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Do compact fluorescent bulbs reduce mercury pollution?

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[synopsis:] Compared with incandescent bulbs, the new energy-saving bulbs reduce mercury emissions to the atmosphere in many, though not all, regions.

Do compact fluorescent bulbs reduce mercury pollution?

When consumers started tossing burnt-out compact fluorescent bulbs (CFLs) into the trash, they kicked off a compact fluorescent kerfuffle. The energy-saving bulbs with the swirly tops contain a small amount of [link url="www.epa.gov/mercury/" title="Mercury"]mercury [end link], likely too low to pose risks to most homeowners but enough to add up to a serious environmental problem if people don't recycle them.

Now, research published in *ES&T* (DOI [link url="**please use url when this article is online**" title="Spatial Assessment of Net Mercury Emissions from the Use of Fluorescent Bulbs"]10.1021/es800117h [end link]) by researchers from Yale University is turning the mercury problem on its head—it turns out that depending on where you live, you may pump more mercury into the atmosphere by flipping on an old-school incandescent bulb, which doesn't even contain mercury, than by going fluorescent. The extra mercury emissions attributable to incandescent bulbs come from burning more mercury-containing coal to power the inefficient lights.

In places that rely heavily on coal for electricity, such as West Virginia or China, the researchers say switching to CFLs can reduce mercury emissions significantly. But cleaner-powered places like California and Norway would do better to stick to incandescent bulbs when it comes to reducing mercury. "The places known for sustainability are the places that have the potential to do the most harm by bringing this technology in," says environmental engineer [link url="www.yale.edu/env/zimmerman/jbz_homepage.html" title="Julie Zimmerman"]Julie Zimmerman [end link] of Yale, a coauthor of the study.

The study is the first to rigorously compare mercury emissions from CFLs and incandescent bulbs in all 50 U.S. states and 130 countries. The authors find that the U.S. could avoid about 25,000 metric tons (t) of mercury emissions annually by switching all incandescent bulbs to CFLs by 2012, assuming steady growth in lighting demand and a 25% recycling rate. By comparison, in a best-case scenario, U.S. power plants would have to cut mercury emissions by 90% to achieve a savings of 17,000 t annually.

Ultimately, a better lightbulb should both save energy and dispense with mercury, Zimmerman says. "If we want to be truly sustainable, we can't be dependent on materials that use toxic substances," she adds. "We need to look toward safe LEDs [light-emitting diodes] or better CFLs."

Vicki Calwell, an expert on mercury in CFLs who is with Ecos Consulting, agrees that the biggest long-term reductions in mercury emissions from lighting will come from

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2
3 reducing mercury in the bulbs. She notes that decreasing mercury from 5 to 3 milligrams
4 (mg) per lamp is equivalent to achieving a 40% recycling rate overnight.
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7 In the meantime, CFLs use up to 75% less electricity than incandescent lightbulbs and
8 last up to 10 times longer, according to [link
9 url="http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf" title="Information on Compact Fluorescent Light Bulbs (CFLs) and
10 eet_Mercury.pdf" title="Information on Compact Fluorescent Light Bulbs (CFLs) and
11 Mercury"]Energy Star [end link], a U.S. EPA and Department of Energy efficiency-
12 rating program. The bulbs contain between 1.4 and 5 mg of mercury, according to the
13 program's website, about the size of the dot over an "i" in this sentence. A voluntary
14 agreement signed in April 2007 by members of the National Electrical Manufacturers
15 Association, a trade group, capped the amount of mercury in each bulb at 5 mg, and some
16 makers have reduced levels even further.
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20 "I believe that CFLs are a low-risk product, but we do need to do more to understand the
21 risk and develop better technologies or practices to manage it," says [link
22 url="http://research.brown.edu/myresearch/Robert_Hurt" title="Robert Hurt"]Robert
23 Hurt [end link] engineer at Brown University. Hurt has developed new nanomaterials to
24 absorb mercury released by broken CFLs, as described recently in *ES&T* (2008, 42, [link
25 url="http://pubs.acs.org/cgi-bin/abstract.cgi/esthag/2008/42/i15/abs/es8004392.html" title="Mercury Vapor Release from Broken Compact Fluorescent Lamps and In Situ
26 Capture by New Nanomaterial Sorbents"]5772–5778 [end link]). "Neither the
27 [Zimmerman] study nor our recent study in *ES&T* are full health-risk assessments, but the
28 new study does clearly show that the use of fluorescents leads to net reduction in mercury
29 emissions and that the benefit varies greatly by region," he notes.
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34 Zimmerman says the issue is "ripe" for further toxicological studies. Although the
35 amount of mercury per bulb is small, the risk is not well understood for situations
36 involving children, pregnant women, or people who handle many broken bulbs, Hurt
37 adds.
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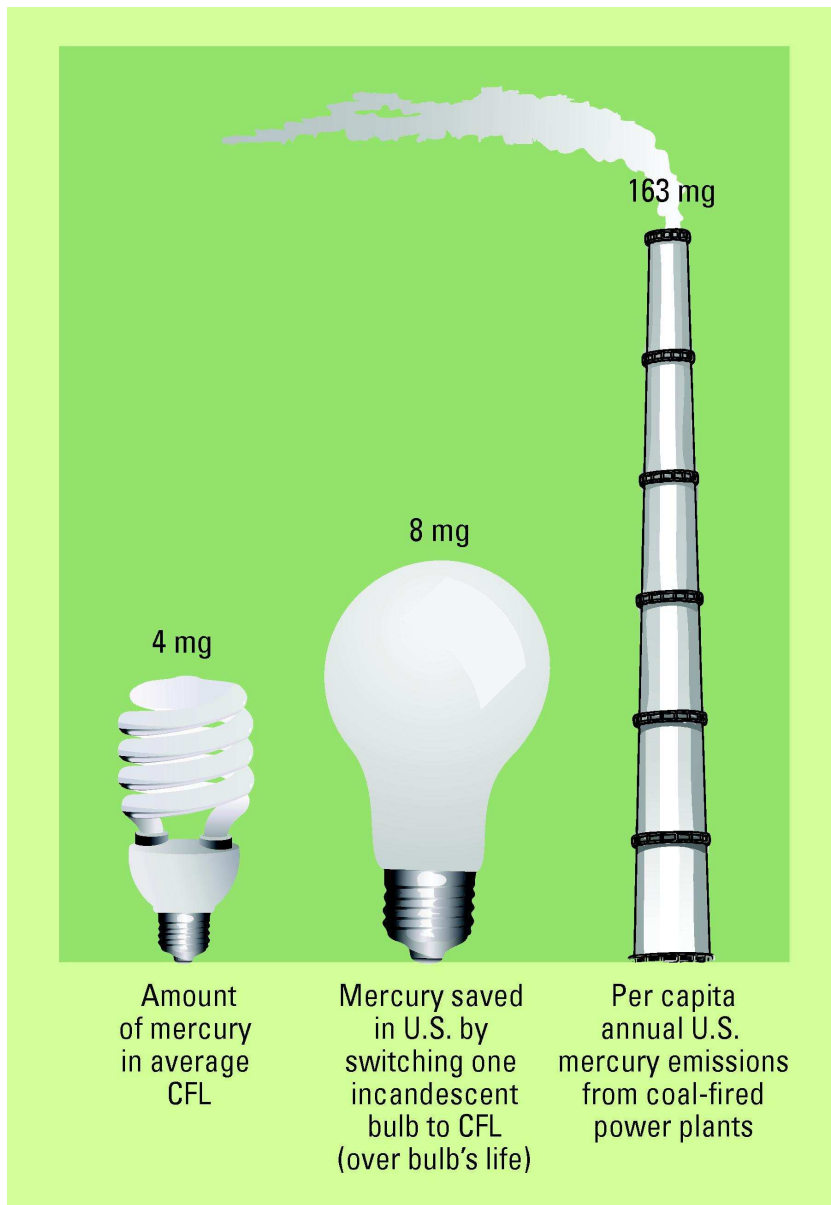
40 Another consideration is that using less electricity does not lead to mercury reductions if
41 power dispatchers cut back on natural gas instead of coal. However, "on a large scale, it's
42 certainly the case that energy efficiency will reduce mercury emissions from coal power
43 [by avoiding building new plants]," says Matthew Eckelman, coauthor of the Yale study.
44 —ERIKA ENGELHAUPT
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47 [graphic 1; es8025566_u1.eps; float]

48 [caption:] Switching from an incandescent bulb to a CFL reduces mercury emissions if
49 the electricity saved comes from coal. Power-plant emissions were calculated using data
50 from EPA and the U.S. Census Bureau. Mercury savings data are from the new *ES&T*
51 paper.
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53 [credit:] RHONDA SAUNDERS
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