Order Code RS22807
February 13, 2008

CRS Report for Congress

Compact Fluorescent Light Bulbs (CFLs): Issues with Use and Disposal

Linda Luther
Analyst in Environmental Policy
Resources, Science, and Industry Division

Summary

Compact fluorescent light bulbs (CFLs), a smaller version of fluorescent tubes, are produced with technology that allows them to fit into standard lighting products such as lamps and ceiling fixtures. The bulbs use one-fifth to one-quarter the energy and can provide roughly 10 times the hours of illumination of traditional incandescent light bulbs. These factors have led to a significant increase in the sales of CFLs. According to the U.S. Environmental Protection Agency (EPA), CFL sales doubled in 2007 and now represent 20% of the U.S. light bulb market. Sales may be expected to increase with the implementation of new energy efficiency standards for lighting specified in the Energy Independence and Security Act of 2007 (P.L. 110-140, enacted December 19, 2007). Those standards require certain light bulbs to use 25% to 30% less energy than today's products beginning in 2012. CFLs already meet the standards.

The increased use of CFLs has led to concern among some groups over the presence in the bulbs of mercury, a potent neurotoxin. By way of example, EPA has likened the amount of mercury in individual bulbs to that which could fit on the tip of a ballpoint pen — ranging from 2 to 6 milligrams (mg). At these levels, mercury is virtually harmless to consumers. Still, EPA recommends that caution be taken in cleaning up broken CFLs to minimize potential mercury exposure. EPA also recommends that spent bulbs be recycled, instead of disposed of with household garbage, in areas where CFL recycling is available. (Federal regulations that apply to the disposal of mercury-containing products (e.g., lighting, switches, thermometers) do not apply to households.) Further, EPA has noted that increased CFL use may actually reduce overall mercury emissions to the environment by potentially reducing power use — coal-fired power plants are the greatest individual source of mercury emissions in the United States.

This report discusses reasons why CFL sales have increased dramatically in the past two years, concerns that have arisen regarding their use and disposal, and some media reports that have exaggerated the potential danger associated with the mercury in CFLs.

In 2001, lighting accounted for 8.8 % (101 billion kilowatt hours) of U.S. household electricity use. Incandescent lamps, which are commonly found in households, are highly inefficient sources of light because about 90% of the energy they use is lost as heat.[1] For that reason, lighting has been one focus of efforts to increase the efficiency of household electricity consumption.

Lighting manufacturers are now producing products that are significantly more energy-efficient than incandescent bulbs. Such lighting includes fluorescent bulbs. Long considered a more economical choice for industrial lighting, compact fluorescent light bulbs are becoming more attractive to household consumers. The primary difference between a *compact* fluorescent light bulb (CFL)[2] and a fluorescent tube is the size. Unlike tubes, CFLs are made to fit into products that can be plugged into standard household light sockets like table lamps and ceiling fixtures. Compared to incandescent bulbs that use a heated filament to produce light, CFLs contain a gas that produces invisible ultraviolet (UV) light when the gas is excited by electricity. UV light hits a white coating inside the fluorescent bulb, which alters the light into light visible to a human eye. Because fluorescent bulbs do not use heat to create light, they are far more energy-efficient than regular incandescent bulbs.[3] In the past, complaints about the high cost, harsh light quality, and the inability to use with a dimmer made CFLs less attractive to some consumers. However, improvements in technology have resulted in less expensive CFLs that illuminate more softly, emitting light similar to light from an incandescent bulb, that are capable of dimming.

Increased Use of CFLs

CFL sales have increased significantly in the past two years. According to the U.S. Environmental Protection Agency (EPA), 290 million Energy Star-qualified[4] CFLs were sold in 2007.[5] That is nearly double the number sold in 2006 (the year that CFL market share increased from a steady 5% to 11%), and represents almost 20% of the U.S. light bulb market.

---

[1] The Department of Energy's Energy Information Administration, "U.S. Household Electricity Report," released July 14, 2005, available online at [http://www.eia.doe.gov/emeu/reps/enduse/er01_us.html].

[2] "CFL" actually stands for compact fluorescent *lamp*.

[3] General Electric, "Compact Fluorescent Light Bulb (CFL) FAQs," available online at [http://www.gelighting.com/na/home_lighting/ask_us/faq_compact.htm].

[4] Energy Star is a joint program of EPA and the Department of Energy. Among other goals, the program advocates energy-efficient products and practices. Energy Star was introduced by EPA in 1992 as a voluntary, market-based partnership to reduce greenhouse gas emissions through energy efficiency. Products that have the Energy Star designation reduce greenhouse gas emissions by meeting energy-efficiency specifications set by the government. More information about the program is available on the program's website at [http://www.energystar.gov/].

[5] See EPA Press Release, "EPA and DOE Spread a Bright Idea: Energy Star Light Bulbs are Helping to Change the World," January 15, 2008, available online at [http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/970f05bf0bc5d9aa852573d10055b38d!OpenDocument].

Energy Efficiency of CFLs. The primary factors contributing to the rise in popularity of CFLs are their energy efficiency and longer life. According to the Department of Energy (DOE), CFLs use about 75% less energy than standard incandescent bulbs and last up to 10 times longer. Further, according to EPA, the increase in sales is due in part to increases in consumer education and promotion by Energy Star retail partners such as Wal-Mart, Lowe's, Home Depot, Costco, Ace Hardware, and Sam's Club.

New Energy Efficiency Standards for Lighting. Another factor that may further increase the use of CFLs is the development of energy efficiency standards for lighting. Sections 321 and 322 of the Energy Independence and Security Act of 2007 (P.L. 110-140, enacted December 12, 2007; referred to hereafter as the Energy Act) established energy efficiency standards for certain types of incandescent lamps, incandescent reflector lamps, and fluorescent lamps. The standards specify the maximum wattage that can be used to power lights within a range of lumens (a measure of the perceived power of light). For example, a standard North American incandescent light bulb that emits approximately 1,700 lumens uses 100 watts of power. A CFL emitting comparable lumens uses approximately 23 watts. The new standard would require incandescent lamps emitting comparable lumens to use no more than 72 watts. The deadlines for meeting the new standard fall between January 1, 2012, to January 1, 2014, depending on the range of lumens emitted by various bulbs. CFLs already meet the Energy Act's energy standard.

The Energy Act has been interpreted by some as a prohibition on the sale or production of incandescent bulbs, or as a mandatory requirement to use CFLs. Neither is true. The Energy Act only establishes standards that incandescent bulbs must meet — it does not prohibit their use, nor does it mandate the use of CFLs.[6]

Concerns Regarding Mercury in CFLs

Mercury is a highly volatile, naturally occurring element. It conducts electricity, is liquid at room temperature, combines easily with other metals, and expands and contracts evenly with temperature change. These properties make mercury useful in a variety of household, medical, and industrial products and processes. Mercury is also a potent neurotoxin that can, at certain exposure levels, cause brain, lung, and kidney damage.

Mercury is an essential component of CFLs that allows a bulb to be an efficient light source. Fluorescent bulbs, unlike many other mercury-containing consumer products, are among the few products for which non-mercury substitutes do not exist. Still, over the past 20 years, the mercury content in fluorescent tubes and bulbs has declined steadily. A CFL generally contains 2 to 6 milligrams (mg) of mercury (an amount that poses virtually no risk of harm[7]). By comparison, mercury has been present for decades in the following household products: watch batteries (25 mg), dental amalgams (500 mg),

---

[6] For more information about the Energy Act, see CRS Report RL34294, *Energy Independence and Security Act of 2007: A Summary of Major Provisions*, by Fred Sissine.

[7] National Electrical Manufacturers Association fact sheet "Handling Small Numbers of Broken Fluorescent Lamps," May 2004, available online at [http://www.nema.org/lamprecycle/broken-lamps.doc].

thermometers (500 mg to 2 grams (g)), thermostats (3 g), and electrical switches and relays (3.5 g).

Concerns About Mercury Releases During CFL Use. Increased use of CFLs has generated concern among some over the potential danger the bulbs may pose if broken in the home during use or after disposal. The amount of mercury that may be released by a CFL depends on a variety of factors, including a bulb's age at the time of disposal. As the bulb ages, the mercury content becomes bound to the glass, where it is not readily available for release into the environment unless it is burned (i.e., disposed of in an incinerator).[8] Therefore, it is possible to essentially eliminate potential mercury releases from CFLs if they are not broken, particularly when new, or incinerated.

Mercury is not released from CFLs during normal use. Consumers would be exposed to mercury only if a bulb were to break. At room temperature, some of a bulb's metallic mercury will evaporate and form mercury vapors; however, the danger posed from exposure to the amount of mercury in an individual CFL is minimal.[9] Although the potential risk of harm associated with CFL use is relatively low, certain precautions are recommended to avoid spreading of mercury vapor. Guidance has been produced by several federal and state agencies regarding cleanup and disposal of broken CFLs.[10] Cleanup advice from the different agencies varies slightly, but generally recommends that consumers take the following steps:

- do not vacuum the area (this will spread any remaining mercury-containing dust throughout the house);
- open a window and leave the room for 15 minutes, and keep children and pets away from the area until it is cleaned up;
- collect larger broken pieces using disposal gloves;
- collect smaller broken pieces using a disposable broom or two stiff pieces of paper;
- pat the remaining area with duct tape or wipe with a damp disposable rag; and
- put all waste materials in a plastic bag and then in a second sealable plastic bag, and dispose of the CFL in the regular garbage or take it to a local recycling center, if available or required by state law.

In guidance provided by the Energy Star program, it has been noted that the use of CFLs in place of incandescent bulbs could actually reduce the amount of mercury

---

[8] Northwest Energy Efficiency Alliance, "CFL Disposal Kit," September 20, 2004, available online at [http://www.northwestenergystar.com/index.php?cID=168].

[9] To provide some context, with regard to typical sources of mercury exposure, the Department of Health and Human Services (HHS) estimates that mercury from dental amalgam may contribute up to 75% of an individual's total daily mercury exposure. See the HHS, Agency for Toxic Substance and Disease Registry, "Public Health Statement for Mercury," available online at [http://www.atsdr.cdc.gov/toxprofiles/phs46.html], see particularly section 1.3 "How might I be exposed to mercury?"

[10] For Energy Star guidance, see "Frequently Asked Questions: Information on Proper Disposal of Compact Fluorescent Light Bulbs (CFLs)," available online at [http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf].

emissions to the environment.[11] Coal-fired power plants currently account for 40% of mercury emissions in the United States.[12] During a five-year span, by some estimates, a coal-fired power plant emits 9.3 mg of mercury in the course of producing the same amount of electricity needed to power an incandescent bulb, compared to 2.3 mg of mercury emissions from a CFL over the same period.[13] The use of CFLs in place of incandescent bulbs could also lead to comparable decreases in carbon dioxide, sulfur dioxide, and nitrogen oxide emissions — all pollutants emitted from coal-fired power plants. Any additional mercury emissions associated with CFLs could be minimized if bulbs are kept out of the waste stream (i.e., recycled rather than discarded) when spent.

Issues Regarding CFL Disposal and Recycling. Products containing mercury may meet the federal regulatory definition of hazardous waste. Pursuant to the Resource Conservation and Recovery Act (RCRA),[14] EPA has established regulations regarding the transport, treatment, storage, and disposal of hazardous wastes. However, households are essentially exempt from RCRA. This means that household hazardous waste (e.g., paint, batteries, thermostats, certain cleaning fluids, and pesticides) may be disposed of in municipal solid waste landfills or incinerators.

The mercury levels in CFLs would potentially cause them to be deemed household hazardous waste. As such, EPA suggests that the bulbs not be discarded in household garbage "if better disposal options exist."[15] EPA recommends that household consumers contact their state or local environmental regulatory agency for information about proper disposal options. If household garbage disposal is the only option, EPA recommends that certain precautions be taken. Since CFLs discarded in the trash will likely break and release mercury, EPA recommends that bulbs be put in two plastic bags and sealed before placement in outdoor trash or a protected outdoor location.

Since virtually all components of a fluorescent bulb can be recycled, EPA recommends recycling as the preferred method to manage spent CFLs. The scope of programs to recycle CFLs varies from state to state. For example, a recycling program operating in Minnesota allows residents to leave CFLs at any of hundreds of retail stores across the state. A program in Indiana accepts CFLs at certain Sears stores. Also, regional groups have formed to develop recycling options. For example, the Northwest Compact Fluorescent Lamp Recycling Project is in the process of designing a pilot project to recycle CFLs in Oregon and Washington.[16] Another possibility is that more retailers will begin to accept CFLs for proper disposal — IKEA currently accepts spent CFLs, and

---

[11] Ibid.

[12] Ibid.

[13] Colorado Department of Public Health and Environment, "Fact Sheet on Mercury in Compact Fluorescent Lamps (CFLs)," available online at [http://www.cdphe.state.co.us/hm/mercury/cflfactsheet.pdf].

[14] The Solid Waste Disposal Act (SWDA), enacted by Congress in 1965, provided federal statutory provisions regarding solid waste disposal practices. RCRA was a 1976 amendment to SWDA. All subsequent amendments to SWDA are commonly referred to as RCRA.

[15] EPA makes its recommendations though Energy Star guidance ([http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf]) produced jointly with the Department of Energy.

[16] Information about the program is available online at [http://zerowaste.org/cfl/cfl_index.htm].

Home Depot has begun to accept them at stores in Canada (but, not yet in the United States).

Generally, recycling is not widely available for waste products that are not generated in sufficient amounts to make it economically feasible for recyclers. It is anticipated that, as more spent CFLs enter the waste stream, recycling opportunities will increase. Further, EPA is currently working with CFL manufacturers and U.S. retailers to expand disposal options. Finally, under § 321(h) of the Energy Act, EPA is directed to submit to Congress a report describing recommendations relating to the means by which the federal government may reduce or prevent the release of mercury during the manufacture, transport, storage, and disposal of light bulbs.

Media Reports Regarding Danger from Mercury in CFLs. A perceived danger posed by the use of CFLs has been fed, at least in part, by some media reports claiming hidden costs and dangers associated their use. These reports escalated after an incident involving a broken CFL in a home in Prospect, Maine, on March 14, 2007. After contacting various sources, the homeowner sought cleanup advice from the Maine Department of Environmental Protection (DEP). A DEP representative advised the homeowner to contact an environmental remediation company to remove any residual mercury from the home. The homeowner was given a $2,000 cleanup estimate.

The Maine DEP later acknowledged that because CFLs were relatively new to the market, department personnel had been unfamiliar with proper cleanup and disposal requirements for the bulbs. The agency subsequently posted cleanup guidance on its website, along with an account titled the "History and facts on CFL breakage in Prospect, Maine."[17] The initial incident was repeated by various media outlets, some of which exaggerated the potential danger and cost associated with CFL use and disposal. For example, one journal stated, in part,

> [T]here is no problem disposing of incandescents when their life is over. You can throw them in the trash can and they won't hurt the garbage collector. They won't leech deadly compounds into the air or water. They won't kill people working in the landfills. The same cannot be said about the mercury-containing CFLs.[18]

As noted previously, significantly higher levels of mercury have been present for decades in several other consumer products. There have been no reports of landfill worker fatalities related to mercury exposure. Additional elements of the incident in Maine have been widely repeated, particularly the claim that it will cost a consumer $2,000 to clean up a broken CFL at home. Even though many of the original details and claims have been refuted,[19] the Maine incident is often cited in online news stories and web logs, particularly when the potential dangers associated with CFLs are discussed.

---

[17] See [http://www.state.me.us/dep/rwm/homeowner/fluorescent.htm].

[18] Joseph Farah, *WorldNet Daily*, "Consumers in dark over risks of new light bulbs: Push for energy-saving fluorescents ignores mercury disposal hazards," April 16, 2007, available online [http://www.wnd.com/news/article.asp?ARTICLE_ID=55213].

[19] Scott Norris, *National Geographic News*, "Fluorescent Lights' Mercury Poses Dim Threat," May 18, 2007, available online at [http://news.nationalgeographic.com/news/2007/05/070518-cfls-bulbs.html]; also available via the Energy Star website.