

BNXS46: Mercury in energy-using products

Version 1.0

This Briefing Note and referenced information is a public consultation document and will be used to inform Government decisions. The information and analysis form part of the Evidence Base created by Defra's Market Transformation Programme.

1 Introduction

Mercury has the potential to harm both the environment and human health. However, owing to its favourable characteristics, mercury is found in some components utilised within lighting and electronic products. This Briefing Note gives an overview of the use of mercury in these applications alongside the quantities they usually contain.

The Briefing Note then examines the potential for reduction or elimination of the use of mercury within these products. Information is presented on current and future management of mercury wastes, in terms of both landfill/recycling practices and the policies that shape them.

2 Environmental impacts of mercury

Mercury and its compounds are highly toxic substances for which potential impacts should be considered carefully. Mercury, particularly in the form of methylmercury (CH_3Hg^+), has the potential to significantly impact on the environment owing to its ability, particularly within the aquatic environment, to build up in organisms within the food chain. The progressive build-up of mercury at successive levels in the food chain¹ has a significant impact on both animals and humans, and this is known as 'biomagnification'.

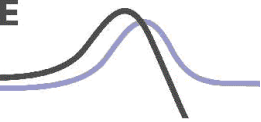
Methylmercury is a central nervous system toxin, which can affect the kidneys, mouth lining and lungs, as well as posing a risk to unborn babies. In terms of long-term occupational exposure, studies suggest a lowest observed adverse effect level (LOAEL) of 15-30 mg/m^3 metallic mercury expressed as an eight-hour concentration².

3 Why is mercury used?

Like gold and silver, mercury is a heavy metal that is extremely malleable, expanding and contracting according to temperature. Mercury compounds are typically used by

¹ A group of organisms interrelated by the fact that each member of the group feeds upon the one below it and is, in turn, eaten by the organism above it in the chain.

² Health Protection Agency: <http://www.hpa.org.uk/chemicals/compendium/Mercury/chronic.htm>



the electronics industry in level indicators, guards, relays, electrical switches and energy efficient mercury-containing bulbs. Mercury components are sometimes used where high levels of reliability are required.

Mercury is found within compact fluorescent lamps (CFLs) to produce the white colour of the emitted light. Their ability to achieve the required degree of light intensity and colour rendition, as well as its energy efficiency, means they are used in the display products mentioned in section 4.2.

4 Products which contain mercury

Mercury is utilised in a variety of products which can be found in the home or workplace.

4.1 Lighting

Various types of lighting bulbs, both domestic and non-domestic, contain mercury. The mercury, although a very small amount, will be sealed within the glass tubing. Examples of these are:

- Compact fluorescent lamps (CFLs).
- Linear fluorescent lamps.
- High intensity discharge lamps.

4.2 Electronic equipment

Some electronic products contain mercury within CFL lighting for their lamps/displays. Examples of these are:

- Flat panel LCD³ monitors and televisions.
- Laptop computers.
- Fax machines.
- Scanners.
- Photocopiers.
- DVD players.
- Telephones.
- Audio equipment.

5 Quantities of mercury found in these products

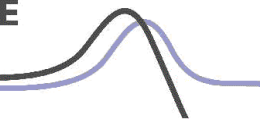
The quantity of mercury contained in lighting and electronic devices is very small, and therefore measured in milligrams (mg).

5.1 Lighting

The precise amount of mercury in a CFL is difficult to estimate, but various sources suggest that a range of 3 to 5 mg for domestic lighting⁴ is reasonable - about the amount that would cover the tip of a ballpoint pen. In larger, non-domestic

³ Liquid crystal display.

⁴ However, in some cases it may be as high as 7.5mg (see footnote 6).



applications quantities may be up to 30 mg. By comparison, older thermometers contain about 500 mg of mercury.

5.2 Electronic equipment

The quantity of mercury in electronic equipment varies according to the type and size of the product. Some types of equipment contain more than one mercury component. For example, the average screen size of an LCD television has risen in recent years, and larger screens require larger or more lamps per unit. Research on behalf of the European Commission has found that a 32-inch LCD television contains, on average, 45 mg of mercury⁵.

Within equipment such as flat screen televisions, laptop computers and display monitors, the quantity of mercury utilised will vary according to screen size, with anywhere from 5 to 50 mg present⁶.

The following types of equipment have far lower quantities of mercury - in the range of 0-5 mg:

- DVD players.
- Digital photo frames.
- Fax machines.
- Audio equipment.
- Telephones.
- Camcorders and cameras.

6 Alternatives to mercury

6.1 Zero mercury options

The alternative technology to CFLs is bright light-emitting diodes (LEDs). However, it is unknown to what extent these will be incorporated into lighting and electronic equipment in the short term. The replacement of CFL backlight lamps with arrays of LEDs may provide the means of eliminating mercury in televisions, as well as saving energy. In addition to containing no mercury, LED backlights are attractive to manufacturers as they are more controllable than CFLs, allowing better picture quality, and should prove cheaper in the long term.

In recent years, some of the larger manufacturers have released LED backlight monitors, and some laptop computers have also begun to feature LED backlight units in their monitors. However, in general, because of current cost and lifetime constraints, LED screens are still uncommon.

⁵ White, P. et al (2006). *Environmental, Technical and Market Analysis Concerning the Eco-design of Television Devices* (<http://www.jrc.es/publications/pub.cfm?id=1388>).

⁶ Electronic Industries Alliance Information Sheet (http://www.eiae.org/chemicals/files/CEI_mercury.pdf).

6.2 Reduced mercury options

As well as attempting to source alternatives which do not contain mercury, finding a means to decrease the quantity of mercury used is also valuable in reducing the hazardous waste burden of waste lighting and electronic equipment.

In the area of monitors and TVs, the CE/ICT industry is working with CFL suppliers to reduce the concentration of mercury in the lamps used in LCD screens. A major LCD television manufacturer has now been able to produce a model in which the concentration of mercury present in each lamp is as little as 3.5 mg. Further reductions may be possible, although there will be a limit on the amount by which the mercury content can be reduced without compromising the reliability and qualities of the light produced by the CFL.

For general lighting purposes, there has been a steady decrease in the amount of mercury used in fluorescent lighting (per lamp) and this trend is expected to continue. For non-domestic lighting, the amount of mercury used could fall as a result of the European Eco-Design of Energy-using Products Directive proposals.

7 UK policy and European legislation

There are four European Union (EU) Directives that are concerned with mercury levels and related to energy-using products. These are the Hazardous Waste Directive (HWD), Waste Electrical and Electronic Equipment (WEEE) Directive, the Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) and the Eco-design of Energy-using Products (EuP) Directive.

7.1 Restriction of Hazardous Substances (RoHS) Directive

The RoHS Directive, 2002/95/EC, dictates that Member States must ensure that any new electrical and electronic equipment put on the market does not contain mercury, amongst other substances. It allows the following exemptions:

- Mercury in compact fluorescent lamps not exceeding 5 mg per lamp.
- Mercury in straight fluorescent lamps for general purposes not exceeding:
 - Halophosphate 10 mg.
 - Triphosphate with normal lifetime 5 mg.
 - Triphosphate with long lifetime 8 mg.
- Mercury in straight fluorescent lamps for special purposes.
- Mercury in other lamps not specifically mentioned in this Annex. Item 4 includes almost all high-intensity discharge lamps including most street lighting.

RoHS exemptions are intended for review every four years, with a view to eliminating exempted substances if financially and technologically feasible.

To summarise, the RoHS Directive seeks to reduce substances such as mercury in new electronic and electrical equipment through setting limits on permissible quantities. This should help to make those products easier and safer to treat and recycle when they become waste.

7.2 Waste Electrical and Electronic Equipment (WEEE) Directive

The WEEE Directive (2002/96/EC) was introduced in the UK in January 2007. Almost all consumer electronics products sold in the UK are subject to the EU WEEE Directive (2002/96/EC and 2003/108/EC)⁷. Therefore, the majority of LCD televisions containing mercury should arrive at an authorised reprocessor at the end of their life.

The WEEE Directive should result in higher levels of mercury recovery through electrical and electronic equipment being channelled through authorised reprocessors for recovery.

7.3 Hazardous Waste Regulations

On 16 July 2005, the Hazardous Waste (England and Wales) Regulations and the List of Wastes (England) Regulations came into force, replacing the Special Waste Regulations.

As part of this legislation, it transposes the European Hazardous Waste Directive (91/689/EEC) including the European Waste Catalogue (EWC) and the Hazardous Waste List (part of the European Waste Catalogue). All wastes will therefore need to be characterised by their EWC code. Lighting and electronic equipment containing mercury, such as fluorescent tubes and computer monitors, will be classed as hazardous waste.

This legislation imposes new requirements on hazardous waste producers, such as registration, inspections, consignment notes and record-keeping. For example, if a person produces hazardous waste (as defined in the Hazardous Waste List of the EWC) such as CFL light bulbs, they will be classed as a producer of hazardous waste. Each hazardous waste production site must be registered annually with the Environment Agency⁸.

7.4 Energy-using Products Directive

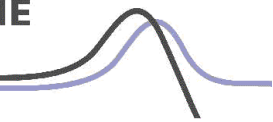
The European Commission is yet to produce a draft set of options for an implementing measure on televisions (Lot 5) under the EuP Directive. However, the final report of the preparatory study for Lot 5 does not make any recommendations on the phasing-out of substances such as mercury (used in LCD backlights) and lead (used in plasma screens), the presence of which is exempted under the RoHS Directive. However, it does suggest that the mandatory labelling of the presence of RoHS-exempted materials be introduced.

8 Recycling and recovery

Since mercury is a valuable commodity, and because there are strict prohibitions preventing its release into the environment, CFL backlight lamps will be removed from the television as part of the disassembly and reprocessing process, and the mercury recovered for re-use. In most cases, it is likely that the WEEE reprocessing company will remove the backlights and send them to a specialist mercury recovery

⁷ It aims to minimise the impact of electrical and electronic goods on the environment, by increasing re-use and recycling and reducing the amount of WEEE going to landfill by making producers responsible for financing the collection, treatment and recovery of waste electrical equipment.

⁸ <http://www.sita.co.uk/assets/hazwastereg05.pdf>



operator for processing. However, a few reprocessors may have on-site mercury recovery facilities.

The number of fluorescent tube recyclers in the UK is slowly growing but at present there are still few places that will accept household electrical equipment for re-use and/or recycling. Methods for retailer take-back schemes, kerbside collections and separate storage at civic amenity sites are under investigation by Defra⁹. Several companies involved in wastes management are planning a national scheme for the take-back and recycling of waste electrical and electronic appliances under the name Transform. This scheme will have three distinct areas:

- Collection from businesses, civic amenity sites and retailers.
- Treatment and recycling of appliances.
- Consumer take-back and refurbishment services.

A different company will manage each of these¹⁰.

The recovered mercury is likely to be sold on to specialist metal aggregators/suppliers to be placed on the global supply market.

9 Conclusion

This Briefing Note has outlined the variety of products in which mercury can be found and also the differing quantities used in each. It is likely that in the short term, the use of mercury within lighting and electronics products will continue. It is currently unclear how much mercury will be recycled in the UK, but early indications suggest there may be a future surplus of mercury in the UK, based upon UK manufacturing requirements versus recycling.

However, technological developments to both reduce and eliminate mercury in these applications are being introduced, and the use of mercury in products is expected to decrease in the longer term.

Related MTP information

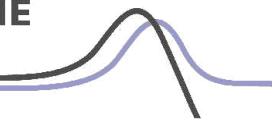
- Briefing Note BNICT26: Sustainable product legislation relevant to ICT

Changes from version 0.0

This is the first version of BNXS46

⁹ <http://www.defra.gov.uk/environment/waste/topics/electrical/pdf/weee-casite.pdf>

¹⁰ <http://www.wasteonline.org.uk/>



Consultation and further information

Stakeholders are encouraged to review this document and provide suggestions that may improve the quality of information provided, email **info@mtprog.com** quoting the document reference, or call the MTP enquiry line on +44 (0) 845 600 8951.

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