

Date of Hearing: April 26, 2022

ASSEMBLY COMMITTEE ON ENVIRONMENTAL SAFETY AND TOXIC MATERIALS

Bill Quirk, Chair

AB 2208 (Kalra) – As Amended April 19, 2022

SUBJECT: Fluorescent lamps: sale and distribution: prohibition

SUMMARY: Bans the offering for final sale, final sale, or distribution of compact fluorescent lamps starting January 1, 2024, and linear fluorescent lamps starting January 1, 2025, and exempts relevant products and applications. Specifically, **this bill:**

- 1) Defines "compact fluorescent lamp" as a compact low-pressure, mercury-containing, electric-discharge light source in which a fluorescent coating transforms some of the ultraviolet energy generated by the mercury discharge into visible light, and includes all of the following characteristics:
 - A) One base (end cap) of any type, including, but not limited to, screw, bayonet, two pins, and four pins;
 - B) Integrally ballasted or non-integrally ballasted;
 - C) Light emission between a correlated color temperature of 1700 Kelvin (K) and 24000K and a Delta u, v (Duv) of +0.024 and -0.024 in the International Commission on Illumination (CIE) Uniform Color Space (CAM02-UCS);
 - D) All tube diameters and all tube lengths; and
 - E) All lamp sizes and shapes for directional and nondirectional installations, including, but not limited to, PL, spiral, twin tube, triple twin, 2D, U-bend, and circular.
- 2) Defines "linear fluorescent lamp" as a low-pressure, mercury-containing, electric-discharge light source in which a fluorescent coating transforms some of the ultraviolet energy generated by the mercury discharge into visible light, and includes all of the following characteristics:
 - A) Two bases (end caps) of any type, including, but not limited to, single-pin, two-pin, and recessed double contact;
 - B) Light emission between a correlated color temperature of 1700K and 24000K and a Duv of +0.024 and -0.024 in the CIE CAM02-UCS;
 - C) All tube diameters, including, but not limited to, T5, T8, T10, and T12;
 - D) All tube lengths from 0.5 to 8.0 feet, inclusive; and,
 - E) All lamp shapes, including, but not limited to, linear, U-bend, and circular.
- 3) Prohibits, on and after January 1, 2024, the offering for final sale, final sale, or distribution in the state as a new manufactured product of a compact fluorescent lamp.

- 4) Prohibits, on and after January 1, 2025, the offering for final sale, final sale, or distribution in the state of a linear fluorescent lamp as a new manufactured product.
- 5) Exempts the following from the above provisions:
 - A) A lamp used for image capture and projection, including photocopying, printing, directly or in preprocessing, lithography, film and video projection, and holography;
 - B) A lamp that has a high proportion of ultraviolet light emission and is one of the following:
 - a. A lamp with high ultraviolet content that has ultraviolet power greater than two milliwatts per kilolumen (mW/klm);
 - b. A lamp for germicidal use, such as the destruction of DNA, that emits a peak radiation of approximately 253.7 nanometers;
 - c. A lamp used for disinfection or fly trapping from which either the radiation power emitted between 250 and 315 nanometers represents at least 5 percent of, or the radiation power emitted between 315 and 400 nanometers represents at least 20 percent of, the total radiation power emitted between 250 and 800 nanometers;
 - d. A lamp used for the generation of ozone where the primary purpose is to emit radiation at approximately 185.1 nanometers; or,
 - e. A lamp used for coral zooxanthellae symbiosis from which the radiation power emitted between 400 and 480 nanometers represents at least 40 percent of the total radiation power emitted between 250 and 800 nanometers.
 - C) Any lamp used in a sunlamp product, defined as any electronic product designed to incorporate one or more ultraviolet lamps and intended for irradiation of any part of the living human body, by ultraviolet radiation with wavelengths in air between 200 and 400 nanometers, to induce skin tanning (as defined in 21 Code of Federal Regulations 1040.20(b)(9));
 - D) A lamp used for medical or veterinary diagnosis or treatment, or used in a medical device;
 - E) A lamp used in pharmaceutical product manufacturing or quality control; and,
 - F) A lamp used for spectroscopy and photometric applications, such as, for example, UV-visible spectroscopy, molecular spectroscopy, atomic absorption spectroscopy, nondispersive infrared (NDIR), Fourier transform infrared (FTIR), medical analysis, ellipsometry, layer thickness measurement, process monitoring, or environmental monitoring.

EXISTING LAW:

- 1) Establishes the Lighting Toxics Reduction Act which, starting January 1, 2010, prohibits the manufacture, offer for sale, or sale of general purpose lights in the state that contain levels of hazardous substances that would result in the prohibition of that general purpose light in the

European Union pursuant to the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC. (Health and Safety Code (HSC) § 25210.9 et seq.)

- 2) Specifies that mercury-containing fluorescent lamps are exempt from management requirements for hazardous waste and are instead managed as universal waste. (22 California Code of Regulations (CCR) § 66261.9)
- 3) Defines "universal waste" as any waste listed in 22 CCR § 66261.9. (22 CCR § 66273.9)
- 4) Specifies regulations that apply to universal waste handlers for mercury-containing lamps. (22 CCR § 66273.33)

FISCAL EFFECT: Unknown.

COMMENTS:

Need for the bill: According to the author, "Now that safe, energy-efficient LEDs are widely available, fluorescent lamps are no longer the best lighting option for California. In order to function, fluorescents must contain mercury, a potent toxin with the ability to do serious and permanent neurological damage to anyone who comes in contact with it. The effects are especially severe in children, who can suffer irreparable setbacks in their cognitive development after being exposed to mercury. If a fluorescent lamp breaks, it will release mercury vapor that can easily injure entire families.

We can no longer sit idly by and let fluorescent lamps poison our communities and harm our environment. By phasing out the sale of fluorescent lamps, AB 2208 will allow better alternatives to light the way to a safer, more energy-efficient future."

Mercury in products: Mercury is a metallic element (chemical symbol: Hg) and the only such element to be liquid at standard temperature and pressure. As outlined below, mercury is both naturally occurring and anthropogenically released into the environment and has significant health effects on humans and wildlife. Nonetheless, mercury is present in many 'everyday' products, including batteries (in the U.S. the only remaining batteries containing mercury are button cell and mercuric oxide batteries), thermometers and barometers, electric switches and relays, fluorescent and other lamps, dental amalgams (a mercury and metal alloy mixture used for dental fillings), skin-lightening products and other cosmetics, and pharmaceuticals. Mercury can occur or be incorporated in various forms and has different toxicities and bioavailability depending on these. Thus, some products, such as thermometers containing mercury, are considered hazardous waste, but dental amalgams have been in use across the world for over 150 years. Fluorescent lamps, specifically, contain mercury in vaporized form, elevating inhalation risk significantly in the event a lamp breaks.

Neurotoxicity of mercury: According to the World Health Organization (WHO), exposure to mercury, even in small amounts, can cause serious health problems and be a particular threat to child development in the womb and early life. All humans are exposed to some level of mercury and the factors that determine whether health effects occur and their severity include the type of mercury to which a person was exposed (e.g. inorganic, organic, etc.); the dose; the age or developmental stage; the duration of exposure; and, the exposure route.

Fetuses are most susceptible to the toxic effects of mercury. Such exposure most commonly results from the mother's consumption of fish and shellfish containing methylmercury. Methylmercury easily travels in the bloodstream and has the ability to cross the blood-brain barrier. Primarily, mercury exposure at this early stage leads to impaired nervous system development, but may also affect other organ systems. Fetal mercury exposure can lead to impairments in cognition, memory, attention, language skills, and fine motor and visual spatial skills. In its most severe form, fetal mercury poisoning leads to Minamata disease, the clinical manifestations of which include the inability to move purposefully, numbness in the extremities, general muscle weakness, and impaired vision, hearing, and speech. The most severe cases of Minamata disease can also cause paralysis, coma, and death. Chronic exposure to high levels of mercury, for example in communities that rely on subsistence fishing, has been shown to result in mild intellectual disability in children.

Minamata disease was named after the city of Minamata in Japan, which was contaminated by industrial discharges containing methylmercury from a chemical factory owned by Chisso Corporation from 1932 to 1968. The methylmercury bioaccumulated and biomagnified (i.e., successively higher concentrations in organisms higher up the food chain) in Manamata Bay, which served as a critical food source to nearby communities. At least 50,000 people were affected to some extent and over 2,000 cases were officially certified; 1,784 deaths were officially reported. Despite mercury poisoning and deaths being observed for 36 years, the local government and Chisso Corporation did little to prevent this tragedy.

Another major disaster linked to methylmercury poisoning occurred in Iraq in 1971 after rural residents consumed seed grain that had been treated with a methylmercury-containing fungicide. The grain was imported from the United States and Mexico and had not been intended for human consumption. However, due to late distribution of the grain during the growing cycle and foreign-language labeling, among other factors, the contaminated product was consumed directly by rural Iraqi communities resulting in at least 459 deaths, though it has been suggested that the real number could be 10 times larger.

According to the WHO, "[t]here are several ways to prevent adverse health effects, including promoting clean energy, stopping the use of mercury in gold mining, eliminating the mining of mercury and phasing out non-essential mercury-containing products." The California Legislature has taken action to ban or limit several such non-essential products, including mercury thermostats (Pavley, Chapter 626, Statutes of 2004), mercury relays and switches (Pavley, Chapter 578, Statutes of 2006), and mercury from cosmetic products (Muratsuchi, Chapter 314, Statutes of 2020). AB 2208 would ban mercury-containing compact and linear fluorescent lamps, except in applications that rely on such lamps.

Mercury in the environment: Mercury occurs naturally in the earth's crust and can be released into the environment from volcanic eruptions, weathering of rocks, forest fires, and as a result of human activity, the primary source of environmental mercury release. Coal-fired power plants, residential coal burning for heating and cooking, industrial processes, waste incineration, and mining can all release mercury.

Once released into the atmosphere, mercury can travel hundreds of miles with the wind and can remain in the air, deposit on soil, or end up in water bodies and sediment. Mercury persists in the environment by cycling between air and soil in different chemical forms. Inorganic

elemental mercury has an atmospheric lifetime of up to two years; methylmercury, an organic form of mercury, can persist in soil for decades.

Methylmercury is produced by anaerobic bacteria in marine environments that have the ability to convert inorganic mercury into organic forms. The methylmercury then moves up the food chain and biomagnifies, resulting in especially high levels of methylmercury in specific fish and shellfish species, such as swordfish, king mackerel, tilefish, and shark. In addition to the risk methylmercury poses to human health, wildlife that consume fish, such as loons, eagles, and otters may also be at risk. Methylmercury poisoning primarily affects reproduction in birds, but birds and mammals may also suffer from neurobehavioral effects and liver and kidney damage.

Alternatives to fluorescent lamps: Despite the known health effects of mercury, fluorescent lamps were long hailed as an important energy-saving alternative to incandescent lamps. Incandescent lamps lose 90% of the energy they draw to heat, as they are designed to heat a metal wire filament (e.g., tungsten) to such high temperatures that it starts glowing. Because of the significant loss of energy to dissipated heat, incandescent lamps are expensive over their lifespan and contribute to environmental pollution if the electricity to power them is derived from fossil fuels. Mercury pollution, specifically, is exacerbated by energy-inefficient light bulbs if the energy is derived from coal-burning power plants. According to the Union of Concerned Scientists, 42% of all anthropogenic emissions of mercury in the U.S. are from coal burned for energy generation.

In a fluorescent lamp, the electrical current ionizes the mercury, which then gives off light in the UV spectrum. The emitted UV light then interacts with the phosphor coating on the inside of the lamp to give off light in the visible spectrum (commonly referred to as white light). This is a much more energy-efficient process. However, fluorescent lamps come with concerns of mercury release upon breakage and improper disposal.

Light emitting diodes (LEDs) produce light when an electrical current passes through the semiconductor light source. LEDs emit light in specific colors, so white light is obtained by either combining LEDs that emit different colors or placing a phosphor coating over the LEDs. LED lighting setups may require more sophisticated engineering due to the directionality of the light emitted by LEDs (as opposed to shining light in all directions). However, the different colors and directionality can also be leveraged in a multitude of applications while remaining energy efficient.

Importantly, LEDs have a much longer lifespan than incandescent and fluorescent lamps, as they do not 'burn out'. Rather, the brightness of LEDs slowly decreases over time (known as lumen depreciation). Lumen depreciation can be mitigated by designing LEDs with proper heat sinks, as heat is the driving factor for this phenomenon. According to Energy Star, thermal management is the single most important factor for the successful performance of an LED over its lifetime.

One key difference for consumers is that with LEDs the traditional 'wattage' signage will no longer correlate with the brightness of a lamp. Rather, LED brightness is rated in lumens. For example, a 40 watt (W) incandescent lamp produces the same brightness as a 450 lumen LED. However, that same LED lamp would only use 6-9W of energy. The significant drop in energy use will both be environmentally friendlier and reduce costs on consumers.

LEDs, like any other lamps, are not perfect. Some of the disadvantages of LEDs include their impact on wildlife such as insects with potential impacts on food webs as the insects become disoriented and exposed to predators, and turtle hatchlings that may be disoriented by LED-emitted light; their greater contribution to light pollution compared to sodium vapor lamps; limitations as area light sources; and, issues as traffic control lights during snow events as they do not dissipate much heat and are therefore more susceptible to snow cover.

Why ban fluorescent lamps now?: While the relative energy efficiency of LEDs has been known, cost was a significant barrier to broad uptake and a ban such as that proposed in AB 2208 would have raised important equity concerns not long ago. The cost of LEDs has dropped significantly, however. Due to energy cost savings, LEDs will be more economical over their lifetime, even if upfront costs may be higher. As policies to phase out fluorescent lamps take effect around the world, LEDs will continue to become more affordable. To align cost considerations with market estimates, the author of AB 2208 bans linear fluorescent lamps starting 2025 to allow for replacement LEDs to further drop in price. The phase-out of mercury-containing lamps in the European Union will also likely reduce the cost of LED lamps and ramp up supply.

European Union (EU) regulations: As the Lighting Toxics Reduction Act (AB 1109, Huffman, 2007) aligned California with some of the EU's regulations, it seems sensible to update California law to reflect advances in technology and continue its alignment with the European single market. The EU regulates light sources and control gears (not just fluorescent lamps) through the Ecodesign Directive (most recently Commission Regulation (EU) 2019/2020) and hazardous substances, including those in lamps, through RoHS directives. In recent RoHS directives, the EU has started the phase-out of mercury-containing lamps over several years. For compact fluorescent lamps and linear fluorescent lamp, Directives 2022/277/EU and 2022/284/EU establish bans between February and August of 2023, respectively.

Exemptions: The bill makes several important exemptions, many of which are modeled after the list of exemptions outlined in the EU's most recent Ecodesign Directive. Upon request by the Committee, the author's office and sponsor are further soliciting information from the academic research community on uses of fluorescent lamps for research purposes that would not be covered by current exemptions. If such uses are identified, the Committee encourages the author to include those in the measure moving forward.

The bill also purposefully does not cover high-intensity discharge (HID) lamps, which also contain mercury and are used where large areas require illumination, such as street lights, parking lots, and stadiums. According to the sponsor, these are being replaced by LEDs for various reasons.

Enforcement: The enforcement mechanism of this bill remains an open question. The author's office and sponsor have been in conversation with Committee staff to discuss this issue. The Committee recommends changing the placement of this bill from the Public Resources Code to the Health and Safety Code. Within the Health and Safety Code, the authors may wish to consider either placing enforcement authority with DTSC, or leaving it up to the Attorney General to prosecute violators.

Arguments in support: A coalition of supporters, including the sponsor of AB 2208, the National Stewardship Action Council, write, "We support AB 2208 because:

- 1) **Mercury-free alternatives are readily available, making the sale of CFLs and LFLs unnecessary:** Mercury and its compounds are highly toxic to humans and the World Health Organization puts mercury in the top ten most problematic chemicals for public health. Much more energy-efficient, mercury-free light emitting diode (LED) technology can easily and affordably replace fluorescent lamps and are readily available.
- 2) **LED alternatives are better for the environment:** LED replacements for fluorescent lamps do not contain any mercury, use approximately half the electricity as fluorescents to produce the same amount of light, and last 2-3 times longer.
- 3) **It will save Californians money:** According to estimates from the Appliance Standards Awareness Project (ASAP), by 2030 California residential, commercial, and industrial consumers would save about \$1 billion annually on their utility bills by transitioning from the most common fluorescent lamps to LEDs.

AB 2208 would not only help protect Californians from the unnecessary threat of mercury exposure from fluorescent lamps, but it is also an important climate protection initiative that would accelerate the transition to a low-carbon economy through increased use of energy-efficient LED lighting solutions."

Related legislation:

- 1) AB 707 (Quirk, Chapter 703, Statutes of 2021). Revises the Mercury Thermostat Collection Act of 2008 and establishes it as the Mercury Thermostat Act of 2021. Revises the funding structure and requires thermostat manufacturers to contract with a qualified third party that meets specified criteria to implement the thermostat collection program statewide.
- 2) AB 2762 (Muratsuchi, Chapter 314, Statutes of 2020). Prohibits, commencing January 1, 2025, the manufacture, sale, delivery, holding or offering for sale in commerce of any cosmetic product containing specific intentionally added ingredients, including mercury.
- 3) AB 1109 (Huffman, Chapter 534, Statutes of 2007). Enacts the Lighting Toxics Reduction Act which, starting January 1, 2010, prohibits the manufacture, offer for sale, or sale of general purpose lights in the state that contain levels of hazardous substances that would result in the prohibition of that general purpose light in the European Union pursuant to the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.
- 4) AB 1415 (Pavley, Chapter 578, Statutes of 2006). Bans the sale and distribution in the state of all products with mercury-containing switches, relays, measuring devices, and gastrointestinal tubes with specified exceptions.
- 5) AB 1369 (Pavley, Chapter 626, Statutes of 2004). Prohibits, on and after January 1, 2006, a person from selling, offering to sell, or distributing for promotional purposes in the state a mercury-added thermostat, unless it meets specified criteria.

REGISTERED SUPPORT / OPPOSITION:

Support

National Stewardship Action Council (Sponsor)
7th Generation Advisors
Active San Gabriel Valley
American Illumination, INC.
American Suntanning Association
California Electronic Asset Recovery (CEAR)
California Product Stewardship Council
Californians Against Waste
Center for Environmental Health
City of Sunnyvale
Clean Water Action
County of Santa Clara
Ecology Center
Environmental Working Group
Greenwaste Recovery
Natural Resources Defense Council (NRDC)
Responsible Purchasing Network
Rethinkwaste
Safer States
San Francisco Baykeeper
Sea Hugger
Sierra Club California
Soltech LLC
The Atrium
The Story of Stuff Project
Tri-ced Community Recycling
Turtle Island Restoration Network
Zero Waste Sonoma

Opposition

None on file.

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