



Review of Compact Fluorescent Lamp Recycling Initiatives in the U.S. & Internationally

Updated: July 23, 2009

Prepared by the Northeast Waste Management Officials' Association (NEWMOA)

Executive Summary

The Massachusetts Department of Environmental Protection (MassDEP) contracted with the Northeast Waste Management Officials' Association (NEWMOA) to prepare a report on compact fluorescent light bulb (CFL) collection and recycling programs in the U.S. and abroad. The main purpose of this Report, *Review of Compact Fluorescent Lamp Recycling Initiatives in the U.S. and Internationally*, is to examine these programs to highlight lessons learned and possible approaches to adopt in Massachusetts.

There is no comprehensive public information available on the number of CFLs available for recycling in Massachusetts, the U.S., and internationally (i.e., number of CFLs that have been sold and have reached their end-of-life). The Worldwatch Institute estimates that 397 million CFLs were sold in the U.S. in 2007 and 3.5 billion bulbs worldwide in 2003.¹ However, sales of CFLs across the globe have increased dramatically over the past few years; therefore, the number of CFLs that are in use in the world today is probably much higher than in 2003.

There is no publically available data on the number of CFLs that have been recycled. The data presented in this Report is available from individual publically-supported programs and does not cover the number of CFLs collected or recycled in an entire state or country. In addition, lamp collection and recycling programs measure their success differently. Some programs measure their collection results based on numbers of lamps, while others compile data by weight, or by the amount of mercury recovered.

A review of the CFL collection and recycling data that is available suggests that the most successful CFL recycling efforts employ a variety of approaches. States and countries that offer a variety of CFL recycling opportunities for consumers appear to be able to collect and recycle the greatest numbers of CFLs.

¹ Worldwatch Institute, *Strong Growth in Compact Fluorescent Bulbs Reduces Electricity Demand*, October 27, 2008: <http://www.worldwatch.org/node/5920>. The estimate from Worldwatch Institute for CFL sales is the only source of this data that NEWMOA was able to find. The Institute has not published an updated estimate.

The following types of programs represent common approaches that cities, states, and/or countries have used to ensure proper collection and recycling of CFLs (and other mercury-added bulbs) from consumers:

- Mail-back programs for recycling out-of-service CFLs are convenient to consumers that do not have access to a collection site, or other recycling service. Examples include manufacturer-sponsored and lamp recyclers' kits.
- Collection programs at retail and wholesale locations offer consumers the ability to recycle their spent CFLs at designated locations. Utility-sponsored collection programs may also support collection sites at retail or other locations.
- Publically-sponsored programs, such as household hazardous waste (HHW) collection facilities, municipal collection sites, and curbside recycling services, target CFL recycling for consumers. Depending on the program, these services may or may not include a fee.
- In Europe and Asia extended producer responsibility programs are currently underway; however, such programs have not yet been implemented in the U.S. for CFLs, except for a new law in Maine. These approaches are intended to provide consumers with convenient recycling opportunities, with the costs shared by the lamp manufacturers and others. The recently enacted law in Maine will create the first such program in the U.S.

Possible approaches for CFL collection and recycling that could be considered for Massachusetts include: mail-back programs, retail-based collection locations, utility-sponsored programs, and household hazardous waste and other municipal collection facilities. By having a variety of options, consumers can choose the method that is most convenient for them. Massachusetts may want to examine in more depth the extended producer responsibility programs underway in Europe and Asia and monitor how Maine implements their new legislation to understand how such a program could be developed and implemented in the Commonwealth.

There are energy-efficient alternatives to standard incandescent lamps besides CFLs, such as light-emitting diode (LED) technology and high efficiency incandescent lamps, which are becoming available on the market. Unlike CFLs, these bulbs do not contain mercury and thus reduce the risk of mercury releases from breakage and disposal in landfills or incineration of CFLs. However, additional research and a reduction in the cost are needed to make these new lighting technologies applicable for more widespread use.

Review of Compact Fluorescent Lamp Recycling Initiatives in the U.S. & Internationally

Introduction

The Massachusetts Department of Environmental Protection (MassDEP) contracted with the Northeast Waste Management Officials' Association (NEWMOA) to review compact fluorescent lamp (CFL) collection and recycling programs in the U.S. and abroad. The main purpose of *Review of Compact Fluorescent Lamp Recycling Initiatives in the U.S. and Internationally* is to examine these programs to highlight lessons learned and possible approaches to adopt in Massachusetts. This Report presents the results of CFL collection and recycling programs across the U.S. and in other countries for which information is publically available.

All fluorescent lamps, including CFLs, contain mercury. The majority (two-thirds) of CFLs sold in the U.S. contain less than 5 milligrams (mg) of mercury, with some containing between 5 and 10 mg, and a small percentage containing between 10 and 50 mg of mercury.² The amount of mercury used in CFLs and other fluorescent light bulbs has declined over the years.³ However, the technology is not yet available to make general purpose, cost-effective, energy efficient light bulbs without the use of mercury.

Proper disposal and recycling of CFLs (and other fluorescent lamps) is important because of their mercury content. If the bulbs break during use or are not properly collected and recycled at end of life, that mercury can enter the environment.⁴

Government agencies, utilities, manufacturers, retailers, and other organizations have implemented a number of initiatives to promote CFL recycling. The different collection and recycling methods described in this Report may provide some insights into the options available for Massachusetts. This Report includes general information about the different approaches used to collect and recycle out-of-service CFL bulbs in the U.S. and in other countries. CFL collection data is not available for most of the programs covered in this Report, at least in part because of their relative newness. As these programs mature and proliferate, additional CFL collection and recycling data may become available. Revisiting this topic to determine if any additional CFL collection data is available and if further analysis is possible could be worthwhile in a few years.

The activities described in this Report include mail-back programs; retail-based collection programs; community drop-off locations and collection centers; utility-sponsored programs; and extended producer responsibility initiatives.

² Northeast Waste Management Officials' Association (NEWMOA), *Trends in Mercury Use in Products: Summary of the Interstate Mercury Education and Reduction Clearinghouse (IMERC) Mercury-Added Products Database*, June 2008: <http://www.newmoa.org/prevention/mercury/imerc/factsheets/mercuryinproducts.pdf>

³ Energy Star, *Frequently Asked Questions – Information on Compact Fluorescent Light Bulbs (CFLs) and Mercury*, June 2008: http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf

⁴ <http://www.maine.gov/dep/rwm/homeowner/cflreport.htm>

Background

Compact fluorescent lamps (CFLs) have been available for sale in the United States since the 1980s. CFLs are an environmentally responsible alternative to traditional incandescent light bulbs for their energy efficiency. The U.S. Environmental Protection Agency (U.S. EPA) reports that EnergyStar-qualified CFLs use up to 75 percent less energy than standard incandescent bulbs and can last up to 10 times longer.⁵ Their costs have come down considerably in recent years, and their use in homes has increased.

CFL usage in the U.S. has increased at a fast pace in recent years and sales are expected to continue to grow. They have undergone many improvements in their light quality and energy efficiency, making them a popular choice for residential lighting. Between 2000 and 2004, estimated CFL sales in the U.S. rose about 343 percent – from approximately 21 million CFLs sold in 2000 to approximately 93 million sold in 2004. By 2007, sales of all brands of CFLs (including EnergyStar-qualified bulbs) in the U.S. totaled approximately 397 million.⁶ This is nearly double the number of CFLs sold in the U.S. in 2006, reflecting changes in consumer behavior and the ongoing trend towards increased interest in energy-efficiency.

Innovative lighting technologies, such as light-emitting diode (LED) bulbs, may eventually replace CFLs. LEDs are a non-mercury alternative to CFLs. They consist of semi-conductor diodes that emit light when an electrical current is passed in the forward direction of the device through the LED circuit. LEDs have been around since the 1960s for commercial applications. They are significantly more energy efficient than incandescent and fluorescent lamps. However, they are also expensive, and are therefore, not usually applicable for general lighting applications. Additional research and a reduction in the cost are needed to make these new lighting technologies applicable for more widespread use.

In February 2007, GE announced that it is working on advancements in incandescent lamps that could raise their energy efficiency to levels four times more efficient than current incandescent bulbs and comparable to CFLs on the market today. The company expects to introduce its high efficiency incandescent (HEI™) lamp over the next several years.⁷ Philips Lighting Co. recently introduced a line of energy-efficient incandescent bulbs. Their “Halogen Energy Savers” are more expensive than traditional incandescent bulbs, but are also 30 percent more energy-efficient.⁸ The other large lamp manufacturers are also working on incandescent energy-efficient technologies, which include bulbs with a special reflective coating on the inside that reflects heat and transforms it into light. These may be other non-mercury alternatives fluorescent lamps.

Until these alternatives are commercially available, CFLs will continue to be used because of their energy efficiency. Most state agencies promote properly recycling these bulbs as the

⁵ Energy Star Website, Compact Fluorescent Light Bulbs: http://www.energystar.gov/index.cfm?c=cfls.pr_cfls

⁶ Worldwatch Institute, *Strong Growth in Compact Fluorescent Bulbs Reduces Electricity Demand*, October 27, 2008: <http://www.worldwatch.org/node/5920>

⁷ Business Wire, *GE Announces Advancement in Incandescent Technology; New High Efficient Lamps Targeted for market by 2010*, February 23, 2007:

http://www.businesswire.com/portal/site/ge/?ndmViewId=news_view&newsId=20070223005120&newsLang=en

⁸ New York Times, *Incandescent Bulbs Return to Cutting Edge*, July 5, 2009:

<http://www.nytimes.com/2009/07/06/business/energy-environment/06bulbs.html?pagewanted=1&r=1&emc=eta1>

environmentally-preferred option over disposal in solid waste. Many states, including Massachusetts, require businesses and other non-residential organizations to properly recycle their mercury-added lamps or dispose of them as hazardous waste.⁹ Some states, including California, Maine, Massachusetts, Minnesota, and Vermont, also require homeowners to recycle or properly dispose of their out-of-service CFLs and other mercury-added lamps as universal waste.

All of the components of CFLs can be recycled, including metal end caps, glass tubing, mercury, and phosphor powder. The metal portions can be sold as scrap metal; the glass can be manufactured into other glass products; and the mercury can be recycled into new fluorescent light bulbs and/or other mercury-added devices.

Because CFLs use less energy than incandescent bulbs, they reduce the overall demand for electricity, which in turn, can reduce the amount of mercury emitted from electricity-generating power plants. According to the U.S. EPA, coal-fired power plants are the largest source of anthropogenic mercury emissions in the U.S. The mercury emissions associated with natural gas and oil electricity generation are low.¹⁰ Mercury that naturally exists in coal is released into the atmosphere when the coal is burned. Some countries rely on coal-fired power generation more than others, and therefore, may contribute greater mercury emissions relative to their energy use. For example, China relies on coal combustion for 72 percent of its primary energy consumption, compared with a global average of around 30 percent.¹¹ Many other developing countries rely heavily on coal combustion, and in developed countries, such as in some parts of the U.S. and in Europe, coal-fired power plants are prevalent.

In the U.S., coal-fired power generation supplies more than one-half of the electricity¹² and accounts for 40 percent of the mercury emissions.¹³ However, the fuels for electricity generation in the U.S. vary greatly by state and region. States that depend on coal-fired power generation, such as North Dakota, New Mexico, and West Virginia, may experience the greatest reductions in the amount of mercury emissions to the environment when their residents switch from incandescent light bulbs to CFLs.¹⁴

New England has few coal combustion facilities for power generation. Those states in the Region, including Massachusetts, that do have coal-fired power plants regulate mercury

⁹ According to the U.S. Environmental Protection Agency (EPA), mercury containing lamps that fail the Toxicity Characteristic Leaching Potential test (TCLP) must be managed as hazardous waste under the Universal Waste Rule (UWR). The UWR is designed to reduce hazardous waste in the municipal solid waste stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. Generally, CFLs are not categorized as universal waste because they do not fail TCLP. Some states, including Massachusetts, do regulate all types of mercury-added lamps, including CFLs, as universal waste to promote recycling.

¹⁰ Energy Information Administration Website: <http://www.eia.doe.gov>

¹¹ Inter-Press Service (IPS), *Environment – China: Coal Far Costlier than Thought – Study*, October 29, 2008: <http://ipsnews.net/news.asp?idnews=44488>

¹² U.S. Department of Energy (DOE) Website: <http://www.energy.gov/energysources/coal.htm>

¹³ Energy Star, *Frequently Asked Questions – Information on Compact Fluorescent Light Bulbs (CFLs) and Mercury*, June 2008:

http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf

¹⁴ Science Daily, *Compact Fluorescent Lighting – Are We Trading Energy Conservation For Toxic Mercury Emissions*, October 3, 2008: <http://www.sciencedaily.com/releases/2008/10/081001093454.htm>

emissions from those facilities and require a high degree of mercury emissions controls. As a result, their emissions are even lower than those in other parts of the U.S. that do not require the same controls.

Researchers at Yale University conducted a recent analysis that examined mercury emissions from coal-fired power plants and mercury reductions from CFL usage and found that overall mercury emissions in some countries are reduced more than in others when people switch from incandescent lighting to CFLs.¹⁵ They found that an important factor contributing to this difference is the degree of mercury lamp recycling – higher recycling rates reduce the amount of mercury released from CFLs, while lower recycling rates result in more bulbs being disposed of as solid waste, possibly contributing to mercury releases to the environment. This analysis further supports the importance of CFL recycling for addressing mercury releases to the environment, particularly in Regions like New England.

In another recent analysis, the Maine Public Utilities Commission (Maine PUC) and the Maine Department of Environmental Protection (Maine DEP) estimated that if not properly recycled and the mercury recovered, using CFLs (as compared with incandescent lamps) may make a net positive contribution to the amount of mercury released to the environment in New England if the bulbs are not recycled.¹⁶ They assumed that a CFL contains an average 3 mg of mercury per bulb, uses 15-watts of electricity, and has a life expectancy of 10,000 hours per bulb (approximately 2,000 hours of use per year for 5 years). They estimated that the amount of mercury displaced by using a CFL instead of a standard incandescent light bulb is about 2 mg.¹⁷ If a CFL is broken or improperly disposed of, the 3 mg of mercury it contains would be released into the environment. Therefore, they estimated that the net amount of mercury released to the environment under a no recycling scenario would be 1 mg. This calculation applies to New England only, because the Region has few coal-fired power plants and those in the Region have implemented pollution controls for mercury emissions.¹⁸

CFL Recycling in Massachusetts & Other States in New England

The Massachusetts Department of Environmental Protection (MassDEP) asked NEWMOA to estimate compact fluorescent lamp (CFL) recycling and compare the programs in the Commonwealth and elsewhere. However, there are no estimated CFL recycling rates available for Massachusetts or any other states at this time. In this Report, NEWMOA analyzed CFL recycling for the Commonwealth by extrapolating from national information.

¹⁵ Science Daily, *Compact Fluorescent Lighting: Are we Trading Energy Conservation for Toxic Mercury Emissions*, October 3, 2008: <http://www.sciencedaily.com/releases/2008/10/081001093454.htm>

¹⁶ Maine Department of Environmental Protection (Maine DEP) and Maine Public Utilities Commission (PUC), *Report Regarding the Recycling of Fluorescent Lamps and Consumer Education Efforts*, January 2008: http://www.maine.gov/dep/rwm/homeowner/cfldep_puc/cflreportwithdep_puc.pdf

¹⁷ These calculations were developed by Mark Roberts (Maine DEP) and Denis Bergeron (Maine PUC) in May 2007. The raw data and calculations were forwarded to NEWMOA as a spreadsheet from representatives at Maine DEP and Maine PUC via email on January 9, 2009.

¹⁸ Mercury emissions in New England vary each year, due to the frequency of which coal-fired power plants are run, which is based on the price of coal relative to natural gas.

There is no data available on the number of CFLs sold by state. The Worldwatch Institute estimates that approximately 21 million CFLs were sold in the U.S. in the 2000.¹⁹ The Massachusetts population is 2.3 percent of the U.S. population,²⁰ and assuming that the population in the Commonwealth purchases CFLs at the same rate as the rest of the country, an estimated 483,000 CFLs were sold in Massachusetts in 2000. If all of these CFLs contained an average of 3 mg of mercury, an estimated 1,449 grams, or 3.2 pounds of mercury was used in the bulbs sold that year in the State. If none of these CFLs are recycled or properly disposed of, this mercury could be released to the environment. Based on their estimated life span of five years, the estimated 483,000 CFLs sold in Massachusetts in 2000 (including approximately 3.2 pounds of mercury) could have entered the waste stream in 2005.²¹

There is no complete data set available on the number of CFLs recycled in Massachusetts per year and, therefore, no estimated CFL recycling rate. However, there is some recent data on individual CFL collection and recycling programs within other states in New England, such as the hardware store collection programs in Vermont and New Hampshire, and the retail-based collection efforts in Maine. Maine has recently enacted a lamp recycling law that should expand the available lamp collection and recycling services in the state. These programs are summarized below.

Vermont's Retail Collection Program at Hardware Stores

Ace, Do it Best, and True Value hardware stores have teamed up with the Vermont Department of Environmental Conservation (VT DEC) and Vermont Small Business Development Center (VT SBDC) to offer free recycling for Vermont residents for up to six intact mercury-containing bulbs per visit. Eligible bulbs include all types of fluorescent lamps, including CFLs and high intensity discharge bulbs (HIDs). To make this process easy for consumers, the participating hardware stores have set up collection points where customers can drop-off their spent lamps.²²

The collection program has been going on for the past three years. As of December 2008, the 66 participating hardware stores in Vermont have collected over 22,000 circline, u-tube, and CFL bulbs (the majority of which were CFLs).²³ The program is currently funded by VT DEC and VT SBDC, who pay the recycling costs of the lamps through a supplemental environmental project (SEP) fund established specifically for this program. To date, the collection program has

¹⁹ Worldwatch Institute, *Strong Growth in Compact Fluorescent Bulbs Reduces Electricity Demand*, October 27, 2008: <http://www.worldwatch.org/node/5920>

²⁰ Using data provided by the U.S. Census Bureau, the population of the United States in 2000 was 281,421,906 people. The population of the state of Massachusetts in 2000 was 6,349,097 people, which is approximately 2.3 percent of the total U.S. population. US Census Bureau State Quick Facts – Massachusetts: Population data (2000) <http://quickfacts.census.gov/qfd/states/25000.html>

²¹ NEWMOA estimated compact fluorescent lamp (CFL) disposal and recycling rates based on per-capita population estimates. Although this method provides a general idea of the amounts of CFLs sold, used, and subsequently disposed of, it does have limitations. It assumes that the ultimate distribution of CFLs is linearly related to population, and that the estimates for total CFLs sold in the U.S. is accurate. Also, this method uses static data, providing a “snap-shot” in time, and therefore, does not consider the cumulative impacts of CFL sales and disposal. As CFL sales increase over the years, more bulbs will reach their end-of-life and become part of the waste stream.

²² Store locations are listed on VT DEC's website at: <http://www.mercvt.org/dispose/lamprecycleproject.htm>.

²³ Peter Crawford (Vermont Small Business Development Center) in email correspondence on December 29, 2008.

cost \$45,000. Eventually, the plan is for the hardware stores to take on the financial responsibility to sustain the program themselves.

Since this retail collection program began, over 22,000 CFLs have been collected. Assuming that each CFL contains 3 mg of mercury, approximately 66,000 mg, or 0.15 pounds of mercury have been recovered as a result of this effort.

In 2008, Efficiency Vermont (EVT)²⁴ started a free CFL recycling program for Vermont residents at approximately 150-200 locations across the state. This is a separate program for lighting partners (e.g., retail stores, grocery stores, and lighting wholesalers) that are not already involved in the VT DEC/VT SBDC program. This program is designed to collect and recycle CFLs specifically (i.e., the lighting partners do not collect other types of mercury-added lamps). The program places 5-gallon mail-back containers for CFLs in grocery and other stores that sell lighting. These additional locations offer consumers more options for safely recycling their spent CFLs. No data is available yet on the results of this collection program.

New Hampshire's Retail Collection Program at Hardware Stores

Modeled on the Vermont hardware store lamp recycling program, the New Hampshire Department of Environmental Services (NH DES) developed a program that offers consumers the opportunity to recycle their fluorescent lamps at participating hardware stores. The program is free to consumers and is currently funded under a settlement agreement.

The program began at True Value stores in New Hampshire in August 2007. As of May 2009, the stores have recovered 6,232 "miscellaneous" lamps, which included mainly CFLs, as well as u-tube and circline fluorescent lamps. Ace Hardware joined the program in July 2008, and its participating stores have recovered an additional 5,943 CFLs.²⁵ Currently, more than 40 hardware stores participate in the program in New Hampshire.²⁶

Since the retail collection program at hardware stores in New Hampshire began in August 2007, a total of 12,175 "miscellaneous" lamps and CFLs have been collected (as of May 2009). This is equivalent to approximately 36,525 mg, or 0.08 pounds of mercury (assuming 3 mg of mercury per bulb).

Maine's Utility-Funded Retail Collection Program

Efficiency Maine, a program of the Maine Public Utilities Commission (PUC), offers a CFL recycling service for homeowners that is free of charge. In June 2007, the Maine Department of Environmental Protection (DEP) and the Maine PUC launched a comprehensive recycling program for consumer CFLs under the Efficiency Maine Residential Lighting Program. Their "Replace, Reduce, Recycle" program makes it easy for consumers to drop-off their spent CFLs at retail stores for recycling. As of December 2007, more than 214 stores were participating in the program. In the first quarter of its operation (July 2007 through September 2007), 803 CFLs

²⁴ Efficiency Vermont Website: <http://www.encyvermont.com>

²⁵ Paul Lockwood (New Hampshire DES) in email correspondence on June 3, 2009.

²⁶ The store locations are posted online at:

http://des.nh.gov/organization/commissioner/p2au/pps/ms/mrpptp/recycle_lamps.htm

were recycled.²⁷ This represents approximately 2,409 mg of mercury (0.005 pounds) and is the most recent data available.

Maine's CFL Recycling Legislation

The Maine legislature recently enacted a bill, legislative decision (LD) 973, to require CFL bulb manufacturers to share the costs and responsibility for recycling mercury-added bulbs.²⁸ The law requires manufacturers that sell or distribute mercury-added lamps in Maine to implement an approved collection and recycling program for mercury-added lamps sold or distributed for household use by January 1, 2011. The approved recycling program(s) will be free to consumers and will encourage recycling of CFLs and other mercury-added lamps by offering convenient collection locations throughout the state (including municipal collection sites). Provisions for providing education and outreach to consumers are also included. Similar legislation has been introduced in other states, including Massachusetts.

Other CFL Recycling Programs in the United States

There are a variety of compact fluorescent lamp (CFL) recycling programs across the U.S. The programs have developed different approaches to the collection of lamps, including mail-back programs, retail programs, municipal programs, and others. These programs are described below. Where available, data on the results of these programs are presented. In general, these programs are new, and data on their impacts is not yet available.

Mail-Back Programs

In the U.S., mail-back programs for recycling unwanted or out-of-use consumer goods have been underway for such products as batteries, cell phones, small electronics, medications and pharmaceuticals, and mercury-added thermostats. Recently, this approach has also been tested for CFLs. An advantage of the mail-back system is that in rural areas, where people may be far from a retail collection center, there is access to a post office or mailbox.

U.S. Postal Service Recycling Program

The United States Postal Service (USPS) is currently piloting a CFL recycling program for consumers.²⁹ The USPS is working with Osram Sylvania (a lighting manufacturer) and Veolia Environmental Services (a mercury lamp recycler) to help consumers properly recycle spent CFLs through the mail in pre-paid packages specifically designed for the product (see specific details about lamp recycler programs below). This initiative is part of the U.S. Postal Service's ongoing commitment to their Cradle to CradleSM certification status by McDonough Braungart Design Chemistry, LLC (MBDC).³⁰

The USPS has over 37,000 retail outlets and post office locations and over 300,000 drop boxes accessible to residents in the U.S. Such widespread convenience could make it easy for

²⁷ Maine Department of Environmental Protection (Maine DEP) and Maine Public Utilities Commission (PUC), *Report Regarding the Recycling of Fluorescent Lamps and Consumer Education Efforts*, January 2008:

http://www.maine.gov/dep/rwm/homeowner/cfldep_puc/cflreportwithdep_puc.pdf

²⁸ (HP0675) LD 973: An Act to Provide for the Safe Collection and Recycling of Mercury-containing Lighting, http://www.mainelegislature.org/legis/bills/bills_124th/billtexts/HP067501.asp

²⁹ USPS Eco-Friendly Products and Services: <http://www.usps.com/green/eco.htm>

³⁰ MBDC Cradle-to-Cradle Certification Program: <http://www.mbdc.com/c2c/>

consumers to recycle CFLs because they could choose a drop-off location that is convenient for them. The USPS offers homeowners free pick-up and delivery service. Mail carriers will pick-up and deliver the pre-paid packages (the postage is paid by the recycler upon receipt of the item) from the consumer free of charge.

Lamp Recycling Kits

In addition to serving as the USPS's final destination, Veolia Environmental Services offers pre-paid lamp recycling kits, called "RECYCLEPAK" that customers can order online.³¹ The consumer CFL recycling kits cost \$22.95, fit up to 12 CFLs, and are designed to ship via the U.S. Postal Service. The price includes shipment of the packaging to the consumer, return shipping, and recycling. In 2008, Veolia recycled approximately 170,000 CFLs using the RecyclePak program. In addition, the number of bulbs collected has continued to increase as the program has aged – in 2008, second quarter CFL recycling rates increased 18 percent over the first quarter; the third quarter increased 30 percent over the second quarter; and the fourth quarter increased 79 percent over the third quarter.³²

Other lamp manufacturers, recyclers, and retailers sell pre-paid lamp recycling kits to consumers, including:

- Osram Sylvania offers a mail-back program for consumers to return spent CFLs for recycling.³³ Consumers can order a "Mini RecyclePak" for \$15.00 online. The kit is pre-labeled and comes with all the necessary packing materials so consumers simply return the kit with the spent bulbs to any U.S. post office or mail collection center. The RecyclePak containers are delivered to Veolia Environmental Services, where they are separated into their individual components and recycled.
- Northeast Lamp Recyclers, Inc. is a "direct" lamp recycler. They collect and recycle the lamps themselves with their "XpressPak" program.³⁴ A CFL recycling kit for consumers costs \$18.95 and is shipped back to Northeast Lamp Recyclers via FedEx.
- Waste Management offers CFL recycling opportunities for homeowners with the "Think Green from Home" program.³⁵ CFL recycling kits cost \$16.95 and can be ordered online. The kit can hold 13 CFLs and comes with a sealable Mercury VaporLok bag and a pre-paid return shipping label. Consumers can return the full recycling kit through any standard mail delivery system. Waste Management also provides linear fluorescent lamp recycling opportunities to businesses, under their "LampTracker" program.

CFL recycling kits can be purchased online from these companies' websites and in some cases may be available in retail stores. As indicated above, exact specifications and kit prices vary, but the goal is the same – making CFL recycling more convenient for consumers.

³¹ Veolia Environmental Services RecyclePak: <http://veoliaes-ts.com/recyclepak>

³² Scott Thibodeau (Veolia ES Technical Solutions) in email correspondence on January 2, 2009.

³³ Sylvania Lamp Recycling Program: <http://www.sylvania.com/Recycle/CFLandHouseholdlightBulbrecycling/>

³⁴ Northeast Lamp Recycling Program: <http://www.nlrlamp.com/xpresspaks.html>

³⁵ Waste Management Think Green From Home: <https://www.thinkgreenfromhome.com/ThinkGreenFromHome.cfm>

U.S. Retail & Wholesale Collection Sites

Another way for consumers to recycle out-of-use compact fluorescent lamps is to utilize designated collection programs at local retail stores and wholesale locations. The retail store, or other drop-off location, is responsible for ensuring that the bulbs dropped off by consumers are handled correctly, labeled and packed, and sent out for recycling. As described above, the Vermont and New Hampshire hardware store fluorescent lamp collection programs have been successful. Some national hardware store chains have recently initiated CFL recycling programs in all their retail outlets, as described below. The EPA maintains a website of these locations.³⁶

Home Depot Collection Program

In July 2008, the Home Depot launched a nationwide recycling campaign for residents wishing to recycle their CFLs at any of their 1,973 locations across the U.S. The CFL recycling effort is an extension of Home Depot's "Eco Options" program.³⁷ Home Depot Canada launched a similar CFL recycling program in November 2007 (see additional information about the Canada program below).

Customers bring in out-of-use, un-broken CFL bulbs and give them to the store associate behind the returns desk. Store associates undergo training on how to manage universal waste, including CFLs. They also undergo training on what to do in the event of lamp breakage. The Home Depot has contracted with a licensed environmental management company that coordinates CFL packaging, transportation, and recycling to maximize safety and ensure environmental compliance. The Home Depot covers all of the associated costs.

Home Depot is the first "national" CFL collection program offered in the U.S. The program is still new, and results have not yet been compiled.

Other Retail Stores

Some CFL collection programs have targeted retail stores in geographic areas, often partnering with stakeholders and other sponsors to maximize collection and recycling opportunities. In 2003, a group of corporate, utility, and government agency sponsors commissioned the Zero Waste Alliance (ZWA) to facilitate a multi-stakeholder group process to design a pilot project to recycle CFLs. This project became known as the "Northwest Compact Fluorescent Lamp Recycling Initiative," and initiated free retail-based CFL recycling pilot programs for homeowners in Lane County, Oregon, and Puget Sound, Washington.³⁸

The Lane County pilot program ran from October 27, 2004 through October 31, 2005. A total of 22,024 fluorescent lamps were collected from the 11 participating retail locations during the pilot – 3,252 of which were CFLs, representing 15 percent of all the lamps collected.³⁹ The Lane County Lamp Recycling Coalition (LCLRC) estimates that CFL recycling rates among homeowners increased from roughly 1 percent to almost 6.7 percent during this pilot program.

³⁶ EPA's state by state lamp recycling locations are listed online at:

<http://www.epa.gov/epawaste/hazard/wastetypes/universal/lamps/live.htm>.

³⁷ Home Depot Lamp Recycling Program: <http://www.homedepot.com/ecoptions>

³⁸ Northwest Compact Fluorescent Lamp (CFL) Recycling Project: http://www.zerowaste.org/cfl/cfl_index.htm

³⁹ Lane County Lamp Recycling Coalition (LCLRC), *Lane County Lamp Recycling Coalition Retail-Based Pilot Program – Final Report*, March 10, 2006: http://www.zerowaste.org/cfl/images/Lane_Co_CFL_Pilot_Report.pdf

Results from a Lane County customer survey indicate that residents were receptive to the retail-based option for recycling spent lamps – 97 percent of respondents indicated that they would continue to use the retail-based recycling program if the free service were available after the pilot program.⁴⁰ Convenience and knowing that the retailers are taking responsibility for the product were customers' main reasons for choosing this retail-based option.

In 2003-2004, Santa Clara County (SCC) in California launched a “Recycling Partners Program” to provide residents with free collection of fluorescent lighting at retail stores. The program was funded with a grant from the California Integrated Waste Management Board (CIWMB). Customers were able to recycle their spent CFLs (and other fluorescent lamps) free of charge at 17 participating retailers. When the bulb collection boxes were full, the stores called the County, which sent staff to pick up and transport the bulbs to a local household hazardous waste (HHW) facility for storage, after which they were transported to a recycler. During the grant term, recycling partners collected a total of 37,774 pounds of fluorescent lamps from residents over 18 months.⁴¹

The program was so successful that SCC has continued to fund the program beyond the grant term, using a portion of its solid waste tipping fees. Since assuming full funding of the “Recycling Partners Program,” SCC has increased the number of recycling partners collecting lamps from 17 to 30. During the last six months of 2006, participating retailers collected an additional 24,687 pounds of fluorescent lamps.⁴² This is the most recent data compiled to date.

Other retail locations that accept CFLs for recycling include:

- IKEA's “Free Take-Back” program allows customers to recycle all brands of CFLs for free at IKEA retail locations in the U.S.⁴³ In 2006, IKEA recycled 156,301 pounds of CFLs.⁴⁴
- Whole Foods Market has partnered with the Northeast Lamp Recyclers (NLR) to provide free CFL recycling for their customers at their location in West Hartford, Connecticut.⁴⁵ With the “ComPak” self-service recycling center, customers can deposit their CFLs in designated containers, which are then delivered to NLR for recycling. Many other Whole Foods Market locations have also started CFL collection programs.
- TAGS Home and Hardware and other independent hardware stores in Cambridge, Massachusetts accept spent fluorescent lamps, including CFLs from homeowners for free

⁴⁰ Lane County Lamp Recycling Coalition (LCLRC), *Lane County Lamp Recycling Coalition Retail-Based Pilot Program – Final Report*, March 10, 2006: http://www.zerowaste.org/cfl/images/Lane_Co_CFL_Pilot_Report.pdf

⁴¹ Santa Clara County's Retail Fluorescent Lighting/Battery Collection Program: <http://www.ciwmb.ca.gov/HHW/Grants/Profiles/SantaClaraCo.htm>

⁴² Santa Clara County's Retail Fluorescent Lighting/Battery Collection Program: <http://www.ciwmb.ca.gov/HHW/Grants/Profiles/SantaClaraCo.htm>

⁴³ IKEA Website: http://www.ikea.com/ms/en_US/about_ikea/social_environmental/environment.html

⁴⁴ Corporate Social Responsibility News (CSRwire), *It all Started with Edison! IKEA Endorses Energy-Saving CFL Light Bulbs and Offers 'Free Take Back' Program Through Recycle Bins in All IKEA Stores*, April 10, 2007: <http://www.csrwire.com/News/8104.html>

⁴⁵ NLR Partners with Whole Foods: <http://www.nlrlamp.com/news.html#wholefoods>

recycling. This program is currently funded by the City of Cambridge.

- Bartell Drugs, a local drugstore chain in the Seattle, Washington area, provides consumers free recycling of CFLs as part of a new pilot program. Customers can bring out-of-use CFL bulbs to any of their 56 retail locations for recycling.⁴⁶
- The Product Stewardship Institute (PSI) and the Washington Citizens for Resource Conservation (WCRC) are currently expanding the “Take it Back Network” in Washington State to engage retailers in the collection of fluorescent lamps and CFLs.⁴⁷
- PSI and Women’s Voices for the Earth (WVE) partnered to design, implement, and evaluate pilot collections of spent fluorescent lights at Ace Hardware retail locations throughout Colorado, Montana, South Dakota, and Utah. The pilot project, funded by EPA Region 8, began May 1 and ended December 31, 2008. The results have not yet been compiled, but are expected to be analyzed later in 2009.

The number of local retail stores in the U.S. now accepting CFLs for collection and recycling is numerous and diverse. The stores mentioned in this Section offer a snap-shot of the potential retail-based CFL recycling opportunities available to consumers.

Personal Transport to Waste Recycling Facilities

A traditional option for consumers to recycle CFLs and other mercury-added lamps is to drop them off at a local household hazardous waste (HHW), or other recycling facility. Depending on the state, CFLs may be banned from residential solid waste disposal (e.g., California, Maine, Massachusetts, Minnesota, and Vermont). This Section summarizes information on some of the available household hazardous waste collection programs that collect spent CFLs.

Municipal, Commercial, and Household Hazardous Waste Drop-Off Locations

As of May 1, 2008, Massachusetts law prohibits the disposal of products containing mercury, including CFLs, in household trash. Intact CFLs that have burned out or are no longer wanted can be recycled through municipal and commercial drop-off locations for mercury-added product recycling (e.g., transfer stations, Departments of Public Works, Boards of Health, and town recycling centers).⁴⁸

California’s “Take-It-Back Partnership” is a collaboration of state and local governments, utilities sponsors, retail businesses, non-profit agencies, and non-governmental organizations that provides free and convenient ways for California residents to recycle household wastes that cannot be disposed in the trash, including fluorescent lamps.⁴⁹ There are currently more than 500 private and public partners that accept CFLs and other wastes at designated commercial,

⁴⁶ Bartell Drugs, *Bartell Drugs Introduces Free Recycling of CFL (Compact Fluorescent) Light Bulbs at all 56 Store Locations*, September 22, 2008: <http://www.bartelldrugs.com/press/CFLRecycling.html>

⁴⁷ Take It Back Network – Fluorescent Bulb & Tube Recyclers: <http://your.kingcounty.gov/solidwaste/takeitback/fluorescent/index.asp#members>

⁴⁸ MassDEP has posted the locations of these facilities, noting which ones accept CFLs online at: <http://www.mass.gov/dep/toxics/stypes/cflrlocs.pdf>.

⁴⁹ The California Take-It-Back Partnership: <http://www.dtsc.ca.gov/TIB/index.cfm>

retail, and municipal drop-off locations throughout California. This program is the first state-run voluntary take-it-back program in the U.S. In addition, Humboldt County is currently piloting a CFL mail-back program for residents, as an alternative to personal transport to fluorescent lamp collection sites in this community. Under this program, launched in the summer 2009, residents can request a free CFL mail-back kit and to mail their spent CFLs to these collection locations from any USPS post office or mailbox (see additional details on the national USPS mail-back program above).⁵⁰ The pilot program is expected to run throughout the summer and results should be available in late 2009.

Another option available for most homeowners in the U.S. is to recycle unbroken CFLs at their local HHW facilities. The collected CFLs are managed as household hazardous waste and sent to a mercury recycler for reclamation. Some facilities operate year-round while others are one-time collection events that occur at specific times during the year. Homeowners should check with their municipality for the schedule of HHW collection opportunities, which items are accepted, and if any disposal fees apply.

Other Recycling Events

Manufactures, utilities, governments, and/or other organizations have also sponsored special collection events for recycling CFLs. Often times these events are hosted in conjunction with other community events, or coincide with such days as Earth Day or America Recycles Day. For example, the Northeast Lamp Recyclers, Inc. (NLR) participated in a one-time collection event at the “One Thing Expo” in Connecticut in 2008. At this event, NLR offered free collection and recycling to consumers that brought in their out-of-service CFLs. Over 200 CFLs were collected and recycled at this event.⁵¹

Product Responsibility Programs

Product take-back programs for CFLs are sponsored by the manufacturers, distributors, and/or the retailers that sell them. This approach is also referred to as “extended producer responsibility.” The concepts of extended producer responsibility and manufacturer take-back are the focus of an ongoing national dialogue, facilitated by the Product Stewardship Institute (PSI), among manufacturers, distributors, government agencies, and other stakeholders that has been underway in the U.S. for over a year.

There are a few different models for financing CFL collection and recycling that have been discussed as part of this dialogue:

- In an extended producer responsibility cost internalization scheme (also known as manufacture cost internalization), the costs of recycling, including collection and transportation, are included in the overall product price and the consumer does not see them as a separate cost.⁵² An example of an extended producer responsibility program in the U.S. is Maine’s law LD 973 (described above), which requires manufacturers of mercury-added lamps to implement collection and recycling programs for consumers.

⁵⁰ P&G and Humboldt Waste Management Authority Team Up to Recycle Fluorescent Lamps, March 4, 2009: <http://www.redwoodenergy.org/uploads/Take%20it%20back%20Release.pdf>

⁵¹ NLR News, *NLR Did One Thing!*, October 2008: <http://www.nrlamp.com/news.html#onething>

⁵² Product Stewardship Institute (PSI), *Fluorescent Light Product Stewardship National Dialogue Meeting Summary*, November 2008: <http://www.productstewardship.us/displaycommon.cfm?an=1&subarticlenbr=409>

- The retailer cost internalization model is being implemented by Home Depot and many of the other hardware stores and retail collection sites noted above. In these examples, the costs of collection, transport, and recycling CFLs are borne by the retailer.
- A manufacturer-managed program has a separate fee to cover the cost of recycling that is visible to the consumer at the point of sale. Consumers pay an additional fee to cover the costs of recycling when they purchase the product. The fee is collected by the retailers, and paid to the manufacturer or a third party entity to support the recycling program.
- A utility/ratepayer financing model is a system benefit charge funded program where the ratepayer (i.e., general public) pays a surcharge on their electric bills to fund the recycling programs. This money goes into a separate fund that is administered by the utility to implement the programs. Often these programs are voluntary and are run in conjunction with other energy efficiency promotions. An example is the Efficiency Maine Residential Lighting Program (described above), which provides consumers with free collection and recycling of CFLs. The collection points are set up at various locations across the state, including retail stores.

Legislation for CFL Collection & Recycling

In addition to Maine's law requiring manufacturers to implement CFL collection and recycling programs for consumers (described above), the state of California enacted the "Lighting Efficiency and Toxics Reduction Act," Assembly Bill (AB) 1109, in 2007. The bill requires reductions in energy use for lighting, the use of more efficient lighting technologies, reductions in hazardous waste, and increased recycling opportunities. The bill also requires the California Department of Toxic Substances Control (DTSC) to create a Task Force to make recommendations on the most effective and cost-effective methods for collecting and recycling end-of-life bulbs.

The Task Force was first convened in March 2008 and has since published a Report, *Recommendations for Collection and Recycling of Spent Fluorescent Bulbs in California*, to identify possible opportunities for the collection and recycling of CFLs and other fluorescent bulbs.⁵³ Key recommendations in the Report include a statewide unified program; management by a non-profit third party organization; stakeholder funding; a comprehensive education and outreach program; and a statewide network of free and convenient places for the public to return spent mercury-added lamps, specifically CFLs and fluorescent tubes. The collection and recycling system must be convenient for all consumers and include some incentives for the sites acting as collection centers. These opportunities include extended producer responsibility, retail take-back, and mail-back collection programs. These recommendations will be tested as a pilot program in Kern County in the summer of 2009.

Curbside Recycling

Although not common, there are some cities and towns in the U.S. that accept CFLs as part of a residential curbside recycling program. For example, Shoreline, Washington recently

⁵³ AB 1109: Lighting Task Force, *Recommendations for Collection and Recycling of Spent Fluorescent Bulbs in California*, September 1, 2008: http://www.dtsc.ca.gov/HazardousWaste/UniversalWaste/upload/ab1109_final.pdf

implemented a curbside recycling program for CFLs and other fluorescent light bulbs.⁵⁴ This program is called “special item recycling.” Recycling of the CFLs is free (it is included in the garbage/recycling service costs), although special preparation is required and residents are limited to recycling two bulbs per pick-up. Residents must securely pack the CFL bulbs in newspaper and a plastic bag sealed with tape. The bulbs must also be separated and cannot be placed in the same container as the standard recyclable items.

Other Recycling Information Resources

There are CFL and mercury-added lamp recycling information resources that are available to consumers. For example, Earth911 is a national online database that provides consumers with information about recycling opportunities in their area. The website⁵⁵ includes information about recycling for a variety of household products, including CFLs.⁵⁶ The programs and services featured on the website include municipal curbside programs; in-store, retail programs; drop-off locations and collection centers; mail-back programs; and local and municipal recycling events. Consumers can search the website and figure out the best CFL recycling option(s) for themselves.

Another example is from the Washington State Department of Ecology (ECY), which maintains a recycling telephone hotline and online database of recycling opportunities in the state, called “1-800 RECYCLE.”⁵⁷ This resource is available to all residents in Washington State to assist them in locating sites or services that recycle or safely dispose of household wastes, including CFLs and other mercury-added lamps.

The Association of Lighting and Mercury Recyclers (ALMR) has information on CFL collection and recycling opportunities. Their website lists the lamp recyclers that are members of the Association, and has an interactive map so that consumers can find specific opportunities near where they live.⁵⁸

CFL Recycling Programs in Canada

According to estimates by Pollution Probe, in 2004 Canada recycled 4,279,300 mercury-added lamps, which is 7 percent of the estimated total of 60 million mercury-added lamps entering the waste stream each year. Of the mercury-added lamps that were recovered for recycling, 3 percent (approximately 128,400 bulbs) were compact fluorescent lamps (CFLs).⁵⁹

In April 2007, the Canadian federal government announced its intentions to ban the sale of inefficient incandescent light bulbs by 2012, in an effort to cut down on emissions of greenhouse gases and reduce other atmospheric pollution.⁶⁰ The shift away from inefficient incandescent lighting should dramatically increase the use of mercury-containing lamps.

⁵⁴ Shoreline Special Items Recycling Program: <http://www.cleanscapes.com/shoreline/Residential/Recyclables.htm>

⁵⁵ Earth911 Website is located at: <http://www.Earth911.com>.

⁵⁶ Earth911 CFL Recycling: <http://earth911.com/hazardous/cfl/tips-on-recycling-a-cfl/>

⁵⁷ 1-800 Recycle Online Assistance Page: <http://1800recycle.wa.gov/>

⁵⁸ ALMR’s map of CFL recycling locations is online at: <http://www.almr.org/map.html>.

⁵⁹ Pollution Probe, *Background Study on Increasing Recycling of End-of-Life Mercury-Containing Lamps from Residential and Commercial Sources in Canada*, October 31, 2005: <http://www.pollutionprobe.org/Reports/merclampsreport.pdf>

⁶⁰ Pollution Probe, *Ontario’s Role in a National Mercury Elimination and Reduction Strategy*, March 3, 2008:

Coal-fired electricity generation accounts for 27 percent of atmospheric mercury emissions in Canada (the largest single source of mercury in the country). The use of CFLs in place of traditional incandescent light bulbs may reduce energy consumption and the resulting mercury emissions from coal-fired power plants.

Many organizations and provincial and local governments recognize the need for increasing the CFL recycling rates in Canada. Three provinces are currently in various stages of developing provincial CFL recycling programs: British Columbia (Recycling Regulation), Ontario (Municipal Hazardous and Special Waste Program), and Quebec (Extended Producer Responsibility Regulation). These programs are not yet up and running. Other retail-based collection and recycling initiatives for CFLs have recently been launched throughout Canada – a few of these are described below.

Retail Collection Centers

Totem Building Supplies, a local hardware store chain in Alberta, Canada, recently initiated a “CFL Recouperation and Recycling Program” for their customers at all 15 of their retail stores.⁶¹ Customers can drop off bulbs for recycling free-of-charge. There is a recycling bin near the entrance of each store with signage and instructions for customers to package their old bulbs in a plastic bag and place them in the receptacle. When the container is full, the store seals it up, attaches a mailing label, and ships it to the recycler.

Since the program started in mid-summer 2008, all of the stores have returned at least one container and some are getting ready to send a second. Each container holds approximately 50 bulbs. Although there has not been an overwhelming collection response, initial feedback from customers has been positive. Some customers have requested that the program be expanded to collect linear fluorescent tubes as well, although Totem has stated that they are not yet equipped to handle these larger bulbs.⁶²

As in the U.S., some national retail chains in Canada may accept certain spent mercury-containing lamps from their customers.

- Since 2001, all IKEA locations in Canada accept CFLs from their customers for recycling through their “Free Take Back” program.⁶³
- In November 2007, Home Depot Canada, in partnership with Phillips Lighting and Fluorescent Lamp Recyclers Inc., announced its national in-store CFL recycling program. Customers can return their spent CFLs to any of the 160 locations throughout Canada for free collection and recycling. Their goal is to recycle 1.5 million CFLs by 2011.⁶⁴

<http://www.pollutionprobe.org/Reports/HgReport-March308.pdf>

⁶¹ Totem’s CFL Recouperation and Recycling Program: <http://www.totem.ab.ca/recycle.aspx>

⁶² Trevor Sweet (Totem) in email correspondence on January 28, 2009.

⁶³ Compact Fluorescent Light Bulbs and Battery Recycling: <http://www.theikeaway.ca/en/wwd-programs-environment-recycling.shtml>

⁶⁴ Press Release – *The Home Depot Canada Launches National CFL Bulb Recycling Initiative*: http://www.homedepot.ca/webapp/wcs/stores/servlet/DisplayTemplate?display=cfl_lander&langId=-15&storeId=10051&catalogId=10051

Outreach Recycling Promotion

“Project Porchlight” is an energy efficiency lighting campaign of One Change, a non-profit organization based in Ottawa. The goal of “Project Porchlight” is to provide a free CFL to every household in Canada. The program has been successful in educating the public on the energy efficiency of CFLs. Since 2005, the program has distributed more than two million CFL bulbs.⁶⁵

CFL recycling is not one of the requirements of the campaign; however, “Project Porchlight” does provide customers with guidance on proper recycling and disposal options for CFLs, including a list of recyclers.⁶⁶ Volunteers completed online surveys describing what they learned from the CFL distribution program. The results indicate that 59 percent of respondents reported that they knew where to take CFLs for proper recycling and disposal. Of those that reported that they knew where to properly recycle or dispose of CFLs, 81 percent also reported that they are either extremely or very likely to take their spent CFLs to one of these sites.⁶⁷

CFL Recycling Programs in Europe

Compact fluorescent light bulb (CFL) sales in Europe have eclipsed those in the U.S. for many years. In 2004, CFL sales in Western Europe reached an estimated 232 million units; in Eastern Europe, an estimated 56 million CFLs were sold in 2004.⁶⁸

CFLs are one of the many products subject to the requirements of the Waste Electrical and Electronic Equipment (WEEE) directive put forth by the countries in the European Union. The WEEE directive requires producer responsibility for end-of-life management of certain products that contain mercury, lead, cadmium, chromium, and such flame retardants as polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). The retail price of a CFL bulb includes the cost for recycling, and manufacturers are required to collect and recycle them. Manufacturers and retailers must also provide information to consumers about where they can recycle their CFLs. Some retailers have in-store collection facilities; however, most retailers rely on “Designated Collection Facilities.” The designated collection facilities (also known as DCFs) are defined in the WEEE regulations as specific collection sites for receiving household electronic wastes, including CFLs.⁶⁹

The Restriction on Hazardous Substances (RoHS) directive is a European program that is closely linked with the WEEE directive. RoHS restricts the use of six designated hazardous materials (i.e., mercury, lead, cadmium, hexavalent chromium, polybrominated biphenyl, and polybrominated diphenyl ether flame retardants) in the manufacture of various types of electronic and electrical equipment. It also provides specific guidelines for acceptable amounts of these hazardous substances in products. For CFLs, it is no more than five milligrams (mg) of mercury per lamp.

⁶⁵ Andrea Thomas (One Change) in email correspondence on January 27, 2009.

⁶⁶ The list of recyclers is available at: <http://www.projectporchlight.com/content/cfl-recyclers>.

⁶⁷ 2007 Ontario Campaign Evaluation: <http://www.projectporchlight.com/blog/2007-ontario-campaign-evaluation>

⁶⁸ Worldwatch Institute, *Strong Growth in Compact Fluorescent Bulbs Reduces Electricity Demand*, October 27, 2008: <http://www.worldwatch.org/node/5920>

⁶⁹ Code of Practice for Collection of WEEE from Designated Collection Facilities: <http://www.berr.gov.uk/files/file37922.pdf>

Each European country has developed its own approach to WEEE and RoHS implementation. The United Kingdom and Germany are examples of two countries that have developed special CFL recycling programs, and these are described below.⁷⁰

United Kingdom's Designated Collection Facilities

The United Kingdom (UK) has implemented a successful program for recycling CFLs under the WEEE directive. There are over 1,400 designated collection facilities (DCFs) in the U.K.⁷¹

As part of the U.K. WEEE, distributors and retailers are required to provide information to their customers on household recycling opportunities as well as collection and take-back systems. "Recycle-more" is a website⁷² supported by the members of the Valpak Distributor Take-Back Scheme, which provides consumers with the locations of WEEE recycling facilities available to them. Persons can type in their location to find the nearest recycling facilities for a variety of WEEE products, including CFLs (called "gas discharge lamps" in the U.K.).

Germany's WEEE Directive for Lamp Recycling

As a member of the European Union, Germany has also adopted the WEEE directive for all mercury-added lamps. The 2006 target recovery rate for lighting products under the WEEE directive was 80 percent, and Germany appears to have reached this goal. In 1994, approximately 70 to 80 percent of all spent mercury-containing lamps were recycled, representing about 50 to 60 million lamps.⁷³ However, CFLs represent only a small portion of these lamps collected under the WEEE system.

Lightcycle Retourlogistik und Service GmbH (Lightcycle) is Germany's lamp collection and recycling service under the WEEE initiative. Lightcycle provides services to approximately 1,100 municipalities and 1,000 commercial facilities in Germany, with an additional 360 non-municipal collection points available to consumers. Collection is free to consumers, and the program is financed by the recycling cost charges paid into the WEEE system by the participating lamp manufacturers and other partners. The program started in March 2006 and collected a total of 35.5 million fluorescent lamps in 2007 (6.75 tons) and an estimated 42 million lamps in 2008 (8.0 tons).⁷⁴ Assuming that each mercury-containing lamp contains 5 mg of mercury per lamp, approximately 391 pounds of mercury was recovered from this program in 2007 and 463 pounds of mercury in 2008. However, only a small percent of the lamps collected are CFLs, and an even smaller percent are from households.

⁷⁰ Other European countries may also have specific CFL recycling programs. However, these are the only European countries for which there was information available in English.

⁷¹ Royal Society of Energy (RSC), *Q & A: Mercury in Energy-Saving Light Bulbs*, January 7, 2008: <http://www.rsc.org/chemistryworld/News/2008/January/07010803.asp>

⁷² Recycle-More Website: <http://www.recycle-more.co.uk/banklocator/banklocator.aspx>

⁷³ Pollution Probe, *Background Study on Increasing Recycling of End-of-Life Mercury-Containing Lamps from Residential and Commercial Sources in Canada*, October 31, 2005: <http://www.pollutionprobe.org/Reports/merclampsreport.pdf>

⁷⁴ Lightcycle Fact Sheet, July 2008: http://www.weee-forum.org/att/members/info_Lightcycle%20Fact%20sheet%202008_20.pdf?weeeforum=6bbaf11a259375cce9cbbac4be4dcfc2

Lightcycle estimates that the CFLs recycled through the program in 2008 were approximately seven percent of all CFLs that were generated as waste (including both household and commercial CFLs). However, the CFL recycling rate for households alone is less; they estimate that approximately two percent of these CFLs are recycled through the program.⁷⁵ Most residential CFLs are thrown in the household trash because there is no requirement for them to be recycled.

CFL Recycling Programs in Australia

In recent years, sales of compact fluorescent lamps (CFLs) in Australia have increased dramatically. In 2006, slightly more than 15 million CFLs were sold in Australia – more than double the amount sold in the last ten years.⁷⁶ In 2009, CFLs containing less than five milligrams (mg) of mercury will be the standard in lighting sources in Australia. The government is working to gradually phase-out the use of incandescent light bulbs beginning with import restrictions starting on February 1, 2009, followed by a retail sales ban in November 2009. The ultimate goal is to eliminate the use of incandescent light bulbs by 2015.⁷⁷

All lighting devices sold in Australia will be required to meet minimum energy performance standards (MEPS), equal to the energy-efficiency levels produced by current CFLs. This does not preclude other energy-efficient lighting technology that may be available in the future, such as higher efficiency CFLs, light-emitting diodes (LED), and energy-efficient incandescent bulbs.

Approximately 70 million mercury-added light bulbs (referred to as “globes” in Australia) are generated as waste in Australia each year. The majority of these are linear fluorescent tubes generated by industry and commercial locations. Approximately 20 million bulbs are CFLs and other miscellaneous lighting devices (e.g., circline and u-tube). The spent bulbs represent 2,000 to 2,300 kilograms (kg) of mercury (4,400 to 5,000 pounds). Only two percent of these bulbs are recycled – the rest are landfilled, which is currently legal in Australia.⁷⁸

Retail Collection Centers

“Flashback” is a free pilot service of Sustainability Victoria’s ResourceSmart Recycling initiatives and is available to households in the state of Victoria, Australia.⁷⁹ Consumers bring their unwanted CFLs (and other fluorescent lamps) to participating retailers and drop them into the specially designed Flashback boxes. The waste management company, CMA EcoCycle, collects and manages the recycling of all bulbs collected through this pilot project.

To date, (June 2008 through December 2008) approximately 6,000 individual bulbs have been collected and recycled through this program. However, only about 28 percent of these bulbs contain mercury (approximately 1,680 bulbs) and of these, only 5 percent are CFLs

⁷⁵ Frank Rosner (Lightcycle) in email correspondence on January 23, 2009.

⁷⁶ Prepared for the Australian Greenhouse Office, *Final Technical Report: Phase-Out of Inefficient Incandescent Lamps and Standards for Compact Fluorescent Lamps*, December 2007:
<http://www.energyrating.gov.au/library/pubs/200718-phaseout-incandescent-lamps.pdf>

⁷⁷ Australian Government, *Phase-Out of Inefficient Incandescent Light Bulbs – Frequently Asked Questions (FAQs)*:
<http://www.environment.gov.au/settlements/energyefficiency/lighting/faq-phaseout.html>

⁷⁸ Peter Bitto (CMA Corp.) in email correspondence on January 12, 2009.

⁷⁹ Resource Smart, *Recycle your old Globes with Flashback*:
http://www.resourcesmart.vic.gov.au/for_households/dropoff_points_3324.html

(approximately 85 bulbs).⁸⁰ The majority of the bulbs being dropped off at these collection points are incandescent and halogen light bulbs, indicating that consumers are uncertain about which types of bulbs contain mercury and which ones do not.

Few of the bulbs collected through this program were brought to supermarket collection points; the majority of bulbs (96 percent) were gathered at a dedicated lighting retailer. The Flashback program will be expanded in 2009, involving a larger number of retailers and a broader geographic area.

Private Recyclers

CMA EcoCycle is a private mercury recycler providing a variety of mercury-added lamp recycling services in Australia and New Zealand, including pre-paid lamp recycling kits and collection centers. From April 2008 through October 2008, CMA EcoCycle conducted a lamp recycling pilot program, offering CFL recycling to consumers free of charge.⁸¹ Consumers were allowed a maximum of two drop-offs of six bulbs at designated drop-off locations at CMA waste recycling centers throughout Australia. Unfortunately, few CFLs were collected through this pilot program (the exact collection data is not available).

Overall, to date in Australia, the Flashback program offered at retail outlets has proved more successful than CMA EcoCycle. Customer surveys indicate that most consumers (66 percent) prefer a retail-based collection system as opposed to returning the bulbs at waste transfer stations or sending them back directly to the manufacturers.⁸²

CFL Recycling Programs in Asia

Most compact fluorescent light bulbs (CFLs) manufactured today are manufactured in Asia, with China being the largest producer of CFLs. In addition to producing CFLs, Asian countries are also significant consumers of them. However, the CFL recycling options available and the collection and recycling rates differ from country to country. For example, Taiwan has the highest rates of CFL recycling, with 87 percent of all fluorescent lamps recycled, due to a compulsory fluorescent lamp recycling program, which was launched in 2002. In Japan, where 80 percent of households use CFLs, the recycling rate is less than 10 percent.⁸³

Taiwan's Mandatory Recycling Program

In 2002, the Taiwan Environmental Protection Administration (TEPA) implemented a mandatory fluorescent lamp recycling program under its *Waste Disposal Act*.⁸⁴ Since November 1, 2004, consumers can recycle their spent fluorescent lamps in any store in Taiwan that sells

⁸⁰ Jan van de Graaff (Sustainability Victoria) in email correspondence on January 11, 2009.

⁸¹ CMA EcoCycle, *Recycling Fluorescent Tubes, HID Lamps, and CFLs from Australian Households*: http://www.cmaecocycle.net/Ecocycle_Household_Fluoro.pdf

⁸² CMA EcoCycle., *Sustainability Victoria PowerPoint Presentation*, December 2008; forwarded by Peter Bitto (CMA Corp.) in email correspondence on January 12, 2009.

⁸³ Environmental Expert, *Managing Mercury Risks from Energy-Saving Light Bulbs*, November 13, 2008: <http://www.environmental-expert.com/resultEachPressRelease.aspx?cid=8819&codi=39832>

⁸⁴ Pollution Probe, *Background Study on Increasing Recycling of End-of-Life Mercury-Containing Lamps from Residential and Commercial Sources in Canada*, October 31, 2005: <http://www.pollutionprobe.org/Reports/merclampsreport.pdf>

them. Store owners that fail to cooperate with the TEPA on the recycling project are fined. The collected lamps are sent to one of four approved mercury reclamation facilities.

TEPA estimates that in 2001, approximately 89.5 million fluorescent lamps were sold in Taiwan, weighing 8,900 tonnes. TEPA reported that 7,800 tonnes of fluorescent tubes were recycled in 2003 (approximately 78 million lamps) – a recycling rate of approximately 87 percent.⁸⁵ Estimating that each lamp collected through this program contains 5 mg of mercury, approximately 860 pounds of mercury was recovered from fluorescent lamps in 2003. However, this represents all types of fluorescent lamps and not just CFLs.

China's CFL Recycling Initiatives

In 2006, China produced 2.4 billion CFLs – approximately 85 percent of the worldwide total.⁸⁶ CFLs are the fastest growing export product in China.⁸⁷ CFLs manufactured in China are also used domestically. Domestic sales of CFLs accounted for 14 percent of the light bulb market share in China in 2003.⁸⁸

TCP, Inc., in collaboration with the Joint U.S.–China Cooperation on Clean Energy (JUCCCE) "China Green Lights for All" program, is launching China's first CFL recycling program for consumers in 2009.⁸⁹ The program will provide CFL recycling opportunities to millions of consumers free of charge. The program's goal is to collect more than two million CFLs every year.

Hong Kong's Manufacturer-Funded Programs

Approximately 3.5 million CFLs were sold in Hong Kong in 2006. This is a small amount, compared to the sales of incandescent lamps, which was estimated at approximately 34.5 million bulbs in 2006.⁹⁰

In November 2007, SUNSHINE Lighting Ltd. (a lamp manufacture in Hong Kong and China) piloted the first CFL recovery initiative to be available to the general public in Hong Kong. The program was called the "Save the Earth Energy Saving Lamp Recycling Campaign", and consumers were allowed to bring in their out-of-service CFLs to any Japan Home Centre (a local hardware store chain) for recycling.⁹¹ To encourage people to continue to use more energy-efficient compact fluorescent lamps, SUNSHINE also provided \$5.00 cash vouchers to use towards the purchase of new CFLs.

⁸⁵ Taipei Times, *Tube Recycling System Launched*, October 30, 2004:

<http://www.taipeitimes.com/News/taiwan/archives/2004/10/30/2003208949>

⁸⁶ National Lighting Test Center (NLTC) Power Point Presentation, *Energy Efficiency Goal: Enhancing Compliance, Monitoring, and Evaluation – Experiences and Challenges in China*, February 28-29, 2008:

http://www.iea.org/textbase/work/2008/meeting_goals/Hua.pdf

⁸⁷ China Association of Lighting Industry Power Point Presentation, *China Responds to Phase-Out of Inefficient Lighting*, 2008: <http://www.energyrating.gov.au/pubs/2008-phase-out-session2-yansheng.pdf>

⁸⁸ Worldwatch Institute, *Strong Growth in Compact Fluorescent Bulbs Reduces Electricity Demand*, October 27, 2008: <http://www.worldwatch.org/node/5920>

⁸⁹ TCP, *TCP, Inc. and JUCCC Launch First Energy Efficient CFL Consumer Recycling Program in China*, November 10, 2008: http://www.tcpi.com/corp/TCP_JUCCCE_Recycling_Program.aspx

⁹⁰ <http://www.legco.gov.hk/yr06-07/english/bc/bc04/papers/bc041004cb1-2425-1-e.pdf>

⁹¹ SUNSHINE, *Pilot Scheme - Save the Earth Energy Saving Lamp Recycling Campaign*, November 20, 2007: http://www.sunshinelighting.com.hk/mediacentre_inner.php?ntype=press_release&id=12&page=1

The “Fluorescent Lamp Recycling Programme,” which was launched in March 2008, provides households with free collection and recycling for all used mercury-containing lamps, including CFLs.⁹² The program is a voluntary Product Responsibility Scheme (PRS) that is funded by 15 members of the lighting industry, and is supported by the Government of Hong Kong’s Environmental Protection Department (EPD), and other non-government environmental organizations. Under this program, manufacturers and suppliers take responsibility for the proper management of their end-of-life products, such as funding and organizing a recycling program.

The initial goal of the “Fluorescent Lamp Recycling Programme” is to collect 400,000 spent lamps from households per year.⁹³ Consumers bring in their spent CFLs to one of the many collection points located at participating housing estates, public collection centers (e.g., shopping malls and retail outlets), or mobile collection vehicles.⁹⁴ The collected lamps are sent to the Chemical Waste Treatment Centre for separation and recycling.

Conclusions

Compact fluorescent lamps (CFLs) do not emit mercury when intact (unbroken) or during normal bulb use. However, if they are not properly recycled or disposed of, CFLs may release mercury into the environment. Also, if a CFL (or any other mercury-added fluorescent lamp) is broken, mercury vapor will be released.

The number of CFLs that are currently being recycled in Massachusetts is not publically available. At least some CFLs are recycled through local programs, such as household hazardous waste (HHW) collection facilities; or through retail collection programs, such as those operated by Home Depot, IKEA, and Whole Foods. Some consumers in Massachusetts may also use the mail-back programs and lamp recycling kits to recycle their CFLs. Implementing additional retail collection projects, like the hardware store collection programs in Vermont and New Hampshire, could help boost CFL recycling rates in Massachusetts.

This initial review of the collection and recycling programs in the U.S. and internationally indicate that the available CFL collection and recycling opportunities vary widely. The types of CFL recycling programs implemented to date appear to depend on the location, community acceptance, stakeholder involvement, and available funding. Common programs in the U.S. and in other countries include:

- Consumer mail-back programs, such as manufacturer and lamp recycler-sponsored recycling kits;
- Retail-sponsored collection programs at hardware and other stores, wholesale facilities, and other commercial locations;

⁹² Fluorescent Lamp Recycling Programme Website – Introduction:
https://www.wastereduction.gov.hk/en/household/flrp_intro.htm

⁹³ Fluorescent Lamp Recycling Programme Website – Introduction:
https://www.wastereduction.gov.hk/en/household/flrp_intro.htm

⁹⁴ A list of drop-off locations is available online at:
https://www.wastereduction.gov.hk/en/household/flrp_detail.htm#where.

- Utility-sponsored collection programs at a variety of locations;
- Publically-sponsored collection programs, such as household hazardous waste (HHW) collection facilities, municipal collection sites, and curbside recycling services; and
- Extended producer responsibility programs, such as the Waste Electrical and Electronic Equipment (WEEE) initiative in Europe, programs in Asia, and the recently enacted law in Maine.

There are many challenges associated with implementing a CFL recycling program. Figuring out the costs of the program (e.g., who pays for the collection, transportation, and recycling); the liability incurred at the sites that are involved with collection; and the potential for mercury exposure resulting from lamp breakage, are a few. Continually evaluating CFL collection and recycling programs is particularly important to ensure that they are functioning properly and that CFL recycling objectives are being met.

Possible approaches for expanding CFL collection and recycling that could be considered for Massachusetts include: mail-back programs, retail-based collection locations, utility-sponsored programs, and household hazardous waste and other municipal collection facilities. MassDEP may also want to examine further the extended producer responsibility programs underway in Europe and Asia, and implementation of the program that is required of mercury-added lamp manufacturers under Maine's new legislation. By having a variety of CFL recycling options available to them, Massachusetts residents can choose the method that is most convenient for them.