



European Union Network for the Implementation and Enforcement of Environmental Law

# WEEE Directive Implementation and Enforcement

*Brominated Flame Retardants in WEEE plastic*

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## Introduction to IMPEL

The European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL) is an international non-profit association of the environmental authorities of the EU Member States, acceding and candidate countries of the European Union and EEA countries. The association is registered in Belgium and its legal seat is in Brussels, Belgium.

IMPEL was set up in 1992 as an informal Network of European regulators and authorities concerned with the implementation and enforcement of environmental law. The Network's objective is to create the necessary impetus in the European Community to make progress on ensuring a more effective application of environmental legislation. The core of the IMPEL activities concerns awareness raising, capacity building and exchange of information and experiences on implementation, enforcement and international enforcement collaboration as well as promoting and supporting the practicability and enforceability of European environmental legislation.

During the previous years IMPEL has developed into a considerable, widely known organisation, being mentioned in a number of EU legislative and policy documents, e.g. the 7th Environment Action Programme and the Recommendation on Minimum Criteria for Environmental Inspections.

The expertise and experience of the participants within IMPEL make the network uniquely qualified to work on both technical and regulatory aspects of EU environmental legislation.

Information on the IMPEL Network is also available through its website at: www.impel.eu

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**Executive Summary**

Waste of electrical and electronic equipment (WEEE) is one of the fastest growing waste streams in the EU, with some 12,3 Mt (16,6 kg/inh) generated in the EU 2016 (and 44,7 Mt worldwide), and expected to grow to more than 52,2 Mt in 2021 worldwide (The global E-waste Monitor UNU-IAS, 2017).

WEEE contains a complex mixture of materials and components, which are partly hazardous. Not properly managed WEEE can cause major environmental and health problems. In addition, the production of electronics requires the use of scarce and expensive resources. The improvement of collection, treatment and recycling and avoiding illegal export (to countries with poor treatment facilities) of electronics at the end of their life is essential to contribute to a circular economy.

For the year 2017 and 2018 is chosen to focus this project on brominated flame-retardants in WEEE plastic, on Annex VI of the WEEE Directive (minimum requirements for shipments) and the classification of WEEE.

In 2017 two questionnaires have been send out to the participants, one on Annex VI and one on BFRs. In June 2017 a workshop was held in the Netherlands to discuss the outcome of the questionnaires and to present and discuss best practises. In 2018 another workshop was held, discussing BFRs in WEEE plastic, a draft guideline on the inspections of Annex VI of the WEEE Directive, and a draft document on the classification of WEEE.

In this report on 2018, we will focus on BFRs in WEEE plastic. There will be separate guidance documents on Annex VI and the classification of WEEE.

**Conclusions and recommendations BFRs in 2018**

In 2018, a workshop was held in which best practices for inspection, detection methods and thresholds for BFRs were discussed. For many countries inspection on BFRs in WEEE is very complicated and not often done.

To improve this situation the following steps could be considered:

- a common understanding on classification of BFR containing WEEE plastic;
- binding threshold for all BFRs (including DecaBDE);
- list of detections methods for BFRs for Bromine alternatively;
- new waste code for plastic containing BFRs;
- clear steps how plastics containing BFRs should be derived from waste stream at WEEE treatment operator or at subsequent steps (e.g. requirements in Austria);
- obligation for waste treatment companies to report the removal and the treatment of WEEE plastic containing BFRs.

Content

# Introduction

## 1.1 Background

Waste of electrical and electronic equipment (WEEE) is one of the fastest growing waste streams in the EU, with some 12,3 Mt (16,6 kg/inh) generated in the EU 2016 (and 44,7 Mt worldwide), and expected to grow to more than 52,2 Mt in 2021 worldwide (The global E-waste Monitor UNU-IAS, 2017).

The new WEEE Directive (2012/19/EU of the European Parliament and the Council of 4 July 2012 on waste electrical and electronic equipment) introduces a collection target of 45% of electronic equipment sold that will apply from 2016 and, as a second step from 2019, a target of 65% of equipment sold, or 85% of WEEE generated. The new collection targets agreed will ensure that around 10 million tons, or roughly 20kg per capita, will be separately collected from 2019 onwards. Article 11 (in combination with annex V) sets the recycling targets for the different product categories.

WEEE contains a complex mixture of materials and components, which are partly hazardous. Not properly managed WEEE can cause major environmental and health problems. In addition, the production of electronics requires the use of scarce and expensive resources.

The improvement of collection, treatment and recycling and avoiding illegal export (to countries with poor treatment facilities) of electronics at the end of their life is essential to contribute to a circular economy.

For the year 2017 and 2018 is chosen to focus this project on brominated flame-retardants in WEEE plastic, Annex VI of the WEEE Directive (minimum requirements for shipments) and classification of WEEE.

For Annex VI and classification separate guidance documents will be developed. This report is on BFRs in WEEE plastic. This report is follow up of the report of 2017.

## 1.2 Aims

This project has two main aims/parts:

1. Improving the enforcement of illegal shipments of WEEE to countries with poor treatment facilities (African and Asian countries) by creating a guideline for a more uniform interpretation and enforcement of Annex VI of the WEEE Directive.

   Annex VI of the WEEE Directive gives Member States tools to fight illegal export of waste more effectively. Annex VI requires exporters to test and provide documents on the nature of their shipments when the shipments run the risk of being waste. Although Annex VI gives more tools, there are still elements which Member States can interpret (e.g. when is testing done properly, classification) and enforce differently. Different interpretation and enforcement will cause effects like port hopping and discussions on return shipments.

2. To prevent next generation of hazardous wastes by using waste plastics contaminated with PBDEs and PBBs for new plastic products (see requirements of the POP-Regulation and ROHS).

   A desk study is necessary on the implementation of the WEEE Directive in national legislation concerning treatment of waste plastic containing brominated flame-retardants (BFR). Furthermore improving the monitoring of waste plastics of WEEE containing BFR, stimulate enforcement actions in this field by exchanging information, working methods, case studies. The main aim is to prevent next generation of hazardous wastes by using waste plastics contaminated with PBDEs and PBBs for new plastic products (see requirements of the POP-Regulation and ROHS.

## Reading Guide

Chapter 2 is on the applicable legal requirements regarding BFRs in WEEE plastic. Chapter 3 contains the outcome of the workshop in 2018 and Chapter 4 contains the main conclusion and recommendations

# Legal requirements

## 2.1. Introduction

WEEE contains a whole range of hazardous substances such as heavy metals and POPs (BFRs) in significant quantities. The uncontrolled release of those substances during disposal and recycling may cause risks to human health and environmental problems.

In the mid-1990s, about 150.000 tons of BFRs were produced annually. By the end of the 1990s the produced amount had almost doubled.

## 2.2. Legal requirements

Regarding BFRs in WEEE plastic, the following legislation is applicable:

**DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS recast)**

Restricted substances referred to in Article 4(1) and maximum concentration values tolerated by weight in homogeneous materials (ANNEX II)

- PBDE, PBB < 1.000mg/kg
- PBB < 50 mg/kg according to WSR/BC hazardous waste and subject to the procedure of prior written notification and consent, export prohibition to NON-OECD countries

**DIRECTIVE 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2012 on waste electrical and electronic equipment (WEEE)**

- annex VI: Minimum requirements for shipments
- plastic containing brominated flame retardants have to be removed from any separately collected WEEE
- these substances, mixtures and components shall be disposed of or recovered in compliance with Directive 2008/98/EC

**COMMISSION REGULATION (EU) No 1342/2014 of 17 December 2014 amending Regulation (EC) No 850/2004 of the European Parliament and of the Council on persistent organic pollutants as regards Annexes IV and V (POP)**

- annex IV: Hexabromobiphenyl – low POP limit: 50 mg/kg, sum of tetra-/penta-/hexa- and heptabromodiphenyl ether – low POP limit: 1.000 mg/kg

Art 7 (2): waste consisting of, containing or contaminated by any substance listed in Annex IV shall be disposed of or recovered, without undue delay and in accordance

- with Annex V, part 1 in such a way as to ensure that POP content is destroyed or irreversibly transformed so that the remaining waste and releases do not exhibit the characteristics of persistent organic pollutants.
- decabromodiphenyl ether (DecaBDE) is POP yet, but no limit value exists up to now

**COMMISSION DECISION of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council**

There is no reference to the low POP limit value for PBDEs (and some other newly listed POPs), except as regards hexabromobiphenyl, for the classification as hazardous waste.

Member States shall specify limit values for classification as hazardous waste at national level. In case of PBDEs, some MS either refer to the low POP-limit values, others to the chemical characteristics of the specific POP, triggering a hazardous property in the meaning of Regulation No. 1357/2014.

In Finland's view, it is not possible to specify limit values for hazardous waste at national level as they are set down by EU legislation.

# Outcome workshop 2018

## 3.1 Problems identifying BFRs

Each year some 3 million tons of plastics are used in new Electric and Electronic Equipment (EEE) in Europe. In the separately collected Waste of Electric and Electronic Equipment (WEEE) many different types of plastics can be found.

The most common are HIPS, ABS, PP and PC-ABS. These plastics may contain Brominated Flame Retardants (BFRs) and several of the BFRs are restricted according to international and national legal requirements.

Plastics with BFRs are typically used in appliances that generate heat such as CRT televisions and monitors, printed circuit boards in IT equipment, printers and cables and connectors.

Although all of the MS have implemented the legal requirements to national law there are considerable differences in classification of BFR-containing WEEE plastic e.g. not listed, Annex IV, Annex III, hazardous or not hazardous waste. There is lack of common understanding how regulators should implement technical requirements of Annex VII of WEEE Directive (e.g. in permits or national legislation concerning BFRs plastics separation). This creates an obstacle both for operators and authorities (and thus for inspections). Furthermore there is no common understanding on the threshold of restricted BFRs and on the best method(s) to detect BFRs in WEEE plastics.

The basic cause of differences seems to be due to the European legislation itself – different Regulations (POPS, REACH) and Directives (RoHS) or conventions (Stockholm) regulate POPs and BFRs. It is difficult to orientate in the diversity of different legislation.

It is also fact that competent authorities do not prioritize enforcement and inspections to detect illegal treatment/shipments of WEEE plastics containing BFRs and in consequence of the competent authorities have only minor experience on how to inspect BFRs in WEEE plastic.

The lack of own waste codes for waste plastics containing BFRs and the unclear situation in classification whether or not waste plastics containing BFRs are to be classified as hazardous waste are reasonable factors that the data about produced, treated or shipped amounts of BFR-containing WEEE plastic are poor or even do not exist.

## 3.2 Some best practices

**Detection methods**
Because the identification of PBDE congeners using gas chromatography combined with mass spectrometry (GC/MS) is time consuming and rather expensive X-ray fluorescence (XRF) may help to overcome this obstacle.
By using XRF (also XRF handheld devices) the content of Bromine in WEEE plastics can be determined with sufficient precision as well as accuracy.

**Threshold for BFRs/Br**
EN standard CLC/TS 50625-1 on collection, logistics & treatment requirements for WEEE - Part 1 sets a threshold value for total elemental Bromine - Br of 2.000 ppm for the check if there are BFRs in plastics.
WEEE plastics containing a total bromine content below 2000 ppm Br are classified as POP free according to this standard. On the other hand, if the content of Bromine exceeds 2000 ppm, it is assumed that restricted BFRs are present and a separation and a further treatment (e.g. incineration) is required.

In the near future, the limit of 2000 ppm Br will require an adjustment when a POP-limit for DecaBDE will be set.

It has been suggested that either the limit for Deca-BDE would be 10 ppm or the total limit for tetra-, penta-, heksa-, hepta and deca-BDE would be 500 ppm.
This means that the CENELEC BFR-standard has to be revised in both cases.

**Legal adjustments**
Germany prepares an ordinance for the treatment of WEEE. By this ordinance the existing treatment requirements for WEEE according to the national ElektroG will be concretized and developed further also in the field of the treatment of BFRs containing WEEE plastics.

In Austria, the national Waste Treatment Obligations Ordinance was amended recently. By this ordinance, the following provisions are laid down:

- WEEE plastics destined for material recycling which are not doubtless free of BFRs **(Br < 2000 ppm)** have to be separated. The separation must be ensured by means of a **quality assurance system** and

- if other validated methods do not ensure that the plastic fractions are free of BFRs a **continuous measurement** of total bromine content must be made (including a continuous recording of the analysis results);
- no analysis of the total bromine content of WEEE plastics is needed if the **entire plastic fraction will incinerated** or the BFRs will be demonstrably separated quantitatively (e.g. by floating-sink procedure in combination with near infrared (NIR) and X-ray transmission technology) before their destruction.

Finland: A survey of BFRs in WEEE and waste vehicles will be performed. The focus will be on how the restrictions have been implemented.
Netherlands: Set up an enforcement plan on BFR in which NL set out how they could enforce. However, there is no validated method to analyze the few specific BFR limit values of POP.

**Inspections**
In Austria, trained experts sometimes do spot checks of bromine content of WEEE plastics with XRF ("handheld"). In Czech Republic trained experts has the possibility to carry out spot checks on Br content. Due to unclear legal context the checks on Br have not been carried out at WEEE operators.

Austria: During road/company inspections, only trained experts take samples in compliance with EN standards for sampling.

Austria: Some inspections at WEEE plastics treatment facilities (Producer of high-grade plastic granulates and flakes). Waste samples (shredded WEEE plastics classified as green listed waste) from loads of just incoming trucks from abroad were taken by trained experts. Results of analysis showed Bromine contents > 2000 ppm for all samples. Wastes have to classify as not listed waste (notification). Consignees and senders were reported for illegal shipments of waste to the administrative and criminal court respectively. Up to now one final sentence was imposed.

**Leaflet/Awareness raising**
European Electronics Recyclers Association (EERA) published a brochure which decribes how WEEE recyclers treat mixed plastics with Best Available Technology in compliance with WEEE and POP regulation.
Leaflet includes also:
- facts and figures about BFRs containing plastics;
- treatment scheme how to detect, separate and treat WEEE plastics containing BFRs
- EN Standard 50625-1 on collection, logistics & treatment requirements for WEEE – general treatment requirements in case total Bromine content > 2000ppm;
- Br > 2000ppm: further separation by specialized recycling facilities and incineration of this fraction.

## Conclusions and recommendations

In 2018 a workshop was held in which best practices for inspection, detection methods and thresholds for BFRs were discussed. For many countries inspection on BFRs in WEEE is very complicated and not often done.

To improve this situation the following steps could be considered:

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