

Guidance document Annex II and article 6.1 of 2002/96

Annex II 1 introduction

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

The interpretation of the term “have to be removed” in the introduction of Annex II is crucial:

Substances, preparations and components may be removed manually, mechanically or chemically, metallurgically with the result that hazardous substances, preparations, and components and those mentioned in Annex II are contained as an identifiable stream or identifiable part of a stream at the end of the treatment process. A substance, preparation or component is identifiable if it can be (is) monitored to prove environmentally safe treatment.

As a consequence of this interpretation of “have to be removed” two different categories in Annex II 1 are distinguished in this guidance document:

1. substances, preparations and components which have to be removed as a first step in the treatment process. According to article 6.1 also all fluids have to be removed.
2. substances, preparations and components which have to be removed as an identifiable (part of a) stream in the next steps of the treatment process.

The substances etc. of Annex II 1 are summed up below according to this division. The distinction is based on technological knowledge of this moment. In the Appendix of this guidance document more information is given on the treatment of these items.

Substances, preparations and components in WEEE that are initially hazardous waste according to the European waste list shall be stored, transported and delivered according to the EU legislation or equal environmental standard.

The monitoring of the substances, preparations and components (either hazardous waste, fluids or mentioned in the entries of Annex II) that have been removed is essential to “prove” the environmentally safe treatment. This monitoring can be organised in the licensing or in the quality systems of the treatment facility. For monitoring no new data have to be collected, because the data already gathered in accordance to the license and to hazardous waste legislation and other waste regulations can be used.

When removed, it has to be demonstrated that the (final) processing, recycling and/or disposal of these substances, preparations and components has no detrimental effects on the environment.

Annex II 1 entries

The following substances, preparations and components and all fluids shall be removed **as a first step** in the treatment process, into a single item stream.

- a) PCB's/PCT's containing capacitors, and other PCB/PCT containing components (1¹).
- b) Mercury containing backlighting lamps of LCD's (2). If backlights are not possible to remove manually, the whole screen must be removed.
- c) Other mercury containing components, such as switches, contacts, thermometers, thermostats and relays (2).
- d) External batteries (= all batteries that can be removed prior to treatment without special equipment), and internal hazardous batteries, excluding printed circuit board mounted batteries (3).
- e) Toner cartridges, liquid and pasty, as well as colour toner (5)
- f) Asbestos waste and components which contain asbestos (7)
- g) Other gas discharge lamps than mentioned in b) (10)
- h) Refractory ceramic fibres (RCF's) (13)
- i) WEEE components containing radioactive substances such as smoke detectors (14)

¹ Numbers between brackets refer to entries in Annex II 1, when numbered.

The following substances, preparations and components shall be removed from WEEE as an identifiable fraction, or as part of an identifiable fraction.

- j) Other batteries than mentioned in d) (3)
- k) Printed circuit boards of mobile phones generally, and of other devices if the surface of the printed circuit board is greater than 10 square centimetres (4) ²
- l) Plastics with brominated flame-retardants (6)
- m) Cathode ray tubes (8) and fluorescent coating. When not metallurgically treated, than as a first step
- n) Chlorofluorocarbons (CFC), hydro chlorofluorocarbons (HCFC) or hydro fluorocarbons (HFC) (9) and other gases that are ozone depleting or have a global warming potential (GWP) above 15 ³
- o) Liquid crystal displays (together with their casing where appropriate) of a surface greater than 100 square centimetres (11) ⁴
- p) External electric cables (12) ⁵
- q) Electrolyte capacitors containing substances of concern (height > 25 mm or proportionately similar volume) (15) ⁶

Annex II 3

Annex II.3: *“Taking into account environmental considerations and the desirability of reuse and recycling, paragraphs 1 and 2 shall be applied in such a way that environmentally sound reuse and recycling of components or whole appliances are not hindered”*

Does this apply for processes where whole appliances are treated for recycling, like for instance cellular phones (provided that the (internal) battery is removed) or stripped monitors in metal smelting processes?

Advice: Be careful to use this paragraph in the process of licensing the treatment company or to forbid a certain recycling process. Reuse should be encouraged before WEEE is sent for treatment.

Annex II 4

“Within the procedure referred to in article 14(2) the Commission shall evaluate as a matter of priority whether the entries regarding printed circuit boards for mobile phones and liquid crystal displays are to be amended”

Does this article refers to printed circuit boards for cellular phones only or for the whole entry in Annex II.1, so also for printed circuit boards in other devices when the boards are greater than 10 cm²?

Conclusion: According to Article 6 and 13 all entries are subject to evaluation and adaptation in the framework of scientific and technical progress (see k).

Article 6.1: Best treatment, recovery and recycling techniques

According to art. 6.1 systems to provide for the treatment of WEEE should use best available treatment, recovery and recycling techniques. How to interpret these terms.

There are no reference documents made for best available techniques of WEEE treatment (in accordance with the procedure of Directive 96/61/EC).

Conclusion: Rather than making lists with best available techniques, there should be a set of outcome parameters.

² Entry (4) (and new k) considered changed to “Printed circuit boards”.

³ Entry (9) (and new n) considered changed so that HC with GWP < 15 do not have to be removed

⁴ Entry (11) (and o in this document) considered deleted from Annex II

⁵ Entry (12) (and p in this document) considered deleted from Annex II

⁶ Entry (15) (and q in this document) considered deleted from Annex II

Appendix: background of the interpretation and technical guidance treatment

“To be removed”

Considerations:

- Annex II should rather focus on objective environmental performance criteria than on the prescription how to meet these criteria. From this point of view, “remove” means “environmentally safe treatment”.
- If “remove” means that components have to be manually removed as a first step in any treatment, then this demand seems to be conflicting with the technological state of the art and discourages further technological development;
- The removal can take place mechanically, chemically or manually, as a first step or in the process and also in the final processing.
- Waste coming from “white goods” or ICT-products is very miscellaneous. There is no such thing as a best practice for the entire scope of the directive.
- The conception of “remove” is defined and in such a way that it leaves room for development of new technologies. Objective environmental performance criteria are preferred rather than the prescription of techniques.

Annex II 1, technical guidance regarding treatment

Nr	Description	guidance ⁷	Elements of concern	Related legislation In general the hazardous waste directive 91/689/EC and waste framework directive 75/442 is applicable	Remarks
1	PCB containing capacitors	a	pcb	96/59/EC on the disposal of pcb's and pct's. Where incineration is used for disposal: 94/67/EC on the incineration of dangerous waste	
2 and 11	Mercury containing components	b, o ⁸	Hg	Hg in ambient air is governed by 2004/107/EC An Hg strategy is being developed Labour conditions legislation p.m.	The stream should be treated as hazardous waste in permitted treatment facilities LCD>100 cm ² are in most circumstances backlighted with gas discharge lamps. Mercury backlights are probably the real problem in entry (11). They have to be removed prior to any processing, although 50% will break even with manually removal. The labour conditions have to be adequate. Technology has to be developed for treatment of these LCD's. At the moment LCD's are either incinerated or landfilled. New LCD technology is developed without backlighting.

⁷ a to i have to be removed as a first step in the treatment; j to q during the treatment, after the first step.

Nr	Description	guidance ⁷	Elements of concern	Related legislation In general the hazardous waste directive 91/689/EC and waste framework directive 75/442 is applicable	Remarks
3	Batteries	d, j	Hg, Pb, Cd	Battery directive: 91/157/EC Revision is in progress NiCd batteries figure on the hazardous waste list	<p>All batteries should be largely kept intact and recognisable as batteries. Harmless internal batteries can be left, for instance at a print card. Hazardous batteries should be removed as a first step in the treatment, but the problem is that handpicking cannot take out 100%. Therefore treatment in metallurgical processes with adequate flue gas treatment is acceptable as a second-best option.</p> <p>In practice, it will be difficult to say what has to be separated or not. Incineration of batteries on circuit boards is acceptable when flue gasses are treated well;</p> <p>The stage of removal of the battery also depends on the location of the battery in the equipment. Internal batteries (most button cell batteries) that are not visible from the outside, may be removed manually or after coarse shredding of the equipment containing these batteries, but must be removed prior to fine shredding. Batteries should be largely kept intact and recognisable as batteries.</p> <p>In the Netherlands and Germany producers of batteries are obliged to collect batteries, because they are on short related to the targets. For some batteries there is also an economic drive to separate them.</p>
4	Printed circuit boards	k ⁹	Pb, Cr, As, Br, Cl, Sb, Be	84/360/EC metallurgical treatment facilities emissions BAT-??	<p>If the shredder of the treatment plant has sufficient environmental standard and maintenance, there is no need for a manually removal. After coarse shredding of equipment containing printed circuit boards, they should be part of the metal/plastic fraction. The result of manually removal beforehand and mechanical removal in the process is the same. Though, this only applies for high quality shredders. Printed circuit boards will anyway go to smelters, steel mills and brokers (often abroad).</p>
5	Toner cartridges	e	Particularly carbon		The stream should be treated as hazardous waste in permitted treatment facilities
6	Plastic containing bromated flame	l	Br	Emissions of incineration: 2000/76/EC and 84/360/EC	<p>There are no large-scale operational techniques available to separate these plastics. However there are technological developments coming out of the research and pilot phase that are tested under operational conditions.</p> <p>There is an increasing demand for plastics for recycling and energy recovery.</p>

⁸ See footnote 4: entry 11 to be deleted

⁹ Entry (4) considered changed to "Printed circuit boards".

Nr	Description	guidance ⁷	Elements of concern	Related legislation In general the hazardous waste directive 91/689/EC and waste framework directive 75/442 is applicable	Remarks
	retardants				<p>Plastic recycling is important because of the recycling targets in the directive. Using the mixed plastics in well-controlled high temperature incineration plants, there are no significant environmental effects.</p> <p>In the coming years WEEE plastics will contain waste amounts of brominated flame retardants and safe treatment of these must have higher priority than material recycling of plastics.</p> <p>On a longer term (10-15 years), problems with brominated flame-retardants in WEEE plastics will be reduced following the RoHS ban on PBB and PBDE. Other brominated flame retardant like Deca BDE still will be evaluated.</p> <p>In practice, two problems often occur: 1) it's not known if plastics contain brominated flame-retardants or not. 2) There is no certainty that these plastics are treated well in non-OECD-countries</p> <p>The problems mentioned should be taken care of as follows: 1) Brominated flame-retardants should be treated in downstream recovery or in thermal/metallurgical treatment processes with appropriate off-gas treatment or may be disposed in licensed landfills . Regarding the burden of proof: all plastics containing brominated flame retardants should be treated in line with what is stated under 1 unless the recycler can prove the contrary. 2) About non-OECD-countries: the directive is clear, recycling must take place as it does in the EU. Material recycling is preferred (material recycling techniques are being developed), but energy-recovery can be accepted as a second-best option.</p> <p>Adequate dust abatement techniques should be applied in order to avoid direct exposure of persons to fine dust of plastics with brominated flame-retardants.</p>
7	Asbestos	f	Si	83/447/EC	
8	Cathode Ray Tubes	m	Pb, Cd		<p>Cathode ray tubes should preferably be treated in manual, mechanical or metallurgical processes.</p> <p>CRT's can be treated directly in metallurgical processes in accordance with BAT references but there is limited capacity. (See letter of Belgium addressed to Commission concerning the Metallo Chimique process).</p> <p>The fluorescent coating has to be removed in the recycling, but not when the appliance as a whole will be processed in a smelter. If the text of Annex II is taken literally for the Belgian example, tubes first have to be separated and</p>

Nr	Description	guidance ⁷	Elements of concern	Related legislation In general the hazardous waste directive 91/689/EC and waste framework directive 75/442 is applicable	Remarks
					afterwards put back together. This shows that Annex II can block new technologies. When CRT's are not treated in a smelter, the CRT's have to be removed as a first step.
9	CFC, HCFC, HFC, HC	n ¹⁰	CFC, HCFC, HFC	Regulation 2037/2000 governs substances that deplete the ozone layer and VOC-regulations	<p>The environmental effects of these substances of concern are very well known: ozone depleting and a heavy CO2 effect. All fluids, CFC, HFC, HCFC and HC from the cooling circuit should be removed in the first step according to article 6.1 of the WEEE directive.</p> <p>The CFC, HFC and HCFC that are present in insulation foam are separated after course shredding and have to be treated as an identifiable stream. The HC in the insulation foam may cause a safety problem during processing (risk of explosion). Therefore fridges containing HC in the foam should be processed in appropriate treatment operations.</p> <p>Standardisation is needed for emission standards of recycling plants with respect to HC. Future technological developments must meet these standards. Remark: Today, fridges with HC-gasses (not dangerous, very low Global Potential Warming, GPW) are mostly treated in the same way as, HFC, HCFC and CFC (dangerous) fridges in order to overcome the difficulties in sorting.</p>
10	Gaz discharge lamps	g	Hg	2004/107/EC mercury in ambient air	
11	LCD's	b, o ¹¹	Hg in backlights		<p>LCD>100 cm² are in most circumstances backlighted with gas discharge lamps. Mercury backlights are the real problem in entry (11). They have to be removed prior to any processing, although 50% will break even with manually removal. The labour conditions have to be adequate. Technology has to be developed for treatment of these LCD's. At the moment LCD's with mercury backlights are treated as hazardous waste in appropriate treatment facilities. New LCD technology is developed without backlighting. LCD is not considered to be hazardous waste because they do not contain hazardous substances at concentrations listed in Directive 91/689/EEC. According to current EEC regulations LCD's can be disposed of in landfills and incinerations. Liquid Crystals (LC's) are not toxic, neither are they mutagenic,</p>

¹⁰ see footnote 3: entry (9) change so that HC with a GWP< 15 not to be removed

¹¹ See footnote 4: entry 11 to be deleted

Nr	Description	guidance ⁷	Elements of concern	Related legislation In general the hazardous waste directive 91/689/EC and waste framework directive 75/442 is applicable	Remarks
					suspicious of carcinogenicity and are not toxic to aquatic organisms. LC's may be irritant or sensitising and some are not readily biodegradable. (Information from Merck: Toxicological and ecotoxicological investigations of liquid crystals and disposal of LCD's; Becker e.a. febr. 2003)
12	External electric cables	p ¹²	PVC, Cd, Pb, Phthalates	Green paper Com 2000/469, 26 July 2000	There is no need to keep the entry on external cables (12), because the original reason, the labour aspects are because of the way of transport and treatment improved. The possible substances of concern are also in internal cables, which are not subject to specific rules. Furthermore, removal is also contra productive for the re-use possibility of the appliances.
13	Refractory ceramic fibres	h	Vitreous (silicate) fibres		These are used mainly in furnaces/heater/kiln linings. It concerns man-made vitreous (silicate) fibres with random orientation with alkaline oxide and alkali earth oxide (Na ₂ O + K ₂ O + CaO + MgO + BaO) content less or equal to 18% by weight and have the same properties as asbestos. Members of the working group do not have any experience with these substances.
14	Radioactive substances	i	Ionising radiation	96/29/Euratom, but below the exemption thresholds	Experience shows, that these substances are found in some types of smoke detectors. Smoke detectors are in the scope. A smoke detector as such does not exceed the thresholds referred to in the entry, but when the smoke detectors are collected and handed over to the treatment plant, it is to prefer to treat them selective because otherwise the streams can be polluted with radioactivity. In NL the treatment operator separates these appliances from the category of small household appliances. The detectors are sent to a special operator who takes out the radioactive element that is landfilled in a special landfill. The (now non radioactive) detector is sent back to the treatment operator. No experience is shown with other EEE containing radioactivity.
15	Electrolyte capacitors with substances of concern	q ¹³	?		The entry on electrolyte capacitors, containing substances of concern is not necessary, because until now there are no other substances of concern found than PCB's, which is already prescribed in entry 1.

¹² see footnote 5; entry 12 to be deleted from Annex II

¹³ see footnote 6; entry 15 to be deleted from Annex II

Nr	Description	guidance ⁷	Elements of concern	Related legislation In general the hazardous waste directive 91/689/EC and waste framework directive 75/442 is applicable	Remarks
II 2	Fluorescent coatings of CRT's have to be removed	m			A waste from the use of phosphorous chemicals is non-hazardous (2001/118/EC). Fluorescent coatings can be disposed of in landfills or incinerators. Treatment in metallurgical and other thermal processes like glass making is also possible and complies to 75/442/EEC

Proposal to amend Annex II of Directive 2002/96

The following amendments of Annex II are in line with the guidance document. Some members of the working group are in favour of additional changes.

These entries in Annex II 1 are proposed to be removed from the Annex:

1. External electric cables (12¹⁴)
2. Electrolyte capacitors containing substances of concern (height > 25 mm or proportionately similar volume) (15)
3. Liquid crystal displays (together with their casing where appropriate) of a surface greater than 100 square centimetres and all those back lighted with gas discharge lamps (11)

The following entries have to be changed:

4. Printed circuit boards of mobile phones generally, and of other devices if the surface of the printed circuit board is greater than 10 square centimetres (4) in:
"printed circuit boards"
5. Chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC) or hydro fluorocarbons (HFC) , hydrocarbons (HC) (9) in:
"Chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC) or hydro fluorocarbons (HFC)"

Explanation:

1. There is no need to keep the entry on external cables (12), because the original reason, the labour aspects are because of the way of transport and treatment improved. The possible substances of concern are also in internal cables, which are not subject to specific rules. Furthermore, removal is also contra productive for the re-use possibility of the appliances.
2. The entry on electrolyte capacitors, containing substances of concern (15) is not necessary, because until now there are no other substances of concern found than PCB's, which is already prescribed in entry 1.
3. Due to the toxic elements in printed circuit boards, the boards have to be removed. Due to the interpretation of remove, size and origin does not matter. Furthermore, 10 cm² is an arbitrary limit.
4. HC gasses have a very low GWP < 15. In Annex II, 2, second entry the minimum GWP is 15 of the gases to be extracted and properly treated. All fluids from the cooling circuit should be removed anyway in the first step. In addition the HC content in foam is not significant from an environmental perspective. Potential VOC emissions are covered already in the VOC-directive. (ref PM).
5. The entry on LCD's (11) is not necessary, because when backlights are used, it will be covered by the entry on mercury (2) because of the mercury content of these backlights. When no backlights are used, there is no need for specific removal, because no hazardous items are found in these LCD's. Liquid Crystals (LC's) are not toxic, neither are they mutagenic, suspicious of carcinogenicity and are not toxic to aquatic organisms. LC's may be irritant or sensitising and some are not readily biodegradable. (Information from Merck: Toxicological and ecotoxicological investigations of liquid crystals and disposal of LCD's; Becker e.a. febr. 2003)

¹⁴ Numbers between brackets refer to entries in Annex II 1, when numbered