

# **Guidance on Best Available Treatment, Recovery and Recycling Techniques (BATRRT) and Treatment of Waste Electrical and Electronic Equipment (WEEE)**



Department of the  
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This guidance will take effect when the Waste Electrical and Electronic Equipment (Waste Management Licensing) Regulations (Northern Ireland) 2006 (the WEEE Licensing Regulations) come into operation.

## **INTRODUCTION**

1. This document provides guidance on the WEEE Licensing Regulations, and provides guidance on the treatment, recycling and recovery of waste electrical and electronic equipment (WEEE) at an authorised treatment facility (ATF).

2. Estimates suggest the UK produces around 900,000 tonnes of WEEE per year from domestic sources alone. This equates to approximately 19 000 tonnes in Northern Ireland. Indeed, the May 2005 WEEE Pilot Scheme Report<sup>1</sup> estimated that the annual household WEEE arisings in NI would be up to 20 000 tonnes. Additional WEEE arises from shops, offices and industrial premises. Although fridges and freezers are treated and a high percentage of large domestic appliances (e.g. cookers, washing machines, etc) are recycled, the majority of items – especially televisions and small items of WEEE - have traditionally been landfilled without treatment. This problem has been addressed in Directive 2002/96/EC on waste electronic and electrical equipment, as amended by Directive 2003/108/EC, commonly referred to as the WEEE Directive.

3. This Directive is a waste stream specific directive which supplements Directive 2006/12/EC on waste (the Waste Framework Directive or WFD). The controls set down in the WFD provide for the safe disposal or recovery of waste. The WEEE Directive makes specific provision for WEEE with the objective of prioritising waste prevention and in addition the reuse, recycling and recovery of WEEE so as to reduce the disposal of waste. In addition to encouraging re-use and recovery, it also lays down more specific standards for treatment, recycling and recovery operations of WEEE. The competent authorities regulating these operations will be required to apply these standards in addition to assessing whether the general objectives in Article 4 of the WFD is met.

4. This document provides guidance as to how the standards for treatment, recycling and recovery set out in the WEEE Directive are to be interpreted by the Department of the Environment in order to comply with the objectives of the Directive. It does **not** cover activities such as collection or any further treatment requirements for removed items or fractions, nor the disposal of waste. It is expected that the Department of the Environment's Environment and Heritage Service and operators of WEEE treatment facilities will refer to it.

## **LEGISLATION**

### **The WEEE Directive**

5. The WEEE Directive introduces the following requirements for the treatment of WEEE:

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<sup>1</sup> <http://www.ehsni.gov.uk/pubs/publications/WEEEPilotRep.pdf>

- establishments or undertakings carrying out treatment operations must obtain an appropriate licence or register an exemption from the waste management licensing regime from the competent authority (Environment and Heritage Service);
- where appropriate, priority should be given to the reuse of whole appliances, and then components, sub-assemblies and consumables. Where reuse is not preferable, high levels of recovery and recycling should be achieved;
- all separately collected WEEE that is not designated for reuse as whole appliances must be sent for treatment;
- systems for the treatment of WEEE must use best available treatment recovery and recycling techniques (BATRRRT);
- to ensure compliance with Article 4 of the WFD, which requires that waste is recovered or disposed of without endangering human health or the environment, treatment must include, as a minimum, the removal of all fluids and the appropriate selective treatments in accordance with Annex II to the WEEE Directive;
- the selective treatment requirements in Annex II to the WEEE Directive must be applied taking into account environmental considerations and the desirability of reuse and recycling, and must be applied in such a way that environmentally-sound reuse and recycling of components or whole appliances is not hindered;
- treatment must be carried out in accordance with the technical requirements in Annex III to the WEEE Directive; and
- treatment must avoid the dispersion of pollutants into the recycled material or the waste stream.

6. Annex II to the WEEE Directive requires that, as a minimum, the following substances, preparations and components must be removed from any separately collected WEEE:

- capacitors containing polychlorinated biphenyls (PCBs)
- mercury containing components such as switches or backlighting lamps
- batteries
- printed circuit boards of mobile phones and of other devices if the surface area of the circuit board is greater than 10 square centimetres
- toner cartridges
- plastic containing brominated flame retardants (BFRs)
- asbestos waste and components which contain asbestos
- cathode ray tubes (CRTs)
- chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs) and hydrocarbons (HCs)
- gas discharge lamps
- liquid crystal displays (LCDs), together with their casing where appropriate, of a surface area greater than 100 square centimetres, and all those back lighted with gas discharge lamps
- external electrical cables
- components containing refractory ceramic fibres
- components containing radioactive substances above exemption thresholds
- electrolyte capacitors containing substances of concern (height > 25 mm, diameter > 25 mm or proportionally similar volume).

7. In addition, Annex II to the WEEE Directive requires that the following components of separately collected WEEE be treated as follows:

- cathode ray tubes (CRTs) – the fluorescent coating must be removed
- gas discharge lamps – the mercury must be removed.

8. Annex II also requires that equipment containing gases that are ozone depleting or have a global warming potential above 15, such as those sometimes used in refrigeration equipment, must be properly extracted and treated. This requirement is already adequately covered by UK legislation and guidance<sup>2</sup>.

9. The WEEE Licensing Regulations transpose the treatment and permitting requirements of the WEEE Directive in Northern Ireland. The producer responsibility requirements of the Directive are to be transposed by regulations being drafted by the Department of Trade and Industry (the WEEE Regulations).

## **Other Legislation**

10. In addition to the WEEE Directive, there are various other pieces of legislation that are relevant to the treatment, recovery and recycling of WEEE. These are briefly described below to provide background to the guidance that follows.

### **Directive 2006/12/EC on Waste (the Waste Framework Directive or WFD)**

11. The WFD lays down controls for the safe disposal and recovery of waste. In particular, Article 4 lays down the objective that waste is recovered or disposed of without endangering human health and without using processes or methods that could harm the environment. The WFD also makes it a requirement for anyone carrying out the waste disposal or recovery operations listed in the Annexes to the WFD to obtain a permit from the “competent authority” (the Environment and Heritage Service (EHS)).

12. Article 2(2) of the WFD provides for specific rules for particular instances to be laid down by means of individual Directives. The WEEE Directive is a waste stream specific Directive made pursuant to Article 2(2) of the WFD and lays down specific standards to meet the requirements of the WFD.

13. Articles 9 and 10 of the WFD require that any establishment or undertaking carrying out a waste recovery or disposal activity obtain a permit from the competent authority unless an exemption from permitting is provided as allowed by Article 11. The WFD was implemented, in the main, by The Waste and Contaminated Land (Northern Ireland) Order 1997<sup>3</sup> and the Waste Management Licensing Regulations

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<sup>2</sup> The recovery, recycling, reclamation and destruction operations that must be carried out for fridges and freezers are laid down in the Regulation (EC) No 2037/2000 on substances that deplete the ozone layer and accompanying guidance “Guidance on the Recovery and Disposal of Controlled Substances Contained in Refrigerators and Freezers”. It should also be noted that fluids must be removed from ALL fridges and freezers, even those that are not Ozone Depleting Substances and thus are outside the scope of the ODS Regulation.

<sup>3</sup> 1997 No. 2778 (N.I.19)

(Northern Ireland) 2003<sup>4</sup> (the WML Regulations 2003) and these regulations provide for both Waste Management Licences as permits and exemptions there from. The WEEE Licensing Regulations transpose the permitting and treatment requirements of the WEEE Directive by amending the WML Regulations 2003 to provide for operators who accept WEEE for treatment to comply with the standards laid down in the Directive.

### **Directive 91/689/EEC on Hazardous Waste (as amended) (the Hazardous Waste Directive)**

14. The Hazardous Waste Directive and domestic implementing legislation<sup>5</sup> ensure that hazardous waste is tracked from the point of production to the final point of disposal or recovery. The process includes requirements that records of the methods of disposal/recovery are kept.

15. Certain items of WEEE or components of WEEE may be hazardous waste and consequently will be subject to the requirements of hazardous waste legislation, in addition to the requirements of the WEEE Directive.

16. The List of Wastes Regulations (Northern Ireland) 2005 contain a harmonised list of hazardous and non-hazardous wastes. Guidance on the distinction between hazardous and non-hazardous entries in these Regulations is comprehensively set out in existing UK guidance<sup>6</sup>.

17. Further guidance on what constitutes hazardous WEEE has been made available through the "WEEE and Hazardous Waste" project, which was conducted on behalf of Defra's Hazardous Waste Unit by AEA Technology. The aim of the project was to identify what components of specified domestic WEEE items are classified as hazardous by virtue of the Hazardous Waste Directive, and to assist in developing guidance primarily for local authorities in identifying WEEE and hazardous WEEE. Results from the project (Parts 1 and 2) are now available, plus Defra's Information and Briefing paper on the project, via the Defra website at <http://www.defra.gov.uk/environment/waste/topics/electrical/weee-hazwaste.htm>.

### **Regulation (EEC) No 259/93 on the Supervision and Control of Shipments of Waste (as amended) (the Waste Shipment Regulation)**

18. The Waste Shipment Regulation regulates all shipments of waste. Under the Waste Shipment Regulation, the export of hazardous waste to non-OECD (Organisation for Economic Co-operation and Development) countries is prohibited.

19. All transfrontier shipments of WEEE fall under the Waste Shipment Regulation. Holders of WEEE should consult the Waste Shipment Regulation for classification of the material they are seeking to export. Shipments of WEEE for recovery are permitted to non-OECD countries provided that they are non-hazardous

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<sup>4</sup> S.R. 2003 No. 493

<sup>5</sup> The Hazardous Waste Regulations (Northern Ireland) 2005 (S.R. 2005 No. 300) and the List of Wastes Regulations (Northern Ireland) 2005 (S.R. 2005 No. 301)

<sup>6</sup> WM2 - Hazardous Waste: Interpretation of the definition and classification of Hazardous of Waste

and are in line with the Waste Shipment Regulation, Commission Regulation (EC) No 1547/1999 (as amended) and Council Regulation (EC) No 1420 (as amended) (the Green List Regulations) and they do not fall within the export ban. The Green List Regulations set out the levels of controls applicable to non-OECD countries.

20. Operators should contact the Hazardous Waste/Trans Frontier Shipments Section in EHS on 028 905 46462 for guidance on this legislation.

### **Other Relevant Legislation**

21. Other pieces of legislation of relevance are:

- Regulation (EC) No. 2037/2000 (as amended) on substances that deplete the ozone layer (the ODS Regulation). This sets out, amongst other things, recovery and destruction requirements for ODS contained in refrigeration equipment. Certain items of WEEE may contain ODS and will be subject to the requirements of this Regulation.
- The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2005, which implement Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (as amended) (the RoHS Directive). This Directive restricts the amount of certain heavy metals and certain flame retardants that can be used in the manufacture of electrical and electronic equipment to be placed onto the market from July 2006.
- The Pollution Prevention and Control Regulations (Northern Ireland) 2003<sup>7</sup> (the PPC Regulations). These Regulations, which implement Directive 96/61/EC on integrated pollution prevention and control (as amended) (the IPPC Directive), apply an integrated approach to the regulation of certain industrial activities including those concerned with waste disposal. It achieves this by the setting of permit conditions, which are based on the use of Best Available Techniques (BAT). Further information is available, including a practical guide, from the EHS website at: <http://www.ehsni.gov.uk/pollution/integrated-pollution-prevention-and-control.htm>. The WEEE Directive requires systems for the treatment of WEEE to use best available treatment, recovery and recycling techniques (BATRRRT), which is an extension of the principles of BAT under the PPC Regulations.

### **BEST AVAILABLE TREATMENT, RECOVERY AND RECYCLING TECHNIQUES (BATRRRT)**

22. Article 6 of the WEEE Directive requires Member States to ensure that producers (of EEE), or third parties acting on their behalf, set up systems in accordance with community legislation to provide for the treatment of WEEE using best available treatment, recovery and recycling techniques (BATRRRT). These systems may be set up individually by producers, or collectively. The systems must comply with Article 4 of the Waste Framework Directive and treatment must, as a minimum, include the removal of all fluids and selective treatment in accordance with Annex II to the Directive. As a result of amendments made by the WEEE Licensing

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<sup>7</sup> S.R. 2003 No. 46

Regulations, the WML Regulations 2003 will require operators to apply BATRRT as well as fulfil Article 4 of the WFD.

23. The importance of subjecting WEEE to specific treatment and minimum standards for those carrying out recycling and treatment operations is described in recital 17 of the WEEE Directive as the most effective way of ensuring compliance with the chosen level of protection. Recital 17 also states that BATRRT can be further defined in accordance with the **procedures** of the IPPC Directive, which defines the "best available technique" (BAT) element of BATRRT.

### **The IPPC Directive & BAT**

24. The objective of the IPPC Directive is to achieve integrated prevention and control of pollution arising from the various activities listed in Annex I to the Directive. It lays down measures designed to prevent or, where that is not practicable, to reduce emissions to air and water in order to achieve a high level of protection of the environment as a whole. This Directive defines BAT, outlines considerations when determining BAT, for example economic and technical viability, and requires the Commission to organise an exchange of information between Member States on BAT. This work is coordinated by the European IPPC Bureau and has led to the publication of a number of BAT Reference Documents (BREFs). The work of the Bureau is divided into 30 sectors and ultimately BREFs will be produced to cover each of these sectors. Currently there is no BREF for waste management activities, but for those industries in which sector specific guidance has not yet been completed, General Sector Guidance has been produced by the Environment Agencies. The onus is on operators to show that they have systematically developed proposals to apply BAT, taking account of relevant local factors. In this respect, the guidance lays down some general standards and expectations in the UK for the techniques and standards that need to be addressed to satisfy the PPC Regulations. It does not prescribe specific processes that are BAT compliant.

### **Definition of 'BAT' in the IPPC Directive**

25. The BAT approach ensures that the cost of applying techniques is not excessive in relation to the environmental protection they provide.

26. For the purpose of the PPC Regulations BAT means the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole; and for the purpose of this definition:

**"available techniques"** means those techniques which have been developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions taking into consideration the cost and advantages, whether or not the techniques are used or produced inside the Member State as long as they are reasonably accessible to the operator.

**"best"** means, in relation to techniques, the most effective in achieving a high general level of protection of the environment as a whole.

“**techniques**” include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned .

### **From BAT to BATRRT**

27. BATRRT is the extension of the principles of BAT to systems that provide for the recovery, recycling and treatment (RRT) of WEEE.

28. Recovery, recycling and treatment are defined in Article 3 of the WEEE Directive.

### **Additional Considerations when determining BAT (Annex IV of the IPPC Directive)**

29. In determining the best available techniques, special consideration should be given to the following matters listed in Annex IV to the IPPC Directive:

- i. the use of low-waste technology;
- ii. the use of less hazardous substances;
- iii. the furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate;
- iv. comparable processes, facilities or methods of operation, which have been tried with success on an industrial scale
- v. technological advances and changes in scientific knowledge and understanding;
- vi. the nature, effects and volume of the emissions concerned;
- vii. the commissioning dates for new or existing installations;
- viii. the length of time needed to introduce the best available technique;
- ix. the consumption and nature of raw materials (including water) used in the process and their energy efficiency;
- x. the need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it;
- xi. the need to prevent accidents and to minimize the consequences for the environment;
- xii. the information published by the Commission pursuant to Article 16 (2) or by international organizations.

30. Dutyholders will also need to consider the full range of other factors that affect their decision making process to ensure that all legal requirements are balanced e.g. fiscal legislation, bio-diversity, planning, employment and health and safety legislation etc.

### **BATRRT and Licence Conditions**

31. For the purposes of the IPPC Directive, the final decision on BAT lies with the EHS as Regulatory authority. The IPPC Directive states that the technical characteristics of the installation, its geographical location, and the local environmental conditions must be taken into account.

32. EHS, in discussion with operators, is required to impose appropriate licence conditions on operators to ensure that BATRRT is adopted.

## **BATRRT for Whole Appliances and Components**

33. The WEEE Directive promotes the reuse of WEEE, and this is reflected throughout the Directive. In recital 18, it states that, where appropriate, priority should be given to the reuse of WEEE and its components, subassemblies and consumables. Paragraph 3 of Annex II further provides that the environmentally-sound reuse and recycling of whole appliances should not be hindered when carrying out selective treatment, as outlined in paragraphs 1 and 2 of Annex II.

34. According to paragraph 1 of Annex II to the WEEE Directive, specified substances, preparations and components are required to be **removed** from any separately collected WEEE. In addition, taking into account environmental considerations and the desirability of reuse and recycling, the selective treatment of WEEE (as described in Annex II (1) and (2)), must be carried out in such a way that environmentally sound reuse and recycling of components or whole appliances is not hindered. This is in line with Article 7(1) of the WEEE Directive, which states that priority shall be given to the reuse of whole appliances.

35. In relation to components, whilst it is arguable that they should be removed intact, this may only be the **best** option if the component is to be reused, or if the result is that the separated materials can be more 'easily' recycled. On the other hand, as long as the components (and the pollutants contained therein) do not contaminate the final waste streams and the objectives of Article 6 and Annex II to the WEEE Directive are achieved, it is over-prescriptive to require removal of the specified components intact if BATRRT **does not** identify this as the best option.

36. BATRRT may not necessarily always require pre-treatment prior to shredding. It will depend on the individual operator's shredding equipment, and any other factors that EHS takes into consideration when determining licence conditions.

## **TREATMENTS**

37. All separately collected WEEE will need to be treated unless the appliance is reused as a whole. In order for opportunities for reuse to be maximised, selection or screening of items suitable for reuse needs to be carried out at an early stage, normally at the point of collection and appropriate handling measures applied during storage and transportation. It is anticipated that such appliances will be transferred to a refurbisher or reseller.

38. Treatment must, as a minimum, include the removal of all fluids, and the appropriate selective treatments in accordance with Annex II to the Directive. All components required to be removed must also be appropriately stored. In removing the fluids and carrying out the selective treatments, care needs to be taken that the techniques used do not endanger the health and safety of the operator. Please see paragraph 117 for further details.

39. As part of the selective treatment of WEEE, certain substances, preparations and components have to be removed. Removal is not defined in the WEEE Directive but is interpreted as including mechanical, chemical or manual processes and could occur at any stage in the treatment process. The manner in which removal is

achieved will therefore depend on the type of WEEE involved, whether hazardous components are present and whether or not it is intended that a component is to be reused. Removal may therefore be a staged process and may also be undertaken at different facilities.

40. Operators of ATFs must be able to demonstrate that they have removed the items identified in Annex II to the WEEE Directive, if present, from separately collected WEEE in accordance with the conditions of their licence. Removal may be by manual or mechanical means. The items listed in Annex II can be broadly split into two groups; those that should be removed as a whole, and those that can be removed as materials i.e. in fragments or equivalent. Items should be safely removed as a whole where the material items concerned are hazardous and to do otherwise would lead to manifest pollution of the waste stream. Items may be removed as materials where the benefits gained by their removal as a whole in health and safety or environmental terms would be disproportionate to the costs involved.

41. Subject to the guidance below, the items listed in Annex II that should be safely removed as a whole are:

1. Capacitors containing polychlorinated biphenyls (PCBs)
2. Mercury containing components
3. Toner cartridges
4. Asbestos
5. Components containing refractory ceramic fibres
6. Components containing radioactive substances
7. Gas discharge lamps
8. Cathode ray tubes
9. Electrolyte capacitors containing substances of concern
10. Batteries that can be removed prior to treatment and internal hazardous batteries

42. Subject to the guidance below, the items listed in Annex II that can be removed as materials are:

1. Plastic containing brominated flame retardants
2. CFCs, HCFCs, HFCs and HCs
3. External electric cables
4. Circuit boards
5. Liquid Crystal Displays
6. Batteries other than those mentioned in the list in paragraph 42
7. The fluorescent coating in cathode ray tubes.

43. The removed substances, preparations, and components shall be disposed of or recovered in accordance with Article 4 of the Waste Framework Directive and all relevant legislation.

44. The treatment of WEEE must avoid the dispersion of pollutants/contaminants into the recycled material or the waste stream or otherwise harm the suitability of the material for recycling or recovery and the achievement of the targets. As a consequence, hazardous or other polluting substances, for example capacitors containing PCBs, may need to be removed early on in the treatment process particularly if fine shredding processes are to be used later in the process. ATFs

should have in place procedures for checking WEEE against information supplied by producers (in accordance with Article 11 of the WEEE Directive). Where this information indicates that equipment contains dangerous substances that would make it hazardous waste under the European Waste Catalogue, and the components containing the dangerous substances are removed, the (shredded) equipment may be considered to be non-hazardous.

45. It is recognised that the full range of treatments might not be undertaken at every ATF. Where partially treated WEEE is transferred to another site or intermediary [for further treatment], it is essential that the WEEE that is transferred is properly described. That is to say that all further recipients of the transferred WEEE are aware of the treatments that have been undertaken and those that remain to be undertaken.

46. The WEEE Directive requires producers to provide information to refurbishers and treatment facilities. This is to facilitate the reuse and environmentally sound treatment of WEEE. The information should be available within one year of new types of equipment being placed on the UK market. Government will produce guidance that will explain what information is to be provided. This is addressed in the WEEE Regulations 2006 and accompanying guidance.

## **FLUIDS**

47. Fluids are typically found in heating and cooling appliances, such as fridges and freezers (coolant circuit) and oil-filled radiators.

48. The WEEE Directive requires the removal of all fluids from WEEE. Fluids must be safely removed prior to crushing or shredding operations. However, care needs to be taken that the techniques used do not endanger the health and safety of the operator. Please see paragraph 117 for further details.

49. Oil-filled radiators and similar devices may be considered to have been drained of fluids when oil or other fluids have been extracted under gravity or by vacuum to an extent that free draining oil or fluid cannot be obtained from the appliance after treatment has been completed. All recovered oils and fluids must be separately contained for disposal or recovery. There are restrictions on the mixing of hazardous wastes<sup>8</sup>.

50. The Environmental Protection (Controls on Ozone-Depleting Substances) Regulations (Northern Ireland) 2003<sup>9</sup> (the ODS Regulations) lay down the treatment operations that must be carried out for fridges and freezers containing the specified controlled substances covered by those Regulations. The Agencies have also produced guidance<sup>10</sup> on the recovery and disposal of controlled substances

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<sup>8</sup> [http://www.ehsni.gov.uk/waste/regulation-and-legislation/regulations\\_specialtest1.htm](http://www.ehsni.gov.uk/waste/regulation-and-legislation/regulations_specialtest1.htm)

<sup>9</sup> S.R. 2003 No. 97

<sup>10</sup> The treatment operations that must be carried out for fridges and freezers are laid down in the ODS Regulations and accompanying "Guidance on the Recovery and Disposal of Controlled Substances Contained in Refrigerators and Freezers". The guidance is periodically revised; operators should have regard to the most recent version. It should also be noted that fluids must be removed from ALL

contained in refrigerators and freezers, which is periodically revised. Operators should have regard to the most recent version.

51. Fridges and freezers containing hydrocarbons should have their fluids removed under safe conditions, in accordance with the Dangerous Substances and Explosive Atmospheres Regulations 2002. Fridges and freezers identified as containing ammonia must have the ammonia extracted and transferred to a suitable container pending disposal. Ammonia is potentially hazardous to the environment, is toxic to humans and can present a risk of fire and explosion. Safe systems of work should be used to protect health, safety and the environment.

## Specific items to be removed

### Capacitors containing polychlorinated biphenyls

52. The WEEE directive requires the removal of:

***“polychlorinated biphenyls (PCB) containing capacitors in accordance with Council Directive 96/59/EC of 16 September 1996 on the disposal of PCBs and polychlorinated terphenyls (PCTs).”***

53. Historically, polychlorinated biphenyls (PCBs) were extensively used in electrical equipment such as capacitors and transformers. However, their use in open applications was widely banned in 1972 and they have not been used in the manufacture of new equipment since 1986. Plants that had been installed prior to 1986 were allowed to continue until the end of their working life. Thus, unless an appliance is more than 20 years old, the chance that it contains capacitors containing PCBs is very remote.

54. Typically, large capacitors were used for power factor correction and similar duties. Small capacitors were used in fluorescent and other discharge luminaires and with fractional horse-power motors of the type used in domestic and light-industrial electrical equipment. They were not labelled as containing PCBs, although they were normally date-coded. Generally, it must be assumed that capacitors manufactured before 1976 contain PCBs. (Note: washing machines with more than one spin speed do not contain a starter capacitor, and it is very unlikely that PCBs have been used in capacitors fitted in domestic appliances for many years).

Listed below are a number of the better known trade names for PCBs that have been used:

ACECLOR	DIACHLOR	KANECLOR
APIROLIO	DISCONOL	KENNECHLOR
AROCLOR B	DUCONOL	NO-FLAMOL
ASBESTOL	DYKANOL	PERMATOL
ASKAREL	ELEMEX	PHENOCLOR
BAKOLA 131	EUCAREL	PYRALENE
BICLOR	FENCLOR	PYRACLOR

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fridges and freezers, even those that are not Ozone Depleting Substances and therefore fall outside the scope of the ODS Regulations.

CHLOREXTOL	HIVAR	PYRANOL
CLORPHEN	HYDOL	SAF-T-KUHL
CLORINOL	HYVOL	SANTOTHERM
CLOPHEN	INERTEEN	SIKLONYL
D.K.		

55. PCBs can harm the environment and human health. See [http://www.ehsni.gov.uk/waste/regulation-and-legislation/regulations\\_specialtest1/regulations\\_specialtest1-disposal\\_of\\_pcbs.htm](http://www.ehsni.gov.uk/waste/regulation-and-legislation/regulations_specialtest1/regulations_specialtest1-disposal_of_pcbs.htm) for specific information.

56. Operators of treatment facilities need to be vigilant in seeking to identify capacitors labelled as containing PCBs and will therefore need to have appropriate procedures in place to ensure such items are identified. Any capacitor that is identified as containing PCBs will need to be removed and disposed of at an appropriately licensed facility.

### **Mercury containing components**

57. The WEEE Directive requires the removal of:

***“mercury containing components, such as switches or back-lighting lamps.”***

58. Mercury is used in gas discharge lamps, in medical equipment, data transmission, telecommunications, and mobile phones. It has also been used in batteries, thermostats, position sensors, relays and switches. Its use in electrical and electronic equipment has declined significantly in recent years, and the RoHS Directive has banned its use from 1 July 2006 (although certain uses are exempted).

59. The treatment procedures for gas discharge lamps are described below. Apart from batteries, most mercury containing items are likely to be found on a circuit board. Thus, removing the circuit board would result in the removal of most mercury containing components such as switches.

60. WEEE treatment facilities should be vigilant for the presence of mercury containing components and where identified should remove these items and store them in appropriate labelled containers.

### **Batteries**

61. The WEEE Directive requires the removal of:

***“batteries.”***

62. Batteries and battery packs occur in many shapes, sizes and types ranging from small back-up batteries on computer motherboards to large batteries in tools and gardening equipment.

63. Batteries should be removed from the WEEE in a manner that does not contaminate the remaining material streams. The location of the battery in the equipment may dictate at what point the battery should be removed. However, they should be removed intact in such a way that they are clearly recognisable as batteries. Removed batteries should be stored in appropriate labelled containers having due regard to the potential fire risk that batteries can present.

64. Although it is relatively easy to remove batteries from most appliances, such as mobile telephones and cordless tools, some equipment will contain a small battery on a circuit board.

65. If the circuit board that contains a small on-board battery has already been removed, then removal of the battery will be considered to have taken place. However, if the circuit boards are to be shredded, then on-board batteries will have to be removed from them. If leaving them on would not lead to the dispersion of pollutants into the recycled material or the waste stream and would not impact on the achievement of the recycling and recovery targets, removal in a specified material stream is permitted.

### **Circuit boards**

66. The WEEE Directive requires the removal of:  
***“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.”***

67. Circuit boards can be found in any piece of electrical or electronic equipment.

68. An increasing number of white goods contain circuit boards that are larger than 10 square centimetres, for example, electronic timers in washing machines and variable speed controllers in vacuum cleaners. Nearly all electronic items, including, for example, calculators and remote control units, also contain circuit boards that may be larger than 10 square centimetres. Circuit boards larger than 10 square centimetres must be removed as whole circuit boards or as large pieces. Once removed they must be stored in suitable labelled containers so as to be able to be sent for specialist recovery.

### **Toner cartridges**

69. The WEEE directive requires the removal of:  
***“toner cartridges, liquid and paste, as well as colour toner.”***

70. Toner cartridges are commonly found in printers, fax machines and photocopiers.

71. Toner cartridges should be removed whole and intact so as to prevent the dispersal of toner in the material or waste streams. The cartridges should then be stored in suitable labelled containers.

### **Plastic containing brominated flame retardants**

72. The WEEE Directive requires the removal of:  
***“plastic containing brominated flame retardants.”***

73. Two primary families of brominated flame retardants (BFRs) have been used in electrical and electronic equipment. The first family is polybrominated diphenyl ethers (PBDPEs), which are mainly used in cabinets. The second family of BFRs is the phenolics, which includes TBBPA (tetrabromo-bisphenol A). TBBPA (also referred to as TBBA) is used primarily in printed circuit boards. Historically, another group, polybrominated biphenyls (PBBs), have also been used, although production

and use of these materials has now ceased in the EU. PBDEs and PBBs will be restricted in electrical and electronic equipment after 2006 by the RoHS Directive.

74. Treatment facilities for WEEE will need to distinguish between plastics that contain BFRs and those that do not. The type of WEEE the plastic arises from and its age will assist in this determination. Proprietary monitoring equipment is also being developed to assist in the detection of BFRs in plastics as part of the "WEEE and Hazardous Waste Part2" project mentioned earlier in this guidance. The presumption should however be that BFRs are present unless it can be confirmed otherwise.

75. The objective of removal is to ensure that BFRs do not re-enter the material stream. BFR plastic items should be removed from WEEE and stored in appropriate labelled bays or containers and disposed of at an authorised facility. If the plastics are removed as part of a shred residue that residue may only be recovered at a facility authorised to receive BFRs. It is recommended that plastics containing BFRs should not be recycled.

76. Further guidance on the extent of BFRs will be included in the results from the results of the WEEE and Hazardous Waste Part2 project mentioned at Paragraph 17 of this guidance.

### **Asbestos**

77. The WEEE directive requires the removal of ***"asbestos waste and components which contain asbestos"***

78. Asbestos has been used in older appliances such as electric coffee pots, toasters and irons. Asbestos was also a component of some electric heaters and other items that benefit from the heat resistant properties of the material. Nowadays, asbestos products must be marked with a large 'a' and a warning that breathing asbestos is dangerous to health.

79. Modern appliances are not permitted to contain asbestos however, operators of treatment facilities need to be vigilant for items which might. Appliances that are over 20 years old might contain asbestos and therefore should be examined. If any asbestos containing components are identified, they must be safely removed and sent for disposal having due regard to relevant health and safety regulations and guidelines for working with asbestos<sup>11 12</sup>

80. Safe systems of work should be designed to ensure the health of workers. Detailed risk assessment, training and safe systems of work will be required for handling products likely to contain asbestos. Work should be organised so that materials likely to contain asbestos are identified and work not initiated without adequate controls being taken. It should be recognised that this guidance is not exhaustive and that competent advice should be sought.

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<sup>11</sup> [http://www.hseni.gov.uk/index/one\\_2\\_one\\_advisory\\_services/asbestos\\_advisory\\_service.htm](http://www.hseni.gov.uk/index/one_2_one_advisory_services/asbestos_advisory_service.htm)

<sup>12</sup> Control of Asbestos at Work Regulations (Northern Ireland) 2003 (S.R. 2003 No. 33)

## **Cathode ray tubes**

81. The WEEE Directive requires:

***“first, that the CRT has to be removed from separately collected WEEE, and second, that the fluorescent coating in the CRT has to be removed.”***

82. Cathode ray tubes (CRTs) are mainly used in either computer monitors or televisions. Handling of CRTs can present a danger of implosion. As a consequence, safe systems of work will need to be used to control the risk to operators. This would typically include enclosure of the process to prevent flying glass entering the working area.

83. The objective of the removal of the fluorescent coating is to ensure that it does not cause pollution or harm. Two main types of approach could be used to separate the fluorescent coating:

(i) The main approach is to separate the lead-containing cone glass from the front glass using a hot wire, laser or cutting disc, followed by removal of the fluorescent coatings.

(ii) An alternative approach is to shred either the CRT or TV/monitor whole and then mechanically recover the various fractions.

84. The second option will only meet the requirements of Annex II to the WEEE Directive if evidence is provided that demonstrates that the fluorescent coatings are removed as a separately identifiable fraction. Furthermore, it is unlikely to be regarded as BATTRT if the mixing and contamination of the various fractions preclude recycling of the glass.

85. The fluorescent coatings that have been removed from the CRT should be stored in appropriate labelled containers and then disposed or recovered at an authorised treatment facility.

## **CFCs, HCFCs, HFCs and HCs**

86. The WEEE Directive requires the removal of:

***“chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs) and hydrocarbons (HCs)”***

87. These materials are typically used in refrigeration and cooling systems such as fridges, freezers and air conditioners. Although labelling of refrigerators in order to identify refrigerant type has been widely practised to allow for ease of servicing (usually listed on the ‘appliance rating plate’) there has been no such practice historically for the insulation foam. Thus, given that appliances reaching the waste stream are generally quite old (i.e. >10 years), the presumption must be that refrigeration appliances contain ODS unless proved to the contrary.

88. Chlorofluorocarbons and HCFCs are ozone depleting substances (ODS). All refrigeration equipment containing ODS is subject to the ODS Regulation<sup>13</sup>. The regulation states that ODS (including HCFCs and CFCs in fridges and freezers) must

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<sup>13</sup> Council Regulation No. 2037/2000 on Ozone Depleting Substances (ODS) as amended.

be recovered for destruction by technologies approved by the parties, or any other environmentally acceptable destruction technology, or for recycling or reclamation during the servicing and maintenance of equipment or before the dismantling or disposal of equipment. The guidance "Guidance on the recovery and disposal of controlled substances contained in refrigerators and freezers" provides further advice on best practice when recovering and destroying ODS from freezers.

89. The removed ODS should be stored in suitable labelled containers and provision made for their recovery or destruction.

90. Given the flammability of HCs, plants for the processing of appliances containing HCs should be intrinsically safe. This is legislated for under the Dangerous Substances and Explosive Atmospheres Regulations (Northern Ireland) 2003<sup>14</sup> All HCs removed should be stored in appropriate labelled containers and provision made to dispose or recover them.

### **Gas discharge lamps**

91. The WEEE Directive requires that:

***"Gas discharge lamps must be removed, and that Mercury must be removed."***

92. Gas discharge lamps are defined as lamps in which light is produced by an electrical discharge through a gas. The discharge can either be through gases (such as xenon, neon and carbon dioxide) or through metal vapour (such as mercury or sodium).

93. The treatment process for fluorescent lamps involves shredding followed by separation into glass, metal and powder (which contains mercury). The separation process should be designed to prevent fugitive emissions of mercury vapour or dust. The separation process can use either a dry or a wet process; the main advantage of the wet process is that it can separate a wider range of lamps. However, the main disadvantage of this process is the requirement for treatment of the water.

94. Recovery of the powder (which contains the bulk of the mercury) and its storage in appropriate labelled containers will be regarded as evidence that the mercury has been removed for the purposes of Annex II to the WEEE Directive.

### **Liquid crystal displays**

95. The WEEE Directive requires:

***"removal of LCDs (together with their casing if appropriate) if either:***

- ***they have a surface area greater than 100 square centimetres; i.e. larger than 4 inches by 4 inches, or***
- ***they are back-lighted with a gas discharge lamp."***

96. Liquid crystal displays (LCDs) are used in a wide variety of applications. Liquid crystals are embedded between thin layers of glass and electrical control elements. A cellular phone display can contain about 0.5mg of liquid crystals, a 'notebook' display about 0.5g.

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<sup>14</sup> S.R. 2003 No. 152

97. LCDs used in computer monitors (and in LCD televisions) are larger than 100 square centimetres, and are also back-lighted with gas discharge lamps. These will need to be removed, and the backlights will then need to be separated from the LCD. Removed gas discharge back-lights and LCDs should be stored separately in appropriate labelled containers.

#### **External electric cables**

98. The WEEE Directive requires the removal of:  
***“external electrical cables.”***

99. These cables can be removed separately either before or after manual or mechanical breaking of WEEE. They may also be removed as part of a shredder residue. Where the cables are removed separately following manual or mechanical breaking they should be placed in suitable labelled containers. Provision should be made for appropriate disposal or recovery.

100. Removed cable must **not** be smouldered.

#### **Components containing refractory ceramic fibres**

101. The WEEE Directive requires the removal of:  
***“components containing RCFs (as described in Commission Directive 97/69/EC of 5 December 1997 adapting to technical progress Council Directive 67/548/EEC relating to the classification, packaging and labelling of dangerous substances).”***

102. Refractory ceramic fibres (RCFs) are mainly used in furnace/heater/kiln linings. Respirable RCFs are classified as category 2 carcinogens, and any work with RCF is subject to stringent controls. Although RCFs may be used in both domestic appliances and building heating appliances, the insulation materials used in domestic electrical appliances are more likely to contain components based on mineral wools rather than RCFs.

103. Appliances which might contain RCFs must be examined to determine if they contain RCFs. If any RCF containing components are identified, they must be removed. The procedure used to remove the RCF containing components should follow all health and safety guidelines relating to RCFs. See <http://www.hseni.gov.uk/> for further information.

#### **Components containing radioactive substances**

104. The WEEE Directive requires removal of:  
***“components containing radioactive substances with the exception of those below the exemption thresholds set in Article 3 of and Annex I to Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of health of workers and the general public against the dangers arising from ionising radiation.”***

105. Radioactive substances are found typically in some medical equipment, certain test instruments, and commonly in smoke detectors.

106. Exempt quantities and exempt concentrations are laid out in Table A of Annex 1 to Directive 96/29/Euratom. Ionisation chamber smoke detectors (ICSD), used in domestic smoke detectors, use americium-241, and should be below these exemption limits. Additionally, operators of ATFs should be aware of the primary legislation relating to use and disposal of radioactive material, i.e. the Radioactive Substances Act 1993<sup>15</sup> and the Ionising Radiations Regulations(Northern Ireland) 2000<sup>16</sup>.

107. Guidance on working with radioactive substances can be found at <http://www.ehsni.gov.uk/pollution/radiation.htm> .

### **Electrolyte capacitors**

108. The WEEE Directive requires the removal of:

***“electrolyte capacitors containing substances of concern (with a height or diameter of over 25 mm, or proportionately similar volume).”***

109. Capacitors of this size are used typically as smoothing capacitors in power supplies that use a transformer, for example in stereo equipment.

110. Currently there is no definition of “substances of concern”, and modern electrolyte capacitors are unlikely to contain any hazardous substances. Nearly all capacitors of this size are now mounted directly on the circuit board, and thus would be removed if the circuit board was removed.

## **TREATMENTS UNDER REVIEW**

### **Mobile telephones**

111. The European Commission propose to evaluate ‘as a matter of priority’ whether the requirements for removal of printed circuit boards from mobile phones should be amended.

### **Liquid Crystal Displays**

112. The European Commission propose to evaluate ‘as a matter of priority’ whether the requirements for removal of LCDs should be amended.

## **ENVIRONMENTAL MANAGEMENT SYSTEMS**

113. Article 6(6) of the WEEE Directive requires that Member States encourage establishments or undertakings which carry out treatment operations to introduce certified environmental management systems (EMS). Adopting a robust environmental management system can help organisations identify and manage their environmental impacts as well as compliance with environmental legislation.

114. Envirowise<sup>17</sup> offers practical help on the WEEE Directive as well as other environmental issues free of charge. The NetRegs website<sup>18</sup> provides help to small

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<sup>15</sup> 1993 c.12

<sup>16</sup> S.R. 2000 No.375

<sup>17</sup> <http://www.envirowise.gov.uk/>

and medium-sized enterprises (SME) in the UK to understand environmental regulations that can affect them and provides advice on good environmental practice.

## **HEALTH & SAFETY CONSIDERATIONS**

115. The treatment of WEEE will involve the removal of substances and components, some of which could be hazardous to operatives. ATF operators must fully consider the health and safety issues associated with the treatment of WEEE. The legislation covering this area includes:

- The Management of Health & Safety at Work Regulations 1999 (Northern Ireland) 2000<sup>19</sup> – these require risk assessments on activities, employees to be informed of the risks, and preparation of emergency procedures.
- Control of Asbestos at Work Regulations (Northern Ireland) 2003<sup>20</sup>.
- The Control of Substances Hazardous to Health Regulations (Northern Ireland) 2003<sup>21</sup> – these require assessments of the risks to health of employees from each hazardous substance.
- The Manual Handling Regulations (Northern Ireland) 1992<sup>22</sup> – these require that activities involving manual contact with hazardous materials are avoided where this is reasonably practical.

116. Safe systems of work should be devised to ensure, so far as is reasonably practicable, the health and safety of workers. Dutyholders should ensure that control of risk is achieved by implementing controls that prevent exposure and where not reasonably practicable then successive measures lower down the hierarchy of control should be used. Only where exposure cannot adequately be achieved by elimination and control of exposure should personal protective equipment be used.

117. Processing WEEE material has the potential to expose workers to the risks from exposure to harmful substances, fire & explosion, cuts and lacerations, musculo-skeletal injury etc. Risk assessments should therefore consider the full range of hazards.

118. Operators of authorised treatment facilities are advised to seek guidance on Health and Safety matters from their competent health and safety adviser. HSENI helpline (tel 0800 0320 121) can provide guidance.

## **FACILITIES**

119. Annex III to the WEEE Directive is being transposed, by the WEEE Licensing Regulations.

120. They provide that establishments and undertakings carrying out treatment operations must apply the following technical requirements:

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<sup>18</sup> <http://netregs.gov.uk/netregs/>

<sup>19</sup> S.R. 2000 No. 388

<sup>20</sup> S.R. 2003 No. 33

<sup>21</sup> S.R. 2003 No. 34

<sup>22</sup> S.R. 1992 No. 2793

*For storage areas:*

- Impermeable surfaces for appropriate areas with appropriate spillage collection facilities, and where appropriate, decanters and degreasers
- Weatherproof covering for appropriate areas.

*For treatment areas:*

- Impermeable surfaces for appropriate areas with appropriate spillage collection facilities and, where appropriate, decanters and degreasers.
- Appropriate storage for disassembled spare parts.
- Appropriate containers for storage of batteries, capacitors containing PCBs or PCTS, and other hazardous waste such as radioactive waste.
- Equipment for the treatment of water, including rainwater.
- (Suitable) balances for measuring the weight of treated waste.

### **Weatherproof covering**

121. The purpose of the weatherproof covering for storage at treatment sites is to minimise the contamination of clean surface and rain waters, to facilitate the reuse of those whole appliances and components intended for reuse and to assist in the containment of hazardous materials and fluids. The areas that are likely to require weatherproof covering will therefore include those storing and treating hazardous or fluid containing WEEE or whole appliances or components intended for reuse.

122. The type of weatherproof covering required will depend of the types and quantities of waste and the storage and treatment activities undertaken. Weatherproof covering may in some circumstances simply involve a lid or cover over a container but in others it may involve the construction of a roofed building.

### **Impermeable surfaces**

123. The WEEE Directive requires the provision of impermeable surfaces for appropriate areas. "Impermeable surface" means a surface or pavement constructed and maintained to a standard sufficient to prevent the transmission of liquids beyond the pavement surface. The impermeable surface should be associated with a sealed drainage system and may be needed even where weatherproof covering is used. This means a drainage system with impermeable components which does not leak and which will ensure that:

- no liquid will run off the pavement other than via the system; and
- except where they may lawfully be discharged, all liquids entering the system are collected in a sealed sump.

124. The activity of treating WEEE itself carries a risk of pollution that must be managed. All treatment activities must take place within an area provided with an impermeable surface.

125. The type of impermeable surface required is likely to depend on a number of factors, including:

- the type and quantity of WEEE being stored or processed including whether the WEEE contains hazardous substances and fluids;
- the type and volume of other materials dealt with;

- the type and level of activity undertaken on the surface;
- the length of time the surface is meant to be in service; and
- the level of maintenance

126. Whether a surface is in fact impermeable will depend on how it is constructed and the use it is put to. A surface will **not** be impermeable and therefore will be unacceptable if, for example,

- it has slabs or paving not properly joined or sealed;
- it is composed solely of hardstanding made up of crushed or broken bricks or other types of aggregate even if the WEEE is also stored in containers; or
- spillages or surface water will not be contained within the system.

### **Spillage collection facilities**

127. Spillage collection facilities include the impermeable pavement and sealed drainage system as the primary means of containment. However, spill kits to deal with spillages of oils, fuel and acids should be provided and used as appropriate.

### **Equipment for treatment of water**

128. The WEEE Directive requires the provision of equipment for the treatment of water, including rainwater, in compliance with health and environmental regulations. However, it should be remembered that as a matter of best practice, operators of treatment facilities should take appropriate steps to minimise the contamination of clean waters. All liquid runoff from an impermeable pavement used for the storage of hazardous WEEE and hazardous components will be regarded as being contaminated, unless it can be shown otherwise (irrespective of whether there happens to be any activity on the pavement at the time.) On most sites, two systems for the management of water will be necessary, for clean water and for contaminated water. Clean water can be dealt with by surface water drains that should carry only uncontaminated water from roofs to a watercourse or soakaway. The treatment of contaminated water to the necessary standard will require a sealed drainage system, as defined above. It may be necessary to obtain a consent if water is to be discharged. Discharges to sewers are generally controlled by the Water Service. Other discharges such as those to soakaways and watercourses are regulated by EHS<sup>23</sup>.

### **Storage for disassembled parts**

129. Treatment sites must provide appropriate storage for disassembled spare parts from WEEE. Some spare parts (e.g. motors and compressors) will contain oil and/or other fluids. Such parts must be appropriately segregated and stored in containers that are secured such that oil and other fluids cannot escape from them. These containers must be stored on an area with an impermeable surface and a sealed drainage system.

### **Storage for other components and residues**

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<sup>23</sup> [http://www.ehsni.gov.uk/environment/waterManage/regulation\\_of\\_Discharges/industrial.shtml](http://www.ehsni.gov.uk/environment/waterManage/regulation_of_Discharges/industrial.shtml) and <http://www.waterni.gov.uk/home1.htm>

130. Other components and residues arising from the treatment of WEEE will need to be contained following their removal for disposal or recovery. Where they contain hazardous substances they should be stored on impermeable surfaces and in appropriate containers or bays with weatherproof covering. Containers should be clearly labelled to identify their contents and must be secure so that liquids, including rainwater, cannot enter them. Components should be segregated having regard to their eventual destinations and the compatibility of the component types. All batteries should be handled and stored having regard to the potential fire risk associated with them.

## **Balances**

131. Annex III to the WEEE Directive also requires that sites for treatment of WEEE have “balances to measure the weight of the treated waste”. The objective is to ensure that a record of weights can be maintained of WEEE entering a treatment facility and components and materials leaving each site (together with their destinations). The nature of the weighing equipment is likely to depend on the type and quantity of WEEE being processed.

## **Meaning of ‘where appropriate’**

132. Which requirements are ‘appropriate’ for a particular site will generally be determined by reference to the waste types and quantity being stored or treated and the purpose of the requirement (e.g. environmental protection, minimising the contamination of clean surface and rain waters, preventing damage to potentially re-usable WEEE or components, etc). The appropriateness of a building, lean-to or enclosed transport container for example will need to be determined on a site specific basis.

## **REPAIR AND REFURBISHMENT**

133. Some treatment sites may wish to operate under the exemption for repair and refurbishment of WEEE. Such sites will take in pre-selected WEEE and seek to repair and refurbish as much of that WEEE as possible so that the highest possible volume of electrical and electronic equipment is delivered for use in the commercial or social market. The general rules for this exemption apply the treatment requirements of the WEEE Directive. Inspection requirements apply to registrations of this exemption.

## **DATA COLLECTION**

134. Operators of treatment facilities need to be aware that there will be a data reporting requirement placed on them. The emphasis will be on obligated producers to report compliance, and in this context they should engage ATFs that provide treatment compliance services to ensure they can show adequate verification of treatment for the WEEE for which they have responsibility.

## Appendix 1

### Annex II B

Operations which may lead to recovery

NB: This Annex is intended to list recovery operations as they are carried out in practice. In accordance with Article 4, waste must be recovered without endangering human health and without the use of processes or methods likely to harm the environment

R1 Solvent reclamation / regeneration

R2 Recycling / reclamation of organic substances which are not used as solvents

R3 Recycling / reclamation of metals and metal compounds

R4 Recycling / reclamation of other inorganic materials

R5 Regeneration of acids or bases

R6 Recovery of components used for pollution abatement

R7 Recovery of components from catalysts

R8 Oil refining or other reuses of oil

R9 Use principally as a fuel or other means to generate energy

R10 Spreading on land resulting in benefit to agriculture or ecological improvement, including composting and other biological transformation processes, except in the case of waste excluded under article 2 (1) (b) (iii)

R11 Use of wastes obtained from any of the operations numbered R1-R10

R12 Exchange of wastes for submission to any of the operations numbered R1-R11

R13 Storage of materials intended for submission to any operation in this Annex, excluding temporary storage, pending collection, on the site where it is produced.