineration with or without other waste but with recovery of the heat;

(g) “recovery” means any of the applicable operations provided for in Annex II.B to Directive 75/442/EEC;

(h) “disposal” means any of the applicable operations provided for in Annex II.A to Directive 75/442/EEC;

(i) “treatment” means any activity after the WEEE has been handed over to a facility for depollution, disassembly, shredding, recovery or disposal and any other operation carried out for the recovery and/or the disposal of theWEEE;

(j) “producer” means any person who:

(i) manufactures and sells electrical and electronic equipment under his own brand, irrespective of the selling technique used, including distance and electronic selling,

(ii) resells under his own brand equipment produced by other suppliers, irrespective of the selling technique used, including distance and electronic selling, or

(iii) imports electrical and electronic equipment on a professional basis into a Member State;

(k) "distributor" means anyone who provides a product on a commercial basis to the party who is going to use that product;

(l) "WEEE from private households" means WEEE which comes from private households and from commercial, industrial, institutional and other sources which, because of its nature and quantity, is similar to that from private households;

(m) "dangerous substance or preparation" means any substance or preparation which has to be considered dangerous under Council Directive 67/548/EEC[15]or Directive 1999/45/EC of the European Parliament and of the Council[16].

Article 4

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 re-use and recycling of those components or whole appliances which might be re-used 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.

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15 OJ L 196, 16.8.1967, p. 1.
16 OJ L 200, 30.7.1999, p. 1.

Article 5

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 re-use 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[17].

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

Article 6

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 re-use 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 re-use 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 re-use 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 re-use 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 re-use 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, re-use and recycling for the years beyond 2008.

Article 7

Financing in respect 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.

   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.

Article 8

Financing in respect of WEEE from users other than private households

Member States shall ensure that the financing of the costs for the collection, treatment, recovery and environmentally sound disposal of WEEE from users other than private households is covered by agreements between the producer and the user of the equipment at the time of purchase.

Article 9

Information for users

1. Member States shall ensure that users of electrical and electronic equipment in private households are given the necessary information about:

   (a) the return and collection systems available to them,

   (b) their role in contributing to re-use, recycling and other forms of recovery of WEEE,

   (c) the meaning of the symbol shown in Annex IV.

2. Member States shall encourage consumers to contribute to collection, treatment and recovery of WEEE.

3. Member States shall ensure that, with a view to achieving a high rate of collection, producers appropriately mark electrical and electronic equipment which might normally be disposed of in rubbish bins or similar means of municipal waste collection with the symbol shown in Annex IV. In exceptional cases, where this is necessary because of the size or the function of the product, the symbol shall be printed on the packaging of the electrical and electronic equipment.

Article 10

Information for treatment facilities

Member States shall ensure that producers provide such information as is needed by treatment facilities to identify the different electrical and electronic equipment components and materials, and the location of dangerous substances and preparations in the electrical and electronic equipment.

Article 11

Information requirements

1. Member States shall provide to the Commission information on an annual basis on the quantities and categories of electrical and electronic equipment put on the market, collected and recycled within the Member States, both by numbers and by weight.

2. Member States shall ensure that the information required under paragraph 1 is transmitted to the Commission by 1 January 2007 and on a three-yearly basis thereafter. The information shall be provided in a format which shall be established within one year after the entry into force of this Directive in accordance with the procedure referred to in Article 14(2).

Article 12

Reporting obligation

Without prejudice to the requirements of Article 11, Member States shall send a report to the Commission on the implementation of this Directive at three-year intervals. The report shall be drawn up on the basis of a questionnaire or outline drafted by the Commission in accordance with the procedure laid down in Article 6 of Council Directive 91/692/EEC[18] with a view to establishing databases on WEEE and their treatment. The questionnaire or outline shall be sent to the Member States six months before the start of the period covered by the report. The report shall be made available to the Commission within nine months of the end of the three-year period covered by it.

The first report shall cover a period of three years from 1 January 2006.

The Commission shall publish a report on the implementation of this Directive within nine months after receiving the reports from the Member States.

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[18] OJ L 377, 31.12.1991, p. 48.

Article 13

Adaptation to scientific and technical progress

Any amendments which are necessary in order to adapt Annexes II, III and IV to scientific and technical progress shall be adopted in accordance with the procedure referred to in Article 14(2).

Article 14

Committee

1. The Commission shall be assisted by the committee instituted by Article 18 of Directive 75/442/EEC.

2. Where reference is made to this paragraph, the regulatory procedure laid down in Article 5 of Decision 1999/468/EC shall apply, in compliance with Article 7 and Article 8 thereof.

3. The period provided for in Article 5(6) of Decision 1999/468/EC shall be three months.

Article 15

Transposition

1. Member States shall bring into force the law, regulations and administrative provisions necessary to comply with this Directive by 30 June 2004 [18 months after the date of adoption] at the latest. They shall immediately inform the Commission thereof.

2. When Member States adopt those provisions, they shall contain a reference to this Directive or be accompanied by such a reference on the occasion of their official publication. Member States shall determine how such reference is to be made.

3. Member States shall communicate to the Commission the text of all existing laws, regulations and administrative provisions adopted in the field covered by this Directive.

Article 16

Entry into force

This Directive shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Communities.*

Article 17

Addressees

This Directive is addressed to the Member States.

Done at Brussels,

For the European Parliament	*For the Council*
The President	*The President*

ANNEX I A

CATEGORIES OF ELECTRICAL AND ELECTRONIC EQUIPMENT COVERED BY THIS DIRECTIVE

(1) Large household appliances

(2) Small household appliances

(3) IT & Telecommunication equipment

(4) Consumer equipment

(5) Lighting equipment

(6) Electrical and electronic tools

(7) Toys

(8) Medical equipment systems (with the exception of all implanted and infected products)

(9) Monitoring and control instruments

(10) Automatic dispensers

ANNEX I B

INDICATIVE LIST OF PRODUCTS WHICH FALL UNDER THE CATEGORIES OF ANNEX I A

1. **Large household appliances**

Large cooling appliances

Refrigerators

Freezers

Washing machines

Clothes dryers

Dish-washing machines

Cooking

Electric stoves

Electric hot plates

Microwaves

Heating appliances

Electric heaters

Electric fans

Air conditioners

2. **Small household appliances**

Vacuum cleaners

Carpet sweepers

Irons

Toasters

Fryers

Coffee grinders

Electric knives

Coffee machines

Hair dryers

Tooth brushes

Shavers

Clocks

Scales

3. **IT & Telecommunication equipment**

Centralized data processing:

Mainframes

Minicomputers

Printer units

Personal computing:

Personal computers (CPU, mouse, screen and keyboard included)

Lap-top computers (CPU, mouse, screen and keyboard included)

Note-book computers

Note-pad computers

Printers

Copying equipment

Electrical and electronic typewriters

Pocket and desk calculators

User terminals and systems

Facsimile

Telex

Telephones

Pay telephones

Cordless telephones

Cellular telephones

Answering systems

4. **Consumer equipment**

Radio sets (clock radios, radio-recorders)

Television sets

Videocameras

Video recorders

Hi-fi recorders

Audio amplifiers

Musical instruments

5. **Lighting equipment**

Luminaires

Straight fluorescent lamps

Compact fluorescent lamps

High intensity discharge lamps, including high pressure sodium lamps and metal halide lamps

Low pressure sodium lamps

Other lighting equipment

6. **Electrical and electronic tools**

Drills

Saws

Sewing machines

7. **Toys**

Electric trains or car racing sets

Hand-held video game consoles

Video games

8. **Medical equipment systems (with the exception of all implanted and infected products)**

Radiotherapy equipment

Cardiology

Dialysis

Pulmonary ventilators

Nuclear medicine

Laboratory equipment for in-vitro diagnosis

Analysers

Freezers

9. **Monitoring and control instruments**

Smoke detector

Heating regulators

Thermostat

10. **Automatic dispensers**

Automatic dispensers for hot drinks

Automatic dispensers for hot or cold bottles or cans

Automatic dispensers for solid products

ANNEX II

Selective Treatment for Materials and Components of Waste Electrical and Electronic Equipment in accordance with Article 5.1

1. As a minimum the following substances, preparations and components have to be removed from any separately collected WEEE:

- PCB containing capacitors
- Mercury containing components, such as switches
- Batteries
- Printed circuit boards
- Toner cartridges, liquid and pasty, as well as colour toner
- Plastic containing brominated flame retardants
- Asbestos waste
- Cathode ray tubes
- CFC, HCFC or HFCs
- Gas discharge lamps
- Liquid crystal displays of a surface greater than 100 square centimetres and all those back-lighted with gas discharge lamps

These substances, preparations and components shall be disposed of or recovered in compliance with Article 4 of Council Directive 75/442/EEC.

2. The following components of WEEE that is separately collected has to be treated as indicated:

- Cathode ray tubes: The fluorescent coating has to be removed
- Equipment containing CFC, HCFC or HFCs: The CFC present in the foam and the refrigerating circuit must be properly extracted and destroyed. HCFC or HFCs present in the foam and the refrigerating circuit must be properly extracted and destroyed or recycled
- Gas discharge lamps: The mercury shall be removed

ANNEX III

Technical requirements in accordance with Article 5.3

1. Sites for storage of WEEE (without prejudice to the requirements of Directive 1999/31/EC on the landfill of waste):

– Impermeable surfaces

– Weatherproof covering

2. Sites for treatment of WEEE:

– Balances to measure the weight of the treated waste

– Impermeable surfaces and waterproof covering for appropriate areas

– Appropriate storage for disassembled spare parts

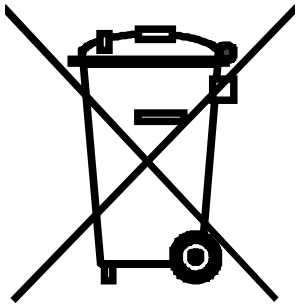
– Appropriate containers for storage of batteries, PCB/PCT containing condensators and other hazardous waste

– Equipment for the treatment of water, including rainwater

ANNEX IV

Symbol for the marking of electrical and electronic equipment

The symbol indicating separate collection for electrical and electronic equipment consists of the crossed-out wheeled bin, as shown below. The symbol must be printed visibly, legibly and indelibly.



2000/0159 (COD)

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on the restriction of the use of certain hazardous substances in electrical and electronic equipment

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 95 thereof,

Having regard to the proposal from the Commission[1],

Having regard to the opinion of the Economic and Social Committee[2],

Having regard to the opinion of the Committee of Regions[3],

Acting in accordance with the procedure laid down in Article 251 of the Treaty[4],

Whereas:

(1) The disparities between the laws or administrative measures adopted by the Member States as regards the restriction of the use of hazardous substances in electrical and electronic equipment could create barriers to trade and distort competition in the Community and may thereby have a direct impact on the establishment and functioning of the internal market. It therefore appears necessary to approximate the laws of the Member States in this field.

(2) The objectives and principles of the Community's environment policy are, in particular, to prevent, reduce and as far as possible eliminate pollution.

(3) The Commission Communication of 30 July 1996 on the review of the Community strategy for waste management[5] stresses the need to reduce the content of hazardous substances in waste and points out the potential benefits of Community-wide rules limiting the presence of such substances in products and in production processes.

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1 OJ C

2 OJ C

3 OJ C

4 Opinion of the European Parliament of .. .. (OJ C .....), common position of the Council of .. . .. (OJ C .....) and Decision of the European Parliament of .. .. (OJ C .....). .....

5 COM(96) 399 final.

(4) The Council Resolution of 25 January 1988 on a Community action programme to combat environmental pollution by cadmium[6] invites the Commission to pursue without delay the development of specific measures for such a programme. Human health also has to be protected and an overall strategy that in particular restricts the use of cadmium and stimulates research into substitutes should therefore be implemented. The Resolution stresses that the use of cadmium should be limited to cases where suitable and safer alternatives do not exist.

(5) The available evidence indicates that measures on the collection, treatment, recycling and disposal of waste electrical and electronic equipment (WEEE) as set out in Directive …… of the European Parliament and of the Council on waste electrical and electronic equipment[7] are necessary to reduce the waste management problems linked to the heavy metals concerned and the flame retardants polybrominated biphenyls (PBB) and polybrominated diphenyl ether (PBDE). In spite of those measures, however, significant parts of WEEE will continue to be found in the current disposal routes. Even if WEEE were collected separately and submitted to recycling processes, its content of mercury, cadmium, lead, chromium VI, PBB and PBDE would be likely to pose risks to health or the environment.

(6) Taking into account technical and economic feasibility, the most effective way of ensuring the significant reduction of risks to health and the environment related to those substances which can achieve the chosen level of protection in the Community is the substitution of those substances in electrical and electronic equipment by safe or safer materials.

(7) The substances covered by this Directive are scientifically well researched and evaluated and have been subject to different measures both at Community and national level.

(8) The measures provided for in this Directive take into account existing international guidelines and recommendations and are based on an assessment of available scientific and technical information. The measures are necessary to achieve the chosen level of protection of human and animal health and the environment, having regard to the risks which the absence of measures would be likely to create in the Community. The measures should be kept under review and, if necessary, adjusted to take account of available technical and scientific information.

(9) This Directive should apply without prejudice to Community legislation on safety and health requirements and specific Community waste management legislation, in particular Council Directive 91/157/EEC of 18 March 1991 on batteries and accumulators containing certain dangerous substances[8], as amended by Commission Directive 98/101/EC[9].

(10) The technical development of electrical and electronic equipment without heavy-metals, PBDE and PBB should be taken into account.

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6 OJ C 30, 4.2.1988, p. 1.
7 OJ L
8 OJ L 78, 26.3.1991, p. 38.
9 OJ L 1, 5.1.1999, p. 1.

(11) Exemptions from the substitution requirement should be permitted if substitution is not possible from the scientific and technical point of view or if the negative environmental or health impacts caused by substitution are likely to outweigh the human, animal and environmental benefits of the substitution. The health and safety of users of electrical and electronic equipment should also not be jeopardised by the substitution of the hazardous substances in electrical and electronic equipment.

(12) Since the measures necessary for the implementation of this Directive are measures of general scope within the meaning of Article 2 of Council Decision 1999/468/EC of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission[10], they should be adopted by use of the regulatory procedure provided for in Article 5 of that Decision,

HAVE ADOPTED THIS DIRECTIVE:

Article 1

Objectives

The purpose of this Directive is to approximate the laws of the Member States on the restrictions of the use of hazardous substances in electrical and electronic equipment and to contribute to the environmentally sound recovery and disposal of waste electrical and electronic equipment**.**

Article 2

Scope

1. This Directive shall apply to electrical and electronic equipment falling under the categories set out in Annex I A to Directive …… [on waste electrical and electronic equipment].

2. Article 4 shall not apply to electrical and electronic equipment falling under categories 8, 9 and 10 of Annex I A to Directive …… [on waste electrical and electronic equipment].

3. This Directive shall apply without prejudice to Community legislation on safety and health requirements and specific Community waste management legislation.

Article 3

Definitions

For the purposes of this Directive, the following definitions shall apply:

(a) "electrical and electronic equipment" means equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields and designed for use with a voltage rating not exceeding 1000 Volt for alternating current and 1500 Volt for direct current;

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[10] OJ L 184, 17.7.1999, p. 23.

(b) "producer" means any person who manufactures and sells electrical and electronic equipment under his own brand, who resells under his own brand equipment produced by other suppliers or who imports that equipment on a professional basis into a Member State.

Article 4

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, cadmium and hexavalent chromium listed in the Annex.

Article 5

Adaptation to scientific and technical progress

1. Any amendments which are necessary in order to adapt the Annex to scientific and technical progress for the following purposes shall be adopted in accordance with the procedure referred to in Article 7(2):

   (a) establishing, as necessary, maximum concentration values up to which the presence of the substances referred to in Article 4(1) in specific materials and components of electrical and electronic equipment shall be tolerated;

   (b) exempting materials and components of electrical and electronic equipment from Article 4(1) if the use of the substances referred to therein in those materials and components is technically or scientifically unavoidable or where the negative environmental and/or health impacts caused by substitution are likely to outweigh the environmental benefits thereof;

   (c) deleting materials and components of electrical and electronic equipment from the Annex if the use of the substances referred to in Article 4(1) in these materials and components is avoidable, provided that the negative environmental and/or health impacts caused by substitution do not outweigh the possible environmental benefits thereof.

2. Before the Annex is amended pursuant to paragraph 1, the Commission shall consult producers of electrical and electronic equipment.

Article 6

Review

By 31 December 2003 at the latest, the Commission shall review the measures provided for in this Directive to take into account, as necessary, new scientific evidence.

Article 7

Committee

1. The Commission shall be assisted by the committee instituted by Article 18 of Directive 75/442/EEC[11].

2. Where reference is made to this paragraph, the regulatory procedure laid down in Article 5 of Decision 1999/468/EC shall apply, in compliance with Article 7 and Article 8 thereof.

3. The period provided for in Article 5(6) of Decision 1999/468/EC shall be three months.

Article 8

Transposition

1. Member States shall bring into force the law, regulations and administrative provisions necessary to comply with this Directive by 30 June 2004 [18 months after the date of adoption] at the latest. They shall immediately inform the Commission thereof.

2. When Member States adopt those provisions, they shall contain a reference to this Directive or be accompanied by such a reference on the occasion of their official publication. Member States shall determine how such reference is to be made.

3. Member States shall communicate to the Commission the text of all existing laws, regulations and administrative provisions adopted in the field covered by this Directive.

Article 9

Entry into force

This Directive shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Communities.*

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11 OJ L 194, 25.7.1975, p. 39.

Article 10

Addressees

This Directive is addressed to the Member States.

Done at Brussels,

For the European Parliament	*For the Council*
The President	*The President*

ANNEX

Applications of lead, mercury, cadmium and hexavalent chromium, which are exempted from the requirements of Article 4(4)

- Mercury in compact fluorescent lamps not exceeding 5 mg per lamp
- Mercury in straight fluorescent lamps not exceeding 10 mg per lamp
- Mercury in lamps not specifically mentioned in this Annex
- Mercury in laboratory equipment
- Lead as radiation protection
- Lead in glass of cathode ray tubes, light bulbs and fluorescent tubes
- Lead as an alloying element in steel containing up to 0.3% lead by weight, aluminium containing up to 0.4% lead by weight and as a copper alloy containing up to 4% lead by weight
- Lead in electronic ceramic parts
- Cadmium oxide on the surface of selenium photocells
- Cadmium passivation as an anti-corrosion in specific applications
- Cadmium, mercury and lead in hollow cathode lamps for atomic absorption spectroscopy and other instruments to measure heavy metals
- Hexavalent chromium as an anti-corrosion of the carbon steel cooling system in absorption refrigerators.