Mercury in Compact Fluorescent Lamps

Source document:
SCHER (2010)

Summary & Details:
GreenFacts

Level 2 - Details on Mercury in Compact Fluorescent Lamps

The answers to these questions are a faithful summary of the scientific opinion produced in 2010 by the Scientific Committee on Health and Environmental Risks (SCHER):
"Opinion on Mercury in Certain Energy-saving Light Bulbs"

The full publication is available at: https://copublications.greenfacts.org/en/mercury-cfl/
and at: http://ec.europa.eu/health/opinions/en/mercury-cfl/

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- Level 3 consists of the Source document, the internationally recognised scientific opinion which is faithfully summarised in Level 2 and further in Level 1.

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1. Why is mercury tolerated in compact fluorescent light bulbs?

Inefficient bulbs will be banned from the market gradually....
[see Annex 2, p. 8]
Source: EC [see http://ec.europa.eu/energy/lumen/overview/whatchanges/index_en.htm]

Traditional incandescent light bulbs are very energy-inefficient and are being phased out in the EU. Compact fluorescent lamps (CFLs) are a popular alternative because they are cheaper to run and are more environmentally friendly: CFLs use less energy than other lamps, so power stations need to burn less coal and gas to produce electricity and this leads to lower carbon dioxide and other emissions.

As opposed to incandescent or halogen light bulbs, compact fluorescent lamps contain mercury. The mercury content cannot escape from the lamps, except if they break accidentally or if they are discarded with unsorted household waste rather than recycled appropriately. If consumers take back their burned-out lamps to collection points, the mercury content will be recycled and not released to the environment.

The ***directive on the restriction of hazardous substances in electrical and electronic equipment*** (2002/95/EC), in short RoHS directive, generally forbids mercury in electronic and electronic equipment with some exemptions in duly motivated cases, such as CFLs.

The mercury tolerance for Compact fluorescent lamps is currently set at 5 mg per lamp and is subjected to reviewed on a regular basis.

[Note: It is scheduled to be gradually lowered to 3.5 mg in 2012 and 2.5 mg from 2013 on with some variations depending on the specific lamp type. (Source: amended RoHS directive [see http://ec.europa.eu/environment/waste/weee/legis_en.htm])]

The complete elimination of mercury in compact fluorescent light bulbs is still technically and scientifically impracticable though reductions have been achieved.

The ***commission regulation*** (No 244/2009) implementing the ***ecodesign*** directive (2005/32/EC) sets ecodesign requirements that that household lamps, other than light spots, must meet and indicates that the compact fluorescent lamps with the lowest mercury content include no more than 1,23 mg.

	Mercury content per bulb	Source
Maximum until 2011	5 mg	RoHS directive
Maximum in 2012	3.5 mg	
Maximum from 2013 on	2.5 mg	
Indicative benchmark	1.23 mg	Ecodesign regulation

2. How could mercury released from a broken CFL affect health?

2.1 How can inhaling or swallowing mercury affect health?

If mercury is swallowed less than a thousandth is absorbed by the body and most of it is eliminated, mainly through the urine and faeces. Still, swallowing a high concentration of mercury on the short term can lead to severe harmful and even life-threatening effects.

When inhaled, most of the mercury vapours are absorbed by the lungs. The parts of the body most affected by mercury inhalation are the kidneys and the central nervous system.

People who have **accidentally** inhaled relatively large quantities of vapours – for instance at certain workplaces – often show inflammation of the lungs, kidney damage, gastroenteritis, restlessness and shaking.

Workers who are exposed **regularly** to mercury vapours (at levels exceeding German maximum limits for short term exposure at the work place) run an increased risk to develop problems with their central nervous system. Long-term exposure to levels of mercury which are about one quarter of the limit allowed in the workplace, can still harm the kidneys and cause subtle effects on the central nervous system such as memory loss, sleeping problems, anger, fatigue and trembling of the hands.

Young children and the developing are growing and developing quickly so they are particularly vulnerable to mercury. Children exposed to mercury vapours can develop breathing difficulties, swelling and redness of the hands and feet, and pealing pink skin at the tips of fingers and toes.

2.2 Does the amount of mercury released by a broken CFL affect health?

When the tube of a fluorescent light bulb breaks, the mercury vapour inside is released into the air. In an average room, the amount of vapour could briefly be well above the limits allowed in the general environment, and could exceed the levels allowed in the workplace. However, these limits are designed to protect adults who are exposed to such levels regularly during a 40-year work life, so they are not applicable for a very short-term exposure. Most of the mercury released from the CFL turns liquid very quickly so, shortly after the breakage, the level of mercury vapour becomes too low to cause any harm to adults, even those who are particularly sensitive.

Children breathe in more air in proportion to their size than adults and tend to be more active, so children could be exposed to comparatively higher levels of mercury than adults.

The amount of mercury in the air is not the only important consideration. The spilt mercury that has turned to liquid can stick to surfaces and dust, particularly if the room is not aired sufficiently or cleaned up thoroughly. This is particularly relevant for young children because they bring their fingers and objects to their mouth and may thus swallow contaminated dust.

At present there are no estimates on the amount of mercury that children are likely to swallow after a lamp has broken and the SCHER recommends that this research be carried out and that customers be given instructions on how to deal with a CFL breakage.

The amount of mercury in the air after a compact fluorescent lamp breaks is relatively high initially but is not enough to cause harm. The released mercury vapour turns quickly into a liquid and the level of mercury in the air decreases very rapidly so it is unlikely that broken CFLs pose any risk to the health of adults.

In principle, a foetus can be exposed to mercury through its mother but the amount of mercury that can cross over from the mother’s blood is very limited so the risk of broken CFLs to the foetus is negligible.

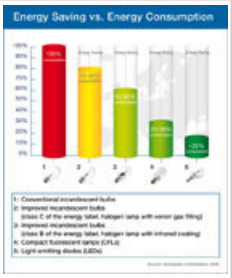
At present, there is no data on how much mercury children could take in through swallowing mercury-containing dust or licking contaminated surfaces so it is impossible to determine the risk that broken CFLs pose to children.

3. Do mercury emissions due to light bulb use and disposal pose a risk to the environment?

3.1 How much mercury is released by different light bulbs during use and disposal?

Several types of light bulbs contain mercury. These include compact fluorescent lamps, straight fluorescent tubes, as well as other lamps such as high-pressure sodium lamps. However, at present there is not sufficient information on how many lamps of each type are sold, how long they last and how they are disposed of, so it is not possible to fully assess the risk that their use poses to the environment.

In 2007, approximately 4% of the total electricity consumption in the EU-27 was used to provide power to light bulbs (excluding spot lights) and three quarters of this electricity is used in homes. In 2007, the best-selling lamps in Europe were frosted incandescent bulbs. Compact fluorescent lamps sold half as much as these, closely followed by clear incandescent lamps.



Energy Saving vs. Energy Consumption
[see Annex 1, p. 7]
Source: EC [see http://ec.europa.eu/energy/lumen/overview/whatchanges/index_en.htm]

Power generation based on coal implies emissions of mercury to air. [According to the DG Joint Research Centre, **the generation of 1 kWh emits 0.016 mg of mercury to air**, assuming that 31 % of the electricity used in the EU comes from coal.] Therefore, using any type of light bulb contributes indirectly to mercury emissions, even if the lamp itself does not contain mercury. To assess the contribution of each type of lamp to the total amount of mercury released, it is necessary to add the mercury emissions associated with energy production for their use to the amount of mercury that reaches the environment when the lamp breaks.

Of the lamps investigated, incandescent lamps result in the highest emissions of mercury to the environment per unit of light produced, and halogen lamps the least per unit of light produced.

Compact fluorescent lamps lie somewhere in between. This calculation is based on the assumption that only 20% of the lamps would be recycled at the end of their useful life. In this case, three quarters of the overall mercury release by CFLs would occur at the end of the lamps' lifetime when the CFL is not disposed of appropriately, i.e. thrown with unsorted household waste and not recycled. Overall, for the light bulbs sold in 2007 over 5000 kg of mercury would be released to the environment in the EU as a result of light bulb usage and disposal.

3.2 How much mercury is released into the environment from other sources?

Worldwide, an estimated 3400 to 5300 tonnes of mercury are released into the environment each year. 1400 to 2300 tonnes are due to natural events (e.g. volcanic activity, weathering of rocks) but the remaining 2000 to 3000 tons of emissions are the result of human activity.

Mercury is released into the soil, water and atmosphere, but most of the human emissions are to the soil, mainly due to mining.

An important use of mercury is in dental amalgams used for tooth fillings. Some of this mercury finds its way into the environment through wastewater discharges from dental practices and through the leaching of mercury from the teeth of deceased people.

3.3 Do mercury releases from light bulbs pose a risk to the environment?

The mercury emissions due to the use and disposal of household lamps (incandescent, halogen & CFLs combined) are approximately 20 times lower than those from dental practices and represent a tiny proportion of the overall mercury released from all human activities so they are considered very unlikely to pose any risk to the environment. However, sites that collect and dispose of light bulbs could be a local risk if they do not deal with potential mercury releases appropriately.

4. What would be the benefits of increased separate collection of compact fluorescent lamps?

The current use and disposal of compact fluorescent lamps is unlikely to pose any environmental risks. However, because of their mercury content they should increasingly be recycled.

It was estimated that, in 2007, households only recycled 20% of burned-out compact fluorescent lamps, while the remainder was discarded inappropriately with unsorted waste. Improving the recycling rate so that more CFLs are collected separately and the mercury they contain is removed thoroughly, would reduce mercury emissions.

In 2007, 353 million CFLs were sold in the EU-27 with an assumed mercury content of 4.5 mg per bulb. By the time they reach the end of their useful life (6000 hours) their electricity use will have led to 462 kg of mercury emissions (from coal fired power plants). In addition, if only 20% of them are recycled, an estimated 1130 kg of mercury would eventually be released by inappropriate disposal. The latter could in part be prevented by improving recycling rates.

5. Do environmental benefits of compact fluorescent lamps outweigh potential risks?

Benefits	Potential Risks
Lower electricity use and greenhouse gas emissions than incandescent and halogen lamps Lower overall mercury releases as a result of use and disposal than incandescent lamps (taking into account mercury emissions from coal fired power plants)	CFLs that break accidentally could pose a potential direct risk to the health of consumers. Mercury released from CFLs that are disposed of inappropriately could pose a potential risk to the environment

Source: Wikimedia [see http://commons.wikimedia.org/wiki/File:Unbalanced_scales.png]

On the one hand, CFLs consume less electricity than conventional household lamps so they offer some clear benefits in that they lead to lower emissions of mercury, greenhouse gases and other pollutants from power plants. On the other hand, CFLs contain mercury which is a hazardous substance so there is a potential health risk in the mercury released from lamps that break accidentally in the consumer's home or after they have been thrown with the general refuse. It is very difficult to weigh benefits against these potential risks and determine the relative importance of these different aspects: effects of greenhouse gases on global warming, mercury released to the environment and potential effects on human health.

The EC Scientific Committee on Health and Environmental Risks (SCHER) is of the opinion that **compact fluorescent lamps offer a net environmental benefit compared to the other light bulbs considered, even if their mercury content is taken into account.**

On potential risks SCHER concluded:

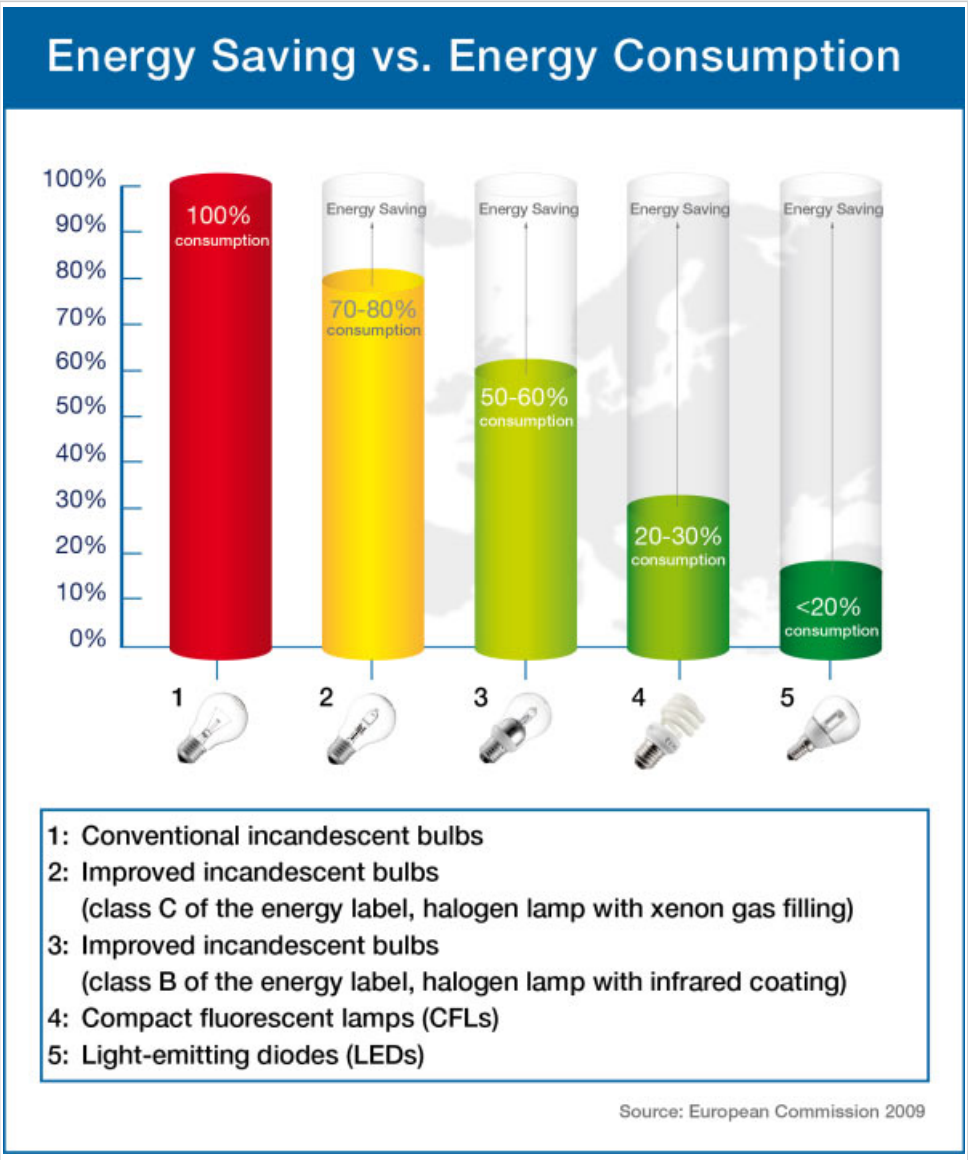
Compact fluorescent lamps that break accidentally in a consumer's home are not expected to pose any health risks to adults. However, no conclusions can be drawn on the potential risks to children, namely because there is a lack of data about the possible oral intake from dust and hand-to-mouth contact. In principle, a foetus can be exposed to mercury through its mother but the amount of mercury that can cross over from the mother's blood is very limited so the risk of broken CFLs to the foetus is negligible. (see question 2).

It is very unlikely that the use and disposal of compact fluorescent lamps poses any risk to the environment. However, facilities that collect and recycle them could pose a local, environmental risk if they do not deal appropriately with the released mercury (see question 3).

When asked to weigh environmental gains from CFLs against any risks to human lives from accidental exposures, SCHER counsels some caution, as the relative weight given to such different aspects has to remain a matter for judgment in the risk management process.

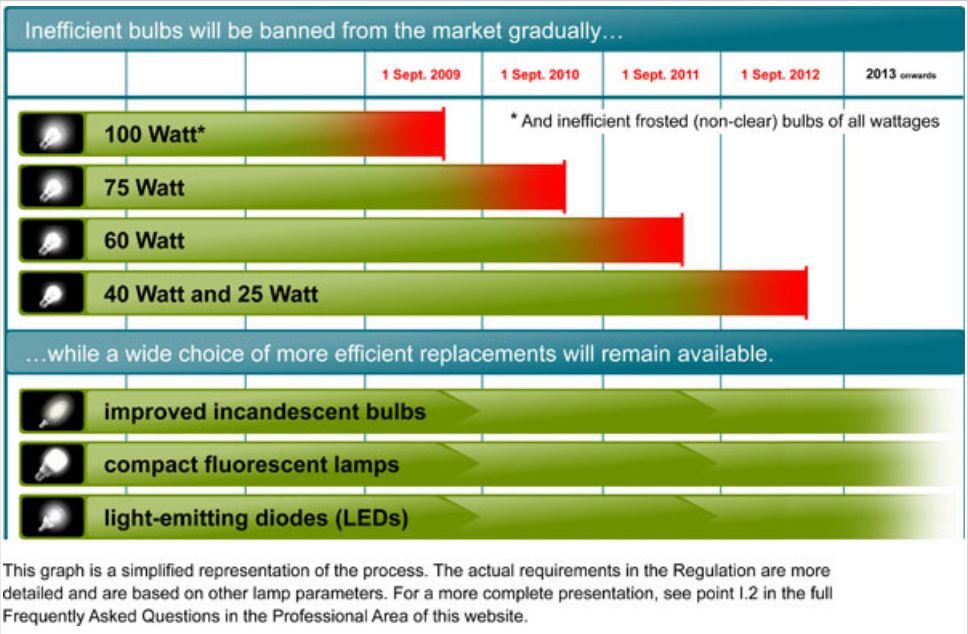
Annex

Annex 1:
Energy Saving vs. Energy Consumption



Source: http://ec.europa.eu/energy/lumen/overview/whatchanges/index_en.htm [see http://ec.europa.eu/energy/lumen/overview/whatchanges/index_en.htm]

Annex 2:
Inefficient bulbs will be banned from the market gradually



Source: http://ec.europa.eu/energy/lumen/overview/whatchanges/index_en.htm [see http://ec.europa.eu/energy/lumen/overview/whatchanges/index_en.htm]

Partner for this publication

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