Lamp disposal rules change

by Kathleen Daly

Beginning in January 2000, regulations governing the way large numbers of mercury-containing lamps are disposed of are changing. In July 1999, the U.S. Environmental Protection Agency (EPA) decided to change the lamps’ classification in the hope that simplified disposal regulations would encourage recycling.

The EPA has been considering the change for several years, and its decision follows as many as 40 states that have deemed hazardous regulations for lamp disposal (see “State regulations for lamp disposal” below).

In its ruling, the EPA classified lamps containing mercury and other hazardous waste as universal waste, which is a subset of hazardous waste. The ruling streamlines federal regulations for lamp disposal or recycling, with the goal of reducing the number of lamps containing hazardous waste in municipal landfills and incinerators while increasing the number of lamps being recycled. Under the universal waste rule, anyone who disposes of or handles universal waste lamps in bulk (“a handler”) can recycle or send them to a hazardous waste landfill without filling the extensive paperwork required for hazardous waste. The ruling includes fluorescent, high-intensity discharge, neon, mercury vapor, high-pressure sodium, and metal halide lamps.

The universal waste category applies to several common, widely dispersed hazardous wastes, including pesticides, batteries, thermostats, and now lamps. The EPA developed the category partly to encourage the growth of recycling programs so that even those disposing of small quantities might find more opportunities to recycle hazardous items than to dispose of them in municipal landfills. Since 1994, the EPA has been considering whether to issue a conditional exclusion for lamps, which would have excluded them from hazardous waste regulations if they were disposed of by recycling or in a lined landfill, or to apply the universal waste rule. "If universal waste has been an option for lamps all along," said Nari Gil-Goode, specialist with the EPA Office of Solid Waste, "there is no assurance that other lamps in the same class, which are not already aware of whether the lamps are hazardous waste through results of previous testing or manufacturer information. The cost of testing each lamp to determine if it is hazardous waste is not economically feasible. Yet, if one lamp passing TCLP costs about $140 per lamp, which means testing all spent lamps for mercury is not economically feasible. Yet, it has been a freebie for recycling programs. Further, fluorescent and HID lamps typically contain some soluble mercury at the end of life, so they are potentially toxic waste and must be tested unless the generator is already aware of whether the lamps are hazardous waste through results of previous testing or manufacturer information. The cost of testing each lamp to determine if it is hazardous waste is not economically feasible. Yet, it has been a freebie for recycling programs. Further, fluorescent and HID lamps typically contain some soluble mercury at the end of life, so they are potentially toxic waste and must be tested unless the generator is already aware of whether the lamps are hazardous waste through results of previous testing or manufacturer information." The cost of testing each lamp to determine if it is hazardous waste is not economically feasible. Yet, it has been a freebie for recycling programs. Further, fluorescent and HID lamps typically contain some soluble mercury at the end of life, so they are potentially toxic waste and must be tested unless the generator is already aware of whether the lamps are hazardous waste through results of previous testing or manufacturer information.

Mercury in lamps

Fluorescent lamps require small amounts of mercury to operate—from less than 10 milligrams in new low-pressure fluorescent lamps to 23 milligrams in typical fluorescent lamps. As an arc of electricity passes through the lamp, the mercury vaporizes and emits ultraviolet radiation. The radiation activates the phosphor powder coating inside the lamp, allowing the radiation to become visible as light. Once the lamp switch is on, the mercury is no longer present as a liquid state. As lamps age, different components absorb some of the mercury.

Mercury, a naturally occurring element, can cause a variety of health problems including damage to the kidney, brain, and developing fetuses. The Agency for Toxic Substances and Disease Registry, part of the U.S. Department of Health and Human Services, recently established a new, higher minimal risk level (MRL) for methyl mercury, the organic form of the element most frequently consumed by people who eat fish. The new MRL of 0.3 micrograms per kilogram of body weight per day is three times the 0.1 microgram per kilogram per day MRL established in 1994. The agency defines an MRL as “an estimate of...”

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Questions about TCLP

By John D. Bullough

The lighting industry has criticized the test used to determine whether fluorescent and high-intensity discharge (HID) lamps are hazardous waste because of its variability.

The U.S. Environmental Protection Agency (EPA) in 1990 established the toxicity characteristic leaching procedure (TCLP) to measure the presence of toxic materials such as benzoic, chloroform, lead, or mercury within waste products, including lamps, destined for landfills. Yet the EPA also presents information about potential variability of test results in its Lighting Upgrade Manual.

TCLP tests for mercury in a soluble form. Because fluorescent and HID lamps contain some soluble mercury at the end of life, they are potentially toxic waste and must be tested unless the generator is already aware of whether the lamps are hazardous waste through results of previous testing or manufacturer information. The cost of testing each lamp to determine if it is hazardous waste is not economically feasible. Yet, it has been a freebie for recycling programs. Further, fluorescent and HID lamps typically contain some soluble mercury at the end of life, so they are potentially toxic waste and must be tested unless the generator is already aware of whether the lamps are hazardous waste through results of previous testing or manufacturer information.

Spent lamps have been considered hazardous waste since 1990, and the universal waste rule was first issued in 1995. “It took a while to listen to all the options and decide that universal waste was the best way to go.”

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Vandal-resistant, ADA-compliant luminaires available from Morlite

M orlite Systems now has a line of fixtures—the LPL Science Series—that are suitable for public environments such as parking garages, commercial workrooms, and sports facilities. The Science Series fixtures are wall luminaries that can be combined with an available battery pack to provide vandal-resistant emergency lighting. Illumination is provided by a choice of two 26-watt quartz tube compact fluorescent lamps or two 40-watt single-ended biax fluorescent lamps. A UV-stabilized, interlocking shock-resistant polycarbonate lens with linear prisms is available in optically clear or translucent opal with additional lens and housing protection. The luminaires are UL and CUL listed and ADA compliant.

M orlite

Uni-Form metal halide offers high lumens in small package

Venture Lighting’s new ED17 200-watt Uni-Form metal halide lamp is designed for new and retrofit applications where energy-efficient, high-lumen lamps are required. This 200-watt medium-base lamp can fit in a smaller fixture than a standard 250-watt lamp.

An alternative to HID fixtures, SportLite’s LX800 Series high-bay fixtures with 420-watt compact fluorescent lamps have multiple lamps to reduce glare. The LX800 Series has AM P-snap lock electrical connectors and spring clip secured ballasts for ease of installation and maintenance. Four-level stepped dimming is available. The LX680 Series comes in four styles—SportLite.

Venture Lighting International

Sponsor: U.S. Environmental Protection Agency

An energy-saving alternative to HID lighting systems.
Questions about TCLP continued from page 1

Why soluble mercury?

The EPA developed TCLP as a way to determine if a waste is hazardous, and it tests for a variety of hazardous materials besides mercury, said Greg Helms, environmental protection specialist with the Office of Solid Waste. EPA staff determined that the way to do this was to simulate the highest-risk-and-nilisket disposal — for those materials, he said. They chose a municipal solid waste landfill.

“We thought a municipal solid waste (MSW) landfill was plausible and probably the highest risk scenario,” Helms said. “That was because MSW landfills can generate acidic conditions which can mobilize metals like mercury, lead, and cadmium. We postulated that as plausible worst case management.”

The EPA’s main concern at the time was groundwater contamination, he said. “If you put waste X in a landfill, how much bad constituent would leach out and reach drinking water wells and how much water (would be) unusable? Drinking water standards were used as a reference value,” Helms said. “We tried to best we could to simulate (the) aggressive waste conditions of an MSW landfill.”

How TCLP works

The EPA Publication SW 846, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, M 1311, “Toxicity Characteristic Leaching Procedure,” gives the procedure for TCLP. Periodically, updates the TCLP for solid materials such as lamps, a sample of the material weighing at least 100 grams is broken into pieces small enough to meet one of the following criteria:

- The narrowest dimension of every piece must be smaller than 1 centimeter
- The surface area of the material must be at least 3.1 square centimeters per gram of material

One way to assure meeting the first criterion is by pailing the material through a 9.5-millimeter standard sieve. Once the material is prepared, it is placed in a vessel where an extraction fluid consisting of an acetic acid solution is added. After the material is mixed in this solution continuously for 12 hours, the liquid is extracted. The test for mercury requires that the concentration of soluble mercury in this liquid be less than 0.2 milligrams per liter for the material to be regarded as non-hazardous. Lamps may also contain mercury that is not temperature, Helms said. However, he noted that soluble mercury is more likely to migrate than metallic mercury. “I think the bottom line on TCLP is if we are doing the test for general use, it’s not going to be perfect,” he said. “It’s a screening test. It’s not going to be extremely precise. In general, I think TCLP has worked pretty well in identifying substances that are hazards.”

The EPA Green Lights Program’s 1995 Lighting Upgrade Manual (EPA 430-B-95-003) identifies several factors that can contribute to inconsistent test results, including:

- Lamp age
- Mercury concentrations in fluorescent lamps remain relatively stable throughout the life of a lamp. However, the relative amount of soluble mercury tends to increase as the end of life approaches. Because of this, the same lamp that could pass the TCLP test when new might fail the test when spent. If samples submitted for the TCLP are new lamps, they might not accurately predict soluble mercury concentrations of spent lamps destined for landfills.

Laboratory procedures. The TCLP, as outlined by the EPA, leaves room for significant variations in laboratory procedures. The size of the pieces tested, for example, can vary considerably. As pointed out by Science Applications International Corporation and reported by Paul Waltisky, manager of environmental affairs for Phillips Lighting, in ECON Magazine January 1996 (“Shedding Light on Fluorescent Waste”), following the TCLP might result in a loss of mercury before the mercury concentration is measured. Sample consistency is also important. Two samples from the same lamp may give different results with the TCLP. A 4-foot T8 fluorescent lamp weighs about 200 grams; a 12 fluorescent lamp of the same length weighs about 300 grams. NEMA recommends that the entire lamp be tested, not merely a 100-gram sample of lamp material.

One important qualification about the TCLP is that it is designed to estimate the potential of toxic substances from landfills into adjacent ecosystems. However, many fluorescent lamps are disposed of via incineration. Incineration releases 90% of the mercury in the lamp, whether soluble or insoluble, directly into the air unless incinerators have proper filtering equipment. New regulations for emission control will take effect this year.

When the EPA developed TCLP in the early 1990s, air pathways were not considered. Helms said, but that is changing. The EPA recently released a new study of risk from waste by released to the air, and is reviewing its mercury waste treatment standards for an update, he said. TCLP, however, has not predicted the release of mercury from lamps into the environment as a whole. It can be useful only as a predictor of the potential for a lamp to leach mercury into the ground.

Mercury in lamps continued from page 1

The daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure.

The U.S. Food and Drug Administration limits the amount of mercury in fish to 1 part per million, and recommends that consumers limit their consumption of large predatory fish with levels at 1 part per million to 3.7 ounces per week. For drinking water, the U.S. Environmental Protection Agency (EPA) has established a mercury limit of 2 parts per billion.

A mercury from lamps can get into the environment through breakage, which can release both mercury and mercury-con- tacted phosphors. Incineration releases both soluble and non-soluble mercury into the atmosphere and accounts for 90% of the mercury released into the atmosphere from fluorescent and HID lamps. In its 1997 mercury Study Report to Congress, the EPA estimates that mercury emissions from landfills in 1994-95 from all sources was less than 0.1 tons, the mercury emissions from fluorescent lamp recycling was also less than 0.3 tons for the same year.

Mercury: a caring balancing act...
The mercury cycle

Mercury is a naturally occurring element, mercury is a part of our world. Present in air, earth, and water, mercury has many forms. It can travel through contaminated water and fish, breathe parts of air. Humans can ingest mercury through contaminated water and fish, breathe parts of air. According to the Agency for Substances and Devices, Mercury is a naturally occurring element, it is a toxic chemical that can be harmful to humans and the environment.

Disincentive to recycle because these people weren't normally familiar with the regulations, didn't want to deal with them, or weren't familiar with how to deal with them. "H owley said. "This may make it simpler. It would also make it simpler for EPA to go in and encourage people to recycle. Instead of saying, 'Now you have to follow several pages of regulation,' (EPA) could say, 'Now you should recycle,' and get them to recycle. This may make it simpler. It would also make it simpler for EPA to go in and encourage people to recycle. Instead of saying, 'Now you have to follow several pages of regulations,' (EPA) could say, 'Now you should recycle,' and get them to recycle. This may make it simpler.

The old regulations

The EPA estimates that 1% of the 158 tons of mercury released into the environment by human activity in the United States in 1994–95 came from spent mercury-containing lamps, compared with 87% from combustion sources such as incinerators and coal-burning power plants.

Federal universal waste regulations apply to two categories of "handlers." A small quantity handler accumulates up to 5000 kilograms of total universal waste at one time, while a large quantity handler accumulates more than 5000 kilograms. Conditionally exempt small quantity generators of hazardous waste are exempt from federal universal waste regulations.

The recycling option

The recycling option is to not use mercury-containing lamps or replace them with energy-efficient alternatives. The decision to recycle or replace lamps depends on the cost-benefit analysis performed by each individual or organization. Recycling options include either recycling the lamp itself or placing it in a hazardous waste container. Recycling options also include donating the lamp to a charity or educational institution.

The appeal of fluorescent lamps

While mercury is an environmental and health concern, fluorescent lamps are responsible for a very small amount of the element being released into the environment. At the same time, their energy efficiency means they are responsible for less mercury entering the environment through coal-fired power generation than that which would be released with incandescent lamps at the same lighting level.

While most commercial and industrial settings already use fluorescent lamps, a retrofit to fluorescent lamps that are more energy-efficient may seem costly, but the issue goes beyond cost. "You are not paying for recovering mercury as a commodity when you recycle. What you are paying for is keeping mercury out of the ecosystem," Walitsky said.

H owley of GE Lighting takes the middle road on recycling, supporting the concept while noting its drawbacks.

"I think recycling is a beneficial way to deal with the disposal of the lamps. There are situations where it doesn’t make sense. There is still a lot of technical and economic hurdles associated with it," he said. "It costs (the recycler) a lot more to collect and separate the materials of the lamp than (they can) get on the open market for the recycled materials."

The old regulations

The old regulations are under the Federal Resource Conservation and Recovery Act (RCRA), spent lamps are determined to be hazardous waste based on the toxicity characteristics of the lamp (TCCLP). The test estimates how much hazardous material such as mercury would potentially leach from the product if the material were placed in a landfill (see "Questions about TCCLP page 1). Those lamps that come through the TCCLP with a mercury concentration of 0.2 milligrams per liter or greater are considered hazardous waste.

Until lamps became universal waste in January, RCRA labeled anyone disposing of lamps that fail TCCLP a "hazardous waste generator," with three classifications. Conditionally exempt small quantity generators dispose of less than 100 kilograms of hazardous waste in a month and exempt from RCRA requirements. A small quantity generator disposes of more than 100 kilograms of hazardous waste (approximately 300 to 335 foot T12 lamps) in a month and must follow substantial record-keeping, transportation, and storage regulation. Even more rigorous regulations apply for large quantity generators who dispose of more than 1000 kilograms of hazardous waste a month.
mercury dose that is too small, said Joe Howley, GE Lighting environmental marketing manager. While reducing mercury in lamps is a significant accomplishment, the EPA universal waste disposal rule could reduce mercury in the environment by more than 600 kilograms this year. It is unlikely that the debate about mercury in lamps and lamp disposal will end with this ruling, manufacturers and environmentalists may never agree on how much mercury is acceptable in lamps in the country’s disposal system. One thing is clear: the element mercury will not disappear from the environment or from a variety of energy-efficient lamps.

Low-dose mercury lamps

Manufacturers are lowering mercury content in lamps and advertising that the low-dose mercury lamps will pass the test that determines whether a substance classifies as a hazardous waste. Manufacturers have developed ways to reduce the soluble mercury in lamps without violating universal waste and universal waste regulations. The EPA, however, encourages recycling for all fluorescent lamps.

The mercury cycle

Mercury dosages have to be calculated precisely in the range of tenths of milligrams, because a mercury dose that is too small will shorten lamp life or cause the lamp to fail. Too large a dose means the lamp may explode.

Obviously, we have issues with removing all of the mercury because it’s a very intimate relationship between the lamp and the environment. "We have a few mercury levels too low, we have concerns about lamp performance and lamp life. Once you drop below 10 milligrams, you have to be very careful in how you design the lamp to assure that it performs the way the old lamps performed and achieves the same lifetime." Low-dose lamps allow a variety of design options because the lamps pass TCLP. They can be discarded in municipal landfills or incinerated, which releases most of the lamps’ mercury into the atmosphere. Low-dose mercury lamps can be recycled even if not classified as hazardous waste by state and federal regulatory agencies.

Making contact

Earth 911, 5110 N 44th Street, L120 Phoenix, AZ 85018, phone 800.527.CARE, www.earth911.org


GE Lighting, 1975 Noble Road, Nela Park, Cleveland, OH 44112, phone 888.838.BALLAST, www.ge.com

International Association of Lighting Designers (IALD), Merchandise Mart, Suite 11-114A, 200 World Trade Center, Chicago, IL 60654, phone 312.327.3677, www.iald.org

Lutron Electronics Co., 7200 Suter Road, Coatesville, PA 19320-1299, phone 800.523.9466, www.lutron.com

Morfitt Systems Inc., 1805 Pittsburgh Avenue, Erie, PA 16502-1916, phone 800.865.5954

NEMA (National Electrical Manufacturers Association), 1300 North 37th Street, Suite 1847, Rosslyn, VA 22209, phone 703.841.3200, www.nema.org


Sportlite, Inc., 3535 N. 51st Avenue #26, Glendale, AZ 85301, phone 623.930.0074, www.sportlite.com

Venture Lighting, 1200 Aurora Road, Solon, OH 44139, phone 800.451.2606, www.venturelighting.com

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employee agrees. Pacific Lightworks paid the examination fee and helped Godfrey study for the exam. All designers in the firm who are eligible now have the LC.

The program fits into the company’s existing commitment to employee training, she said, so that many people will use their professional improvement time to study for and take the exam. The company also showed its support by featuring the 16 LC employees in the internal newsletter.

“We’ve publicized it internally, so people are aware that it exists, and we put LC on our business cards,” she said.

Dian McDowell, LC, director of industrial marketing for Holophane and a former NCLP board member, continues to support the program.

“I believe that a minimum level lighting qualification is necessary to compete in our field,” she said. “For companies such as Holophane, I believe it’s important for our sales and marketing representatives to show that they have the necessary expertise to be helpful to their customers.”

Holophane encourages employees to attend courses to prepare for the LC exam and reimburses them their costs when they pass it. As many as 25 employees have earned LC, earning Holophane recognition at Lightfair 1999 for having the most employees with LC, McDowell said.

With the exam establishing a basic knowledge level, it also requires continuing education to maintain certification, she noted. “After three years you have to renew to show that you are still current,” he said, through some of the many possible methods of accruing lighting education units (LEU), such as attending trade shows and courses, writing papers, giving lectures, and reading approved lighting articles.

Another issue that has arisen is one involving who is eligible to take the exam. Again, unlike engineering or architecture, an LC candidate does not necessarily need to be working in a lighting practice. Lighting is such a broad industry that manufacturers, sales representatives, and electricians are included as ‘related fields’ and can take the exam.

How does this affect international lighting professionals? In this day of global economies and blurred boundary lines, many lighting practices have gone worldwide, opening offices in far-off continents. Should lighting designers in other countries take an exam that is currently written only for North America? Then NCLP lists reference sources on which the exam is based, and these relate only to North American practice. They make no reference to practices in other countries or to documents issued by international bodies.

“The official position of the IALD is that lighting practice is in a state of transition, and there are no finite answers to these questions. As an international organization, we must represent the rights of our non-American members,” said Morag Fullilove, executive director of the IALD. "The IALD has always believed in, and supported, the importance of upgrading the quality of services." More than 100 IALD members have the LC credential, but until these issues can be resolved, the IALD will not require this credential for its members.

Regardless of how lighting practice gets there, lighting professionals are determined to achieve a level of professionalism and credibility similar to that of the engineering and architecture professions. The general feeling throughout the industry is positive. The LC creates a comprehensive base, and in the future, more precise and specialized requirements may emerge to work in conjunction with the LC for specific areas of lighting practice.