

Protecting Workers from Mercury Exposure While Crushing and Recycling Fluorescent Bulbs

This fact sheet assists employers and workers in understanding the hazards that mercury poses and how to work safely when crushing or recycling tubular or compact fluorescent bulbs. Fluorescent bulbs should only be broken using appropriate equipment, such as drum-top crushing machines or fluorescent bulb recycling machines.

Tubular and compact fluorescent bulbs contain the hazardous metal mercury. Metallic mercury is liquid at room temperature, but can easily evaporate from liquid to a vapor. Mercury vapor is colorless and odorless. Fluorescent bulbs contain mostly mercury vapor, but can contain small amounts of liquid mercury.

Health Effects of Mercury

The nervous system and kidneys are sensitive to mercury exposures. Mercury can also harm unborn children. Health effects of mercury depend upon exposure route, duration and level of exposure.

- Signs of mercury poisoning include mild tremors, subtle effects on mood, impaired memory and coordination, and skin irritation or allergy.
- Signs of exposure to higher levels of metallic mercury can include coughing, chest discomfort, difficulty breathing, nausea, vomiting, diarrhea, sore gums, eye irritation, severe tremors and changes in behavior or vision.

Mercury Exposure

When a fluorescent bulb accidentally breaks, mercury in the glass tube is released and a small amount of mercury vapor enters the air. A small amount of liquid mercury falls to the ground, where it continues to evaporate to form a vapor. Workers are primarily exposed by breathing in vapors. Exposure can also occur by skin contact.

Work processes that involve breaking or crushing fluorescent bulbs can expose workers to mercury. Workers who operate **drum-top crushing machines** or **fluorescent bulb recycling machines** can be exposed when:

- Bulbs are accidentally broken outside the machine.
- The machine's air filtration system is not working properly.

- The seals on the machine are broken or missing.
- The machine is opened for servicing.
- The crusher unit is removed from the top of a full drum.



A fluorescent bulb recycling machine (Photo courtesy of AERC Recycling Solutions.)

Reducing Mercury Exposure in the Workplace

All workplaces where fluorescent bulbs are deliberately broken or crushed should have:

- **A cleanup plan** that informs workers how to safely clean up incidental mercury releases from broken bulbs.
 - Brooms should not be used to clean up broken fluorescent bulbs because they will spread the mercury.
 - A vacuum cleaner should only be used if it is specifically designed to collect mercury. A regular vacuum cleaner will increase air levels of mercury and the vacuum will become contaminated.
 - Contact with broken glass should be avoided.
- **Training** to educate workers about mercury exposure, safe practices for working with fluorescent bulbs and procedures for ensuring that air filtration systems and seals are functioning properly.

- **Process isolation** so that areas where fluorescent bulbs are broken or recycled are physically separated from areas where workers are not involved with bulb processing.
- **Flooring materials** that are easy to clean (e.g., hard, smooth surfaces). Carpeting can absorb mercury and is difficult to clean.
- **Well-ventilated** work areas. Drum-top crushing machines and bulb recycling machines are equipped with air filtration systems; however, there is still potential for mercury vapor to be released. Where feasible, these machines should be located in rooms with a ventilation system that does not recirculate air or exhaust air near intake vents.
- **Evaluation and maintenance programs** to ensure that crushing or recycling equipment and ventilation systems are functioning properly.
- **Air monitoring** to measure the amount of mercury present in the air. Air monitoring should be conducted as necessary to ensure that workers are not being exposed to hazardous levels of mercury.
- **Respiratory protection** is required if feasible engineering and administrative controls do not prevent concentrations of mercury from exceeding OSHA's permissible exposure limit (PEL). If respirators are used, the employer must establish and implement a respiratory protection program in accord with OSHA's Respiratory Protection standard (29 CFR 1910.134).
- **Personal protective equipment (PPE)** such as coveralls, booties, gloves, face shields and safety goggles to prevent skin and eye contact. Employers must assess the workplace to identify hazards and provide appropriate protective equipment under OSHA's General Requirements for Personal Protective Equipment (29 CFR 1910.132). Protective equipment must be cleaned and periodically replaced to maintain its effectiveness.

Workplace Exposure Limits

The OSHA permissible exposure limit (PEL) for mercury is a ceiling limit of 0.1 milligrams per cubic meter of air (mg/m^3), which is currently enforced as an 8-hour time-weighted average. Other organizations suggest lower exposure levels. The National Institute for Occupational Safety and Health (NIOSH) recommends that exposures to mercury metal be limited to an average of $0.05 \text{ mg}/\text{m}^3$ over a 10-hour workday, in addition to a ceiling limit of $0.1 \text{ mg}/\text{m}^3$. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends that metallic mercury exposures be limited to an average of $0.025 \text{ mg}/\text{m}^3$ over an 8-hour workday.

For fluorescent bulb recycling and other work operations where breaking or crushing fluorescent bulbs is a primary activity, OSHA recommends that employers also provide:

- **Disposable or reusable protective clothing** to prevent workers from tracking mercury home on their clothing. Contaminated protective clothing should be removed at the end of each shift. Reusable clothing should be collected and cleaned by laundry service workers trained to safely handle contaminated materials. Where workers must remove their street clothes to wear protective clothing, the employer should provide change rooms with storage facilities for street clothing and separate storage facilities for protective clothing.
- **Medical and biological monitoring** of exposed workers, including medical examinations focusing on the eyes, skin, respiratory system, nervous system and kidneys, as well as measuring mercury levels in urine.
- **Worker protections under 29 CFR 1910.120** (Hazardous Waste Operations and Emergency Response) if a spill or release requires emergency response or the facility is operating as a hazardous waste treatment, storage and disposal facility.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.



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