



PRODUCT STEWARDSHIP ACTION PLAN FOR FLUORESCENT LIGHTING

June 30, 2008

*Product Stewardship Institute, Inc. • 137 Newbury Street • 7th Floor • Boston, MA 02116
Telephone: (617) 236-4855 • Fax: (617) 859-9889 • www.productstewardship.us*

 *Non-chlorine Bleached | 100% Post-Consumer Recycled Paper | Soy Ink*

Product Stewardship Action Plan for Fluorescent Lighting
Table of Contents

I. Project Contacts..... 1

II. Description of the Product Stewardship Institute..... 1

III. Purpose of this Action Plan..... 1

IV. PSI Approach..... 1

V. Fluorescent Lamps – Consumer Benefit 2

VI. Proposed Issue Statement..... 2

VII. Proposed Project Goal..... 2

VIII. PSI Dialogue Process 3

Proposed Timeline 3

Phase 1: Research and Outreach.....3

Phase 2: National Dialogue Meetings/Negotiations4

Phase 3: Implementation.....5

Phase 4: Evaluation5

IX. Benefits of a National Approach..... 5

Other Multi-stakeholder Processes..... 5

X. Stakeholders..... 5

XI. Manufacture and Use of Fluorescent Lamps..... 9

Manufacture of Fluorescent Lamps..... 9

Types of Fluorescent Lamps 9

Mercury Amounts in Fluorescent Lighting..... 10

Increasing Use of Compact Fluorescent Lamps to Replace Incandescent Lamps 11

Choosing Environmentally-Preferable Lighting Equipment 12

XII. Fluorescent Lamp Recycling..... 13

Lamp Breakage 14

Lamp Crushing 14

Statutes and Regulations Related to Management of Spent Fluorescent Lamps 15

Federal Laws 15

State Laws 16

Table 2. Summary of state policies specific to spent fluorescent lamp management that exceed Universal Waste requirements 18

Collection and Recycling Infrastructure and Issues..... 20

Recovered Materials.....	20
Recovery and Recycling Programs	20
Commercial.....	20
Mail-back Options Available to Residential and Commercial Users.....	21
Collection at HHW Facilities for Residential Consumers	21
Collection at Retail and Other Locations for Residential Consumers	22
<i>XIII. Options for Shared Responsibility.....</i>	29
<i>XIV. Sustainable Financing Options.....</i>	30
Sustainable Financing	30
Advanced Recycling Fee	31
Cost Internalization	31
Deposits	32
End-of-Life Fees	32
Retail Coupons	33
<i>XV. Key Issues and Potential Strategies.....</i>	33
<i>APPENDIX A.....</i>	36
<i>APPENDIX B.....</i>	38

PRODUCT STEWARDSHIP ACTION PLAN

FOR

FLUORESCENT LIGHTING

I. Project Contacts

For more information or to participate in this project, please contact Sierra Fletcher, PSI Associate, at sierra@productstewardship.us, or 617-236-4886, or Scott Cassel, PSI Executive Director, at scott@productstewardship.us, or 617-236-4822. PSI's project web pages will be updated regularly during the project and can be viewed at: www.productstewardship.us/FluorescentLightingProject

II. Description of the Product Stewardship Institute

The Product Stewardship Institute, Inc. (PSI) is a national non-profit organization located in Boston, Massachusetts. PSI develops partnerships with manufacturers, retailers, government agencies, environmental groups, and other stakeholders to reduce the health and environmental impacts from the production, use, and end-of-life management of consumer products. PSI membership includes 44 states, 51 local governments, and 17 businesses, environmental groups, and other organizations. By forging partnerships with all participants involved in the lifecycle of a product, PSI opens channels of communication that lead to sustainable product stewardship systems. PSI has conducted pilot projects, national dialogues, and/or other initiatives in the following product categories: electronics, paint, mercury thermostats, fluorescent lamps, pharmaceuticals, medical sharps, phone books, tires, pressurized gas cylinders, beverage containers, and radioactive devices.

III. Purpose of this Action Plan

The intent of this *Product Stewardship Action Plan for Fluorescent Lighting* is to prepare participants for the dialogue phase of PSI's Fluorescent Lighting Product Stewardship Initiative. The *Action Plan* proposes a draft issue statement, project goal, and dialogue process, and presents key issues, potential solutions, and other information derived through interviews and discussions with key stakeholders, as well as other documentation. The contents of the *Action Plan* reflect varying perspectives on the management of fluorescent lighting and not a unanimous approach. PSI seeks to refine this document so that the information presented is as comprehensive, objective, and accurate as possible. At the first dialogue meeting, PSI will seek to gain consensus on the issue statement, project goal, and dialogue process, and will begin to prioritize strategies for implementation.

IV. PSI Approach

PSI's product stewardship approach recognizes the shared responsibility of those involved with the manufacture, distribution, retail, procurement, use, and end-of-life management of fluorescent lamps. PSI's collaborative method entails presenting the entire issue, developing relationships among participants, honoring existing partnerships, and finding each participant's role within the context of an

overall solution. PSI will identify areas where innovation is most needed and develop a plan to fill the void, with projects, policies, or other initiatives.

V. Fluorescent Lamps – Consumer Benefit

According to a 2007 U.S. EPA Energy Star fact sheet, “Switching from traditional light bulbs to CFLs (compact fluorescent lamps) is an effective, accessible change every American can make right now to reduce energy use at home and prevent greenhouse gas emissions that contribute to global climate change. Lighting accounts for close to 20 percent of the average home’s electric bill. ENERGY STAR qualified CFLs use up to 75 percent less energy than incandescent light bulbs, last up to 10 times longer, cost little up front, and provide a quick return on investment.”¹ Efficient lighting reduces power plant emissions and/or costs (depending on the relevant energy generation mix). Longer-lasting lamps can also reduce manufacturing, transportation, and disposal impacts.

VI. Proposed Issue Statement

Fluorescent lamps emit light through a chemical reaction involving mercury, a harmful neurotoxin that is persistent in the environment and bioaccumulates in living organisms. Lamp manufacturers have reduced the amount of mercury used per lamp significantly over the past two decades for many of their products. However, increased sales of CFLs – spurred by consumer demand and statutory requirements for improved lighting efficiency – raise concerns about the fate of mercury contained in the lamps if not properly managed at the end of their useful life. Large and small generators of spent fluorescent lamps are subject to different regulations and typically use different lamps². Only about 30 percent of fluorescent lamps used by business and industry, and 2 percent of the fast-growing residential market for CFLs were estimated to be recycled in 2003, although this estimate has much uncertainty.³ This low rate of recycling is largely due to a poor awareness about the mercury in lamps⁴ and the problems it can cause, an inadequate collection infrastructure (including convenient locations for residential consumers), a patchwork of regulations (including exemptions for residents and other small quantity generators in most states), lack of enforcement, an insufficient motivation for recycling, and significant end-of-life management costs. In addition, bulbs that are broken during use, consolidation, or transport will emit mercury, with the potential to harm those in the immediate vicinity.

VII. Proposed Project Goal

The overall goal of this fluorescent lighting initiative is to promote the use of energy efficient lighting while eliminating or reducing the amount of mercury and other toxins entering the environment during the lifecycle of fluorescent lamps. Specific goals include reducing the environmental impact of the manufacture of fluorescent lighting, increasing the manufacture and procurement of environmentally

¹ U.S. EPA Energy Star Fact Sheet: “Frequently Asked Questions: Information on Compact Fluorescent Light Bulbs (CFLs) and Mercury,” April 2008 Available at: http://energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf.

² These lamps are commonly, though not exclusively, tubes and pin-based CFLs in the commercial/institutional sector and screw-in CFLs in the residential sector.

³ “National Mercury-Lamp Recycling Rate,” Association of Lighting and Mercury Recyclers, 2004. Available at: http://www.nema.org/lamprecycle/docs/ALMR_capacity_statement.pdf. These data are roughly estimated, and more current recycling rates were not available.

⁴ In a 2007 survey of residents conducted by King County, Washington, 52 percent of respondents either did not know if there was mercury in fluorescent lamps or believed there “definitely” or “probably” was not. This number was slightly lower than in 2004. (EMC Research, “King County Hazardous Waste Management Program: Hazardous Waste Survey,” October 24–November 4, 2007.)

preferable lighting, and maximizing the safe collection and recycling of spent lamps from households and businesses through the development of a nationally-coordinated system that is financially sustainable.

VIII. PSI Dialogue Process

PSI will facilitate a collaborative process that seeks agreement on joint solutions that aim to reduce the lifecycle health and environmental impacts from fluorescent lighting. The dialogue will include representatives from lighting manufacturers, distributors, retailers, government agencies, waste managers/recyclers, utility and energy conservation groups, environmental groups, and others. PSI will assist stakeholders, as needed, in the implementation of agreements reached.

Proposed Timeline

PSI’s dialogue process involves a four-phased approach to meeting the project goals. PSI proposes to conduct this project according to the timeline below to allow participants time to seek the internal approvals necessary among their constituencies to be effective dialogue participants. According to the proposed timeline, meetings will be scheduled every three months. However, if dialogue participants want to expedite this timeline, PSI can mobilize resources to meet participant needs.

<i>ACTIVITY</i>	<i>TIMING</i>
Phase 1: Research and Outreach	
Finalize <i>Product Stewardship Action Plan</i>	April 2008
Phase 2: National Dialogue Meetings/Negotiations	
Convene 1 st meeting	April 23-24 (Utah)
Convene 2 nd meeting	July 15-16 (Washington State)
Convene 3 rd meeting	October (Washington State)
Convene 4 th meeting	January 2009 (Illinois)
Ratify and refine agreements	February - March 2009
Phase 3: Implementation	
Begin implementing agreements	February - March 2009 (or earlier if possible)
Phase 4: Evaluation	
Develop and implement plan to evaluate achievement of performance goals; adjust program as necessary	TBD

Phase 1: Research and Outreach

PSI conducted a literature review and interviewed stakeholders involved with the manufacture, promotion, sale, use, recovery, and recycling of fluorescent lighting. Those interviewed expressed a high level of support for the dialogue and shared their own interests and perspectives for improving the management of fluorescent lamps. (See Appendix A for a list of stakeholders interviewed.) PSI

summarized the research, including existing pilot projects and initiatives, into this *Product Stewardship Action Plan for Fluorescent Lighting*, which will serve as the basis for four face-to-face meetings with key stakeholders. PSI has compiled an extensive database of stakeholder contacts from around the country. This group was invited to participate directly in the national dialogue and/or to be updated on the project's progress.

Phase 2: National Dialogue Meetings/Negotiations

PSI will convene four national dialogue meetings over one year, as well as separate workgroup discussions via conference call to address specific issues. PSI will facilitate the meetings, track next steps, follow relevant issues and opportunities as they emerge, and mediate agreements.

- **Meeting Design**: For each meeting, PSI will develop an agenda, attendance list, PowerPoint presentations, supplemental meeting materials, and follow up meeting notes. PSI will design the series of meetings so that each one addresses a different set of strategies identified during the interview phase. At the meetings, PSI will work with stakeholders to identify the top strategies they want to pursue. PSI staff will manage all meeting logistics, including meeting space, meals, and a possible informal reception, and will seek public and private sponsors to defray costs. Meetings are usually held in partnership with a host government agency.
- **Workgroups**: PSI will convene workgroup conference calls between meetings to further develop priority solutions that emerge from the meetings. These workgroups will refine solutions for discussion and subsequent decision by the full group of stakeholders. It is possible that the group, or a segment of participants, may want to immediately embark on one or more strategies while the dialogue is still underway. Implementation of good ideas should occur as soon as possible. PSI expects that additional funding will be required to employ these strategies and will depend on the type of agreements that are developed.
- **Agreement on Priority Initiatives**: At the fourth dialogue meeting, PSI expects that stakeholders will reach agreements on the development and implementation of joint initiatives. If the stakeholder group decides that subsequent ratification of this agreement is needed by their respective companies, agencies, and organizations, the schedule includes one month for this to take place, although several more months might be necessary. PSI's goal will be to find common ground and develop "actionable items" as quickly as possible. If the group can reach agreement on certain priority actions prior to the last meeting, we will move ahead with those initiatives.
- **Stakeholder Communication**: Throughout the project, PSI will act as a clearinghouse of information associated with managing spent fluorescent lamps. PSI will maintain an extensive stakeholder database and communicate with stakeholders continually throughout the dialogue via email and conference calls. It will also initiate a list serve to promote daily communication, and will develop a comprehensive webpage on the PSI website to post up-to-date reports, articles, and other information on fluorescent lamp management.

Phase 3: Implementation

PSI will hold conference calls and meetings with stakeholders to implement agreements reached in Phase II. PSI expects that additional funding will be required for this implementation phase, depending on the nature of the agreement(s).

Phase 4: Evaluation

Pending available resources, PSI will assist stakeholders in evaluating projects implemented, using the metrics of success established in earlier dialogue phases. Throughout the phases, participants will gather data to subsequently evaluate initiatives.

IX. Benefits of a National Approach

PSI will create a focused and efficient forum for sharing information and identifying gaps in understanding, saving participants the resources required to engage in multiple forums around the country, and avoiding unnecessary duplication of efforts. A national solution will allow industry to abide by one coordinated set of programs, rather than a piecemeal approach among the states. Through its network of government, industry, and environmental leaders, PSI will provide the institutional capability to strengthen existing management efforts, promote successful reduction and recovery models, and unify regulatory approaches.

Other Multi-stakeholder Processes

As required under AB 1109 legislation, California is conducting a multi-stakeholder process, including state and local government, manufacturers, retailers, and utilities, to develop recommendations for a fluorescent lamp recycling system. This group is charged with developing recommendations by a September 1, 2008 deadline, and is being led by the Department of Toxic Substances Control.

In Dane County, WI, a Dane County Lamp Recycling Subcommittee is likewise developing recommendations to the Solid Waste and Recycling Commission. This process is being led by Dane County Public Works, with input from manufacturers, utilities, the Public Health Department, and other stakeholders.

X. Stakeholders

Table 1 below describes the primary stakeholder groups relevant to PSI's national dialogue.

Stakeholder Category	General Description	Specific Companies, Associations, and Other Groups
Manufacturers	Lamp manufacturers make a wide range of fluorescent lamps sold under many different brand names. Most linear fluorescent lamps sold in the U.S. are manufactured in North America (U.S., Canada, or Mexico) by one of three companies (listed to the right), while most CFLs are made overseas by TCP and Feit Electric Company.	<p>National Electrical Manufacturers Association (NEMA) is a trade association representing most fluorescent lighting manufacturers. For NEMA recycling information: http://www.lamprecycle.org.</p> <p>The primary CFL manufacturers include:</p> <ul style="list-style-type: none"> • TCP • Feit Electric Company • For a complete list of CFL manufacturers, see EPA’s website, at: http://energystar.gov/index.cfm?c=cfls.pr_cfls <p>The primary manufacturers of other types of fluorescent lighting include:</p> <ul style="list-style-type: none"> • OSRAM SYLVANIA • Philips • GE Lighting <p>For a list of manufacturers, fluorescent lighting products, and mercury content, please see NEWMOA’s website at: http://www.newmoa.org/prevention/mercury/imerc/notification/</p>
Distributors and Retailers	Lamps are distributed and sold by diverse groups ranging from distributors serving the large-scale commercial and industrial markets with national contracts to small hardware stores selling one bulb at a time to residential consumers. Some of these groups provide lamp recycling or collection services.	<p>The consumer/residential and small-scale commercial market are served by large and small retailers that include and are represented by:</p> <ul style="list-style-type: none"> • Wal-Mart, IKEA, Target, Costco, K-Mart and other household product stores • National Grocers Association⁵ • Home Depot, Lowe’s, Ace, TrueValue, Grainger, and other hardware stores • Council of State Retail Associations <p>The large-scale commercial and industrial markets are served by thousands of electrical lighting distributors around the country.</p>
Consumers	Fluorescent lamps are used in offices, industrial and other business facilities; public buildings; institutional and healthcare facilities; and, increasingly, residences.	<ul style="list-style-type: none"> • Building Owners and Managers Association • Building Service Contractors Association International • interNational Association of Lighting Management Companies (NALMCO) • American Institute of Architects • U.S. Green Building Council

⁵ Some 70-90 percent of lamps purchased for use in homes and small businesses are purchased at grocery stores and drug stores. “Fluorescent Bulbs are Known to Zap Domestic Tranquility: Energy-Savers a Turnoff for Wives,” *Washington Post* April 20, 2007.

Stakeholder Category	General Description	Specific Companies, Associations, and Other Groups
Recyclers	Recyclers process spent lamps to recover mercury, phosphors, glass, and aluminum to be manufactured into new products. Recyclers may also transport spent lamps to a processing facility.	<p>Association of Lighting and Mercury Recyclers (ALMR) represents 19 U.S. companies that recycled an estimated 85 percent of the mercury-containing lamps recycled in 2006 in the U.S. ALMR provides educational and informational resources to government, industry, environmental groups, and the public. They also promote recycling policies and programs.</p> <p>Full list of U.S. lamp recyclers: http://www.nema.org/lamprecycle/recyclers.html.</p>
Transporters	Lamp recycling requires transport of the spent bulbs to recycling facilities. This can be done by the recycling company, through “reverse distribution” by a distributor or retailer, or shipping through a waste management company, the postal service, or another shipping company. Hazardous waste haulers may serve large commercial market customers for recycling.	<ul style="list-style-type: none"> • Many lamp recyclers on this list provide transportation services: http://www.nema.org/lamprecycle/recyclers.html. • U.S. Postal Service provides CFL recycling kit for consumers which is shipped directly to a recycler. • FedEx and UPS ship spent lamps from collection points to recyclers. • Ace, TrueValue, and other local hardware stores participating in pilot reverse distribution systems.
Government Agencies	<p>Waste management officials regulate the management of hazardous wastes, often specializing in regulations, policy/planning, and pollution prevention.</p> <p>Procurement offices set specifications and negotiate low prices for lighting fixtures, ballasts and lamps.</p> <p>Energy offices are involved in setting energy efficiency standards that are incorporated into regulations and building codes. They sometimes help their purchasing offices develop technical specifications for lamps, ballasts and fixtures that are purchased as replacement items and for those that are installed in new construction, renovation and relamping projects.</p>	<ul style="list-style-type: none"> • U.S. Environmental Protection Agency Office of Solid Waste • U.S. Environmental Protection Agency and Department of Energy: Energy Star Program • PSI members include state and local government officials working on mercury issues. • Quicksilver Caucus is coalition of state environmental association leaders that aim to reduce mercury in the environment. It is staffed by the Environmental Council of the States (ECOS). • Association of State and Territorial Solid Waste Management Officials (ASTSWMO) is comprised of officials from all 50 states who are experts on regulations, but are also involved in sustainability, recycling, waste minimization, and reduction programs. • Northeast Waste Management Officials’ Association (NEWMOA) represents waste management and pollution prevention programs in the eight northeastern states, and coordinates a fluorescent lamps workgroup.

Stakeholder Category	General Description	Specific Companies, Associations, and Other Groups
	Local governments collect spent fluorescent lamps from residents through their household hazardous waste collection programs. A growing number promote retail collection initiatives.	
Buying Cooperatives	Some non-profit organizations sell fluorescent lamps at reduced cost through subsidies provided by utilities or energy conservation funds.	<ul style="list-style-type: none"> • Energy Federation, Inc. is a residential distributor of energy efficiency-related products in the United States.
Power Utilities/Energy Efficiency Program Administrators	<p>Electric utilities often promote fluorescent lamps for their energy efficiency benefits, sometimes providing rebates or lamps at discounted prices. Some utilities are participating in small-scale or pilot lamp recycling efforts as well.</p> <p>Utilities commonly purchase lamps for street lighting and other applications.</p>	<ul style="list-style-type: none"> • Xcel Energy, Washington PUD Association, Platte River Power Authority, Rocky Mountain Power, Flathead Electrical Co-op • Northeast Energy Efficiency Partnerships • Consortium for Energy Efficiency • Efficiency Maine, Efficiency Vermont, ComEd (IL), Focus on Energy (WI), Lamp Recycling Coalition (Eugene, OR)
Environmental Advocates	Environmental groups advocate for laws, regulations, and practices that eliminate or minimize the health and environmental impacts of toxics in the waste stream. Other environmental groups are actively involved in promoting energy-efficiency and climate protection policies and initiatives, including the distribution of CFLs.	<ul style="list-style-type: none"> • CA Communities Against Toxics • Clean Air Council • Clean Water Action • Ecology Center • Environment Illinois • Green Purchasing Institute • Illinois Environmental Council • Mercury Policy Project • Natural Resources Defense Council • Ohio Environmental Council • Sierra Club • Vermont Public Interest Research Group (PIRG) • Washington Citizens for Resource Conservation • Women's Voices for the Earth

XI. Manufacture and Use of Fluorescent Lamps

The data available on fluorescent lamp sales and disposal in the U.S. are incomplete and largely based on estimates created from the few data points that are available. This section cites some of relevant estimates available.

Manufacture of Fluorescent Lamps

Linear tubes sold in the U.S. are manufactured primarily in NAFTA countries⁶ by OSRAM SYLVANIA, GE, and Philips, which sell an estimated 80 to 90 percent of the fluorescent lamps sold in the U.S. CFLs are made almost exclusively in China for Technical Consumer Products (TCP), Feit Electric Company,⁷ Lights of America, Greenlite Lighting Corporation, Energetic Lighting, Verilux, and Maxlite. The number of each type of lamp sold in the U.S. is not known.

The Natural Resources Defense Council (NRDC), a national environmental organization, recently collaborated with China's State Environmental Protection Administration (SEPA) on a study which concluded that Chinese factories used approximately 64 metric tons of mercury to make 3.0 billion lamps in 2005. Most of the mercury (42 metric tons) was used to make 1.56 billion linear fluorescent lamps, while 14.11 metric tons was used to make over 1.7 billion CFLs. The study concluded that about half of the mercury used in the manufacturing process does not end up in the finished product. The efficiency and safety of mercury use in the lamp manufacturing process depends on the method used to insert the mercury into the product. In China, the least efficient drip method is almost always used for tubular lamps⁸, while the more efficient pre-sealed capsule method is used for CFLs for 20 percent of China's production. However, it is not clear which of these lamps were manufactured for the U.S. market, as the largest manufacturer of CFLs for the U.S. market reports using the preferred "pill" (pre-sealed capsule) method.

Types of Fluorescent Lamps

There are two major types of fluorescent lamps: tubular (also called linear, and including circular or U-shaped bulbs) and CFLs (including both pin and screw-in bulbs).⁹ Linear tubes are most often used in office buildings and the industrial sector. Screw-in CFLs, which are based on the same technology but are adapted for use in conventional light sockets, have become popular in residential settings. Today, many lighting companies sell multiple forms of fluorescent bulbs, all of which use mercury as a reactive vapor.

⁶ U.S., Canada, Mexico

⁷ Letter from Mark Kohorst, NEMA to Sierra Fletcher, PSI, March 24, 2008. Over 100 CFL manufacturers are listed on the Energy Star website at: <http://www.energystar.gov>. Wal-Mart, The Home Depot, and other retailers sell their own brands as well.

⁸ All Philips linear tubes use the capsule method, per Ric Erdheim, via email, April 3, 2008.

⁹ Fluorescent lamps also come in u-tube and round shapes.

The fluorescent lamp “mix” on the market has changed over time. Sales of CFLs have increased, and the use of tubes has trended towards those that are smaller (in diameter) and more efficient. While the largest lamp, the T12, dominated the market in the past, as of 2004 sales of the smaller T8 lamps had pulled even with the T12.¹⁰

Mercury Amounts in Fluorescent Lighting

Fluorescent lamps contain various amounts of mercury depending on the type of the bulb, dosing method, and manufacturer. According to a 2007 report for the Washington Department of Ecology by the Cascadia Consulting Group, the Northeast Waste Management Officials’ Association (NEWMOA) used data from the Interstate Mercury Education and Reduction Clearinghouse (IMERC) database to conclude that, in 2004, “...12 percent of fluorescent lamps, which is understood to mean tubes and to reflect the mix of lamps sold in the market, contain less than 5 milligrams (mg) of mercury. An additional 48 percent contain between 5 and 10 mg, and 27 percent contain between 10 and 50 mg.”¹¹ Also in 2004, NEMA reported other fluorescent lamps (not CFLs) totaled 5,537 kg.¹² NEMA states that half of fluorescent lamps contain 5 to 10 mg of mercury, a quarter of fluorescent lamps contain 10 to 50 mg of mercury, and some fluorescents contain up to 100 mg of mercury.¹³ Philips has reduced the mercury content of its standard linear fluorescent lamps to 1.75 to 2 mg¹⁴

In 2002, the European Union adopted the Restriction of Hazardous Substances (RoHS) Directive, which sets exemptions for hazardous materials outlined in the Directive for lamps of different types, including allowing maximum mercury levels. CFLs, for example, must contain 5 mg of mercury or less. In the U.S., the State of California¹⁵ and several municipalities included a similar 5 mg cap on mercury in CFLs sold on their lighting equipment contracts. In 2007, NEMA members agreed to cap the total mercury content in CFLs at no more than 5 mg of mercury per bulb for lamps using up to 25 watts of electricity, and no more than 6 mg of mercury per bulb for CFLs using more than 25 watts.¹⁶ (In Europe, CFLs do not exceed 25 watts.) The ENERGY STAR program is in the process of integrating NEMA’s mercury limits into its certification

¹⁰ Steven Nadel and Liu Hong, “Market Data on Efficient Lighting: A Summary and Comparison of More than a Decade of Data from the U.S. and China,” American Council for an Energy-Efficient Economy and China Green Lights Project Program Management Office, pages 3-4. Within the market of T8s that are designed to run on modern electronic ballasts, models vary in terms of lumen output, efficiency, rated life, light quality (measured by color rendering index) and other performance factors. Early generations of T8s ran on magnetic ballasts and preheat starters; they are much less efficient, had a lamp life about a third of today’s modern T8s that run on electronic ballasts, and contained significantly more mercury.

¹¹ Cascadia Consulting Group, “Fluorescent Lamp Recycling in Washington State,” Report to Washington State Department of Ecology, June 2007, page 93.

¹² Adam Weinert, IMERC Coordinator, NEWMOA, via email, March 10, 2008. Note that lamps sold by NEMA members in the U.S. account for approximately 85 percent of the total mercury in lighting products sold in the U.S.

¹³ “Mercury Use in Lighting,” May 2006. NEWMOA.

<http://www.newmoa.org/prevention/mercury/imerc/factsheets/lighting.cfm>.

¹⁴ Ric Erdheim, Philips Electronics. “CFL Mercury Dosing,” presentation at U.S. EPA meeting hosted by ICF International, Washington DC, May 22, 2007.

¹⁵ State of California Department of General Services Bid Specification for Fluorescent Lamps, November 2005, <http://www.documents.dgs.ca.gov/pd/contracts/62-31//6240-05BS-001.pdf>.

¹⁶ See “NEMA Voluntary Commitment on Mercury in Compact Fluorescent Lights,” at <http://nema.org/gov/ehs/committees/lamps/cfl-mercury.cfm>.

program on a voluntary basis. In 2004, NEMA reported that CFL sales from their member companies totaled 295 kilograms (kg) of mercury.¹⁷

There are currently underway efforts to adopt new standards for CFLs that cap the mercury levels at less than 5 mg. For example, Canada's Environmental Choice eco-labeling program has adopted a standard that certifies CFLs as environmentally preferable if they have 3 mg or less of mercury and a rated life of 10,000 hours or more, and meet other environmental and performance criteria. In the U.S., Green Seal has proposed a similar eco-logo standard for CFLs.¹⁸ In 2007, Wal-Mart announced that it was encouraging its suppliers to offer CFLs that are below the NEMA's 5 mg cap.¹⁹ Sierra Club adopted guidelines for the CFLs it distributes, which encourages its members to favor models with 3 mg of mercury or less.²⁰

OSRAM SYLVANIA committed to reducing mercury content in its CFLs to under 4 mg by the end of 2007 and to under 2.5 mg by the end of 2008.²¹ Philips offers many models of screw-in and pin-based CFLs with mercury content below 1.5 mg.

The Canadian Council of Ministers of the Environment, made up of both Federal and Provincial governments, set a standard in 2001 that required the amount of mercury in lamps sold in Canada to be reduced by 70 percent from 1990 levels by 2005 and 80 percent by 2010.²² In 2003, Electro-Federation Canada reported that the average mercury content of all mercury-containing lamps sold in Canada was 11.4 mg per lamp, down from the 43 mg baseline. This reduction represents a 73.5 percent reduction in the average mercury content per lamp, slightly surpassing the 2005 target.²³ In the US, low-mercury specifications that have been included in bid solicitations, green building credits, and other environmental guidelines for fluorescent lamps has helped drive down the mercury content in linear fluorescent lamps.

Increasing Use of Compact Fluorescent Lamps to Replace Incandescent Lamps

Fluorescent lamps have long been used in commercial, industrial, and institutional facilities, although CFLs are continuing to replace incandescent bulbs in residential settings. Data compiled from a variety of sources by Nadel and Hong roughly estimate that CFL sales in the U.S. increased from 90 million units in 2001 to 150 million in 2004.²⁴ In the first quarter of 2007, almost 47 million

¹⁷ Adam Weinert, IMERC Coordinator, NEWMOA, via email, March 10, 2008. Note that lamps sold by NEMA members in the U.S. account for approximately 85 percent of the total mercury in lighting products sold in the U.S.

¹⁸ Green Seal proposed revised standard (Gs-05) for Compact Fluorescent Lamps, http://www.greenseal.org/certification/gs-5proposed_revised_standard.pdf.

¹⁹ Wal-Mart Newsroom, "Wal-Mart Announces Major Mercury Reduction in Compact Fluorescent Light Bulbs," May 10, 2007, <http://walmartstores.com/FactsNews/NewsRoom/6457.aspx>

²⁰ Sierra Club, "Guidelines for Selecting, Distributing and Recycling Environmentally-Preferable Light Bulbs During Mass Giveaways," January, 2008, <http://www.sierraclub.org/policy/conservation/cfl-guidelines.pdf>.

²¹ Jennifer Dolin, OSRAM SYLVANIA. "Mercury and CFLs," presentation at U.S. EPA meeting hosted by ICF International, Washington DC, May 22, 2007.

²² Canadian Council of Ministers of the Environment, "Canada-wide Standard for Mercury-Containing Lamps," 2001. Available at: www.ccme.ca/assets/pdf/merc_lamp_standard_e.pdf.

²³ Canadian Council of Ministers of the Environment, "Canada-wide Standards for Mercury: A Report on Progress" 2005. Available at: http://www.ccme.ca/ourwork/pollution.html?category_id=120

CFLs with the Energy Star label were sold in the U.S. by retailers that report to that program.²⁵ CFL sales have been promoted by Wal-Mart, The Home Depot, and other retailers nationwide.

The United States and other countries have set standards for lighting efficiency that will be fully in effect by 2014 under the Renewable Fuels, Consumer Protection, and Energy Efficiency Act of 2007. This law is likely to mean a further increase in the use of CFLs, as they are the most cost effective product category on the market today that meets the standards of a 25 to 30 percent efficiency improvement compared to the incandescent now used. However, NEMA reports that incandescent and other technologies will meet the new efficiency standards by the 2014 deadline.²⁶ Philips already has an energy efficient halogen lamp on sale at The Home Depot that meets the new federal standards.

CFLs are touted for their energy efficiency benefits and longer life-span relative to incandescent bulbs; however, there has been some question about the actual benefits of these lamps over their entire lifecycle because of concern that they require a more energy intensive manufacturing process and their efficiency can be diminished if they are turned off and on frequently. The Rocky Mountain Institute concluded that CFLs result in reduced mercury emissions over their lifecycle as compared to today's incandescent bulbs providing the same lighting services.²⁷

Australia, Ireland, the Philippines, and the United Kingdom have all passed laws that will eliminate incandescent lamps in favor of fluorescents sometime between 2009 and 2012. Canada and the E.U. may follow suit. Other countries, such as India, Pakistan, and New Zealand are promoting the use of fluorescent lamps through incentives and voluntary measures. China has agreed to phase out the manufacture of incandescent lamps by 2017²⁸ through a project with the Global Environment Facility, an environmental financing group associated with the World Bank.

Choosing Environmentally-Preferable Lighting Equipment

Consumers can influence the relative environmental impacts of a product's lifecycle by choosing environmentally preferable options, using products according to efficiency and manufacturer guidelines, and recycling the product appropriately at the end of its life. In the past, those involved in procuring or specifying lighting were often not involved in the use (and associated energy consumption and costs) and disposal of the products. However, due to the effort of groups such as the

²⁴ Steven Nadel and Liu Hong, "Market Data on Efficient Lighting: A Summary and Comparison of More than a Decade of Data from the U.S. and China," American Council for an Energy-Efficient Economy and China Green Lights Project Program Management Office, page 2. The authors note that, "In the U.S. comprehensive data are not available. However, we do have a few data points that allow us to estimate trends."

²⁵ "Energy Star Qualifying CFL Sales Data from Six Major National and Regional U.S. Retailers by State (First Quarter 2007)," Energy Star Program, available at: http://www.energystar.gov/index.cfm?c=pt_reps_res_retail.pt_reps_res_retail#

²⁶ Letter from Mark Kohorst, NEMA, to Sierra Fletcher, PSI, March 24, 2008.

²⁷ Laurie Ramroth, "Comparison of Life-Cycle Analyses of Compact Fluorescent and Incandescent Lamps Based on Rated Life of Compact Fluorescent Lamp," Rocky Mountain Institute, February 2008. Available at: <https://www.rmi.org/sitepages/pid173.php>. Note that the exact emissions reductions and cost savings attributable to CFL use vary depending on the mix of power generating sources being drawn upon to light the lamp. Results of such studies can also vary depending on the methodology used.

²⁸ "China to Phase Out Incandescent Light Bulbs," Environmental Leader, October 3, 2007. Available at: <http://www.environmentalleader.com/2007/10/03/china-to-phase-out-incandescent-light-bulbs>.

Green Purchasing Institute, Responsible Purchasing Network, U.S. Green Building Council, and others, the importance of taking a lifecycle approach is more widely understood and incorporated into procurement policies and contracting documents. Residential consumers are also becoming more aware of the environmental and cost impacts of lighting in their homes, thanks to information provided by environmental groups, the U.S. EPA/ Department of Energy (DOE) ENERGY STAR program, energy efficiency and utility programs, and lamp manufacturers and retailers.

The Green Purchasing Institute (GPI) provides recommendations to institutional and other large building owners and operators about how they can develop and implement a green purchasing policy for lighting. Potential lighting policy goals include: saving energy, reducing greenhouse gas emissions, qualifying for green building credits through the U.S. Green Building Council, minimizing toxic chemical emissions and exposures, promoting recycling, encouraging producer responsibility, and supporting sustainable manufacturing. For example, lamp efficiency, longevity, and mercury content standards have been established by the ENERGY STAR program, the State of California, New York City, and San Francisco.

- A Responsible Purchasing Lighting Guide created by the Responsible Purchasing Network is available for a fee at: <http://www.responsiblepurchasing.org/publications/>. This publication explains how to specify environmentally preferable CFLs and other types of lighting equipment commonly used in institutional facilities. It includes links to model policies, bid specifications, and other resources that can be useful to purchasing agents. For example, both OSRAM SYLVANIA and Philips have developed online tools to help consumers calculate the amount of mercury in lamps. These data are intended for building professionals and owners seeking Leadership in Energy and Environmental Design (LEED) certification for existing buildings through the U.S. Green Building Council. ENERGY STAR also provides a calculator for assessing lifecycle costs and impacts of different lighting options.

Environmentally-preferable lighting options may soon move consumers past fluorescent lighting; attention is already turning to LED and efficient halogen options.

XII. Fluorescent Lamp Recycling

The Cascadia Report estimated that approximately 675 million fluorescent lamps become waste each year in the United States, about 78 percent from the commercial sector and about 22 percent from residences.²⁹ The Association of Lighting and Mercury Recyclers (ALMR) estimated that, for 2003, 23.3 percent of approximately 670 million discarded fluorescent lamps were recycled.³⁰ Most lamp shipments for recycling are made with a Bill of Lading, not a hazardous waste

²⁹ Cascadia Consulting Group, "Fluorescent Lamp Recycling in Washington State," Report to Washington State Department of Ecology, June 2007, page 93. Cascadia used 2006 lamp generation estimates from the Association of Lighting and Mercury Recyclers (ALMR), which applied the industry's standard 5-year lifespan estimate, and sales data from the National Electrical Manufacturers Association (NEMA).

³⁰ "National Mercury-Lamp Recycling Rate," Association of Lighting and Mercury Recyclers, 2004. Available at: http://www.nema.org/lamprecycle/docs/ALMR_capacity_statement.pdf. This estimate was based on NEMA manufacturer and US Census Bureau import data, and an estimated 5-year lamp lifespan.

manifest, making it difficult to track exactly how many are being recycled and where.³¹ Roughly 30 percent of all fluorescent lamps used by business and industry, and about 2 percent of CFLs, are recycled.³² Regardless of the exact percentages, it is clear that most fluorescent lamps are still being disposed of in landfills and incinerators, resulting in mercury releases. A study by the New Jersey Department of Environmental Protection estimated the amount to be about 2 to 4 tons annually.³³

Lamps that are not being recycled are being disposed of in municipal landfills or combustion facilities, and thus have the potential to release mercury to the environment through the air or water. In 2003, NEWMOA studied mercury emission from municipal landfills. The mercury used in fluorescent lamps is released to the air when the lamp breaks, including during collection, transport, and transfer to the landfill; during waste handling, dumping, spreading, or compacting at the landfill; from the landfill gas vents; or from the surface of inactive areas. Mercury in landfills may also be released to the groundwater, even if the landfill is lined or leachate treated.³⁴

Lamp Breakage

When a fluorescent lamp breaks, some amount of mercury is released. This is a concern any time it occurs outside a controlled environment, although the exact amount of mercury released from a broken fluorescent lamp can vary greatly with temperature, the type of bulb, and other factors. Direct health impacts are unknown, and consumers are generally advised to be careful in handling, using, and storing the lamps. This can affect the safety of using, handling, and transporting the lamps for collection and recycling programs as well. The U.S. EPA provides recommendations at <http://www.epa.gov/mercury/spills/index.htm>.

The Maine Department of Environment Protection completed a study in February 2008 that measured mercury concentrations in the air in the vicinity of a broken CFL at the heights of one-foot and five-feet, representing the breathing area for a child and an adult, respectively. Over the course of 45 experimental trials, mercury concentrations were found to exceed the state's ambient air quality guideline (300 nanograms/cubic meters). The concentrations spiked well above this for short periods, but venting lowered concentrations considerably. As a result of the study, the U.S. EPA, Maine, and many other states updated their broken bulb clean-up recommendations.³⁵

Lamp Crushing

Drum Top Crushers (DTC) are used to consolidate linear fluorescent lamps (not CFLs) at the site of a large generator or collection point, and can significantly reduce the volume of

³¹ Linda Barr, Office of Solid Waste, EPA, "Recycling 101." Presentation at U.S. EPA meeting hosted by ICF International, Washington DC, May 22, 2007.

³² "National Mercury-Lamp Recycling Rate," Association of Lighting and Mercury Recyclers, 2004. Available at: http://www.nema.org/lamprecycle/docs/ALMR_capacity_statement.pdf.

³³ Michael Aucott, Michael McLinden, and Michael Winka, "Release of Mercury from Broken Fluorescent Bulbs," Environmental Assessment and Risk Analysis Element: Research Project Summary, State of New Jersey Department of Environmental Protection, February 2004. Available at: <http://www.state.nj.us/dep/dsr/research/mercury-bulbs.pdf>

³⁴ "Summary of Research on Mercury Emissions from Municipal Landfills", NEWMOA, October 2003. Available at: <http://www.newmoa.org/prevention/mercury/landfillfactsheet.pdf>.

³⁵ Deb Stahler, Stacy Ladner, and Heather Jackson, "Maine Compact Fluorescent Lamp Study," Maine Department of Environmental Protection, February 2008. Available at: <http://www.state.me.us/dep/rwm/homeowner/cflreport.htm>

materials requiring storage and transport for processing.³⁶ However, according to Cascadia Consulting Group, recycling costs for crushed lamps often exceed costs for handling intact lamps. In addition, crushing can release hazardous mercury vapors and put device operators at risk.³⁷ Citing a U.S. EPA study,³⁸ Cascadia reports that "...minor errors in the installation or operation of these devices can greatly impact the level of mercury vapors emitted..." Citing a study from NEWMOA and U.S. EPA,³⁹ Cascadia reports that, "Several states have categorically prohibited onsite lamp crushing, such as Maine, New Hampshire, Rhode Island and Vermont. Other states rigidly regulate the procedure by issuing permits under hazardous waste management rules; in California, these permits are so difficult to acquire that none have been granted."⁴⁰ Based on this information, Cascadia has recommended to WA Department of Ecology not to pursue lamp crushing as a recycling strategy.

Statutes and Regulations Related to Management of Spent Fluorescent Lamps

Federal Laws

Spent fluorescent lamps that exhibit the "toxicity characteristic" are regulated by the U.S. EPA under the Universal Waste Rule (UWR), a subset of the Resource Conservation and Recovery Act (RCRA) subtitle C hazardous waste regulations. However, many lamps will pass EPA's Toxicity Characteristic Leaching Procedure (TCLP).⁴¹ These lamps can technically be managed as municipal solid waste (MSW) and disposed of in an MSW landfill or incinerator if this is not prohibited by the state or local jurisdiction. Lamps generated by households can be managed as MSW unless regulated differently by the state or local jurisdiction. Nevertheless, U.S. EPA recommends recycling all fluorescent lamps.

Under RCRA, regulations at 40 CFR Parts 261 and 262 set requirements specific to large and small *generators*, as well as conditionally exempt small quantity generators (CESQGs), for waste identification, storage, transport, and record keeping. Part 273 regulates small and large quantity *handlers* of universal waste. No handler of universal waste is allowed to dispose, dilute, or treat the waste except under specific circumstances. See Appendix B for a detailed breakdown of the requirements for those generating or handling universal waste. Drum top crushers that are

³⁶ This process is used at both HHW facilities and commercial facilities that have large numbers of their own lamps to handle.

³⁷ Cascadia Consulting Group, "Fluorescent Lamp Recycling in Washington State," Report to Washington State Department of Ecology, June 2007, page 84.

³⁸ U.S. Environmental Protection Agency, *Mercury Lamp Drum-top Crusher Study*, EPA530-R-06-002, August 24, 2006. <http://www.epa.gov/epaoswer/hazwaste/id/univwast/drumtop/drum-top.pdf>

³⁹ NEWMOA and U.S. Environmental Protection Agency, *Summary of Northeast State's Policies Regarding Use of Drum Top Crushers*. <http://www.epa.gov/epaoswer/hazwaste/id/univwast/drumtop/newmoa.pdf>

⁴⁰ Cascadia Consulting Group, "Fluorescent Lamp Recycling in Washington State," Report to Washington State Department of Ecology, June 2007, page 84. Minnesota also prohibits the use of drum top crushers.

⁴¹ The Northeast Waste Management Officials' Association (NEWMOA) website describes the TCLP test: "TCLP is a Federal EPA test method that is used to characterize waste as either hazardous or non-hazardous for the purpose of disposal... The TCLP test measures the potential for mercury (or another chemical) to seep or 'leach' into groundwater from waste potentially disposed in a landfill... Low mercury, 'green end' or 'environmentally preferable' lamps are developed by lamp manufacturers to pass the TCLP test; however, some manufacturers use additives to influence the TCLP test and mask the true mercury content of the lamp... Furthermore, the TCLP test is irrelevant for lamps that are burned in an incinerator; all of the mercury content of these lamps will be released into the atmosphere." Available at <http://www.newmoa.org/prevention/mercury/lamprecycle/requirements.cfm>.

used to consolidate lamps prior to shipping and recycling have their own regulatory requirements, including those on worker safety and vapor control.

The Renewable Fuels, Consumer Protection, and Energy Efficiency Act of 2007 established lighting efficiency standards, as discussed above, but is silent on the management of spent lamps or other environmental attributes of lighting equipment. Legislation introduced in March 2007 by Senators Barack Obama (D-IL), Lisa Murkowski (R-AK), Joseph Biden (D-DE), and Ken Salazar (D-CO) would amend the Toxic Substances Control Act to prohibit the export of elemental mercury, study mercury stockpiling, and prohibit the federal government from selling or distributing elemental mercury. As of March 2008, the legislation (S. 906, the Mercury Market Minimization Act of 2007) was being considered in the Senate Committee on Environment and Public Works. H.R. 1534, the Mercury Export Ban Act of 2007), passed the House November 13, 2007. Congressman Tom Allen (D-ME) introduced this bill.⁴²

State Laws

According to ALMR, “Most states have adopted these [UWR] rules, and several have adopted regulations that are more stringent than the UWR.”⁴³ States may adopt or modify federal requirements. Those that have passed their own legislation related to mercury-added lamps and other products (which may apply to sale, recycling, and/or disposal) are listed in Table 2.⁴⁴

California’s AB1109 legislation, passed in 2007 requires a multi-stakeholder work group to provide recommendations on a collection and recycling infrastructure that is convenient and cost-effective; these draft recommendations are being developed for a September 1, 2008 deadline. The law also requires all lamps sold in the state to meet RoHS guidelines starting in 2010 to 2014, including limiting mercury content to 5 mg for CFLs and 10 mg for linear tubes, eliminating lead solder (with some exceptions), per the Annex of Directive 2002/95/EC of January 27, 2003. The California requirement to abide by RoHS guidelines will affect the entire U.S. market.

Legislation related to the management of spent fluorescent lamps has been introduced in Minnesota, Washington, and Iowa this year. Minnesota’s HF No. 3766 would require manufacturers to establish a collection and recycling program for residential consumers of fluorescent and high intensity discharge (HID) lights. In Washington, producer responsibility legislation for fluorescent lamps was introduced, but was later changed to a bill which would require the Department of Ecology to study methods of collecting and recycling lamps, but this did not pass. Iowa’s SF 2321 passed from the Senate to the House in mid-March and would require a study and recommended recycling options for mercury-containing lamps by January 1, 2009.

The North Carolina Division of Pollution Prevention and Environmental Assistance and Division of Waste Management submitted its report to the legislature in March 2008 as required by

⁴² Full text and history of both bills is available at <http://www.thomas.gov>

⁴³ See the Laws and Regulations section of the website for the Association of Lighting and Mercury Recyclers, at: <http://www.almr.org>. This section includes a state stringency analysis of relevant policies.

⁴⁴ For a more detailed discussion of regulations governing lamp management, see ALMR’s Laws and Regulations website section, at: <http://www.almr.org>. In addition, the Cascadia report provides a good summary of select state legislation.

Session Law 2007-550, Section 17. This report recommended focusing on collection of fluorescent lamps from non-residential sources as having the greatest impact on mercury diversion from the waste stream. For household generated lamps, the study recommended creating more convenient collection options, and involving utilities, retailers, and other stakeholders in this process.⁴⁵

⁴⁵ North Carolina Division of Environment and Natural Resources, “Report on the Generation and Potential Recycling of Fluorescent Lamps,” March 2008.

Table 2. Summary of state policies specific to spent fluorescent lamp management that exceed Universal Waste requirements⁴⁶

State	Disposal ban	Labels	More Information	Applicable Legislation
Arkansas	Partial		As of January 1, 2008 disposal of lamps with more than 0.2 mg/l of leachable mercury (according to TCLP) is prohibited, <i>provided facilities exist for proper disposal.</i>	Adopted into law as Act 452 (March 22, 2007)
California	Yes		A collaborative study group is considering options for fluorescent lamp collection and recycling in California. The law also requires manufacturers to comply with European Union standards for the content of mercury and other hazardous substances by 2010. The household exemption on fluorescent lamps as a hazardous waste has expired, creating an effective disposal ban for fluorescent lamps from all users.	Chapter 534, Statutes of 2007 (referred to as AB1109)
Connecticut		Yes	Large vendors notify purchasers in writing of disposal requirements. Contractors removing lamps must notify owner of disposal requirements. Lamps must be labeled as containing mercury. Mercury-containing lamp retailers must inform consumers that the lamps contain mercury and should be recycled. All fluorescent lamps except those used in the household must be recycled.	Public Act 06-181 (June 7, 2006) HB 5539 Sales Ban Law Public Act No. 02-90 (June 3, 2002)
Illinois			State office buildings over 1000 square feet must use Energy Star lighting and recycle all mercury-containing lamps.	Chapter 95-0104 (August 13, 2007)
Maine	Yes	Yes	Disposal of mercury products is prohibited. Has applied to businesses previously, applies to residential users as of January 1, 2005. Retailers may not sell mercury products, including lamps, unless they are labeled as such, including recycling requirement.	Title 38 16B-1663 Chapter 25 (May 15, 2007)
Maryland		Yes	As of April 1, 2006, manufacturers must label all specified mercury-added products, including fluorescent lamps.	Chapter 494 (May 26, 2004)

⁴⁶ Information provided in part by John Reindl, formerly with Dane County, WI. February 20, 2008.

State	Disposal ban	Labels	More Information	Applicable Legislation
Massachusetts	Yes (May 2008)	Yes	Lamp manufacturers must develop an education plan to inform consumers of the importance of recycling spent fluorescent lamps, including labeling on the product and information about the benefits of using these lamps. Target recycling rates are set at 30% of fluorescent lamps by the end of 2008, 40% by the end of 2009, and so on until 70% by the end of 2011 and each year thereafter. Manufacturers must provide data to the Department of Environmental Protection annually. If recycling rates are not met, according to the Department's calculations, manufacturers must pay collectively up to \$1 million per year to be used as grant funds to municipalities and other groups to improve collection.	Chapter 190, Acts of 2006 (July 28, 2006)
Minnesota	Yes	Yes	Bans disposal of mercury products including fluorescent lamps. Retailers may not sell mercury products without clear labeling stating that the product contains mercury and may not be disposed of in the trash. Lamps must be recycled instead. Utilities with at least 200,000 customers must establish collection programs. When providing information on fluorescent lamps, they must state that it is illegal to put lamps in the garbage and provide toll-free number or website with information on legal disposal options.	SF 1085 (May 21, 2007) Law 201 (March 20, 2006)
New Hampshire	Yes		Bans disposal of all fluorescent lamps and any other product with intentionally-added mercury in incinerators, landfills, or transfer stations.	Chapter 0279 (2007)
Vermont	Yes		Disposal in landfills and incinerators is prohibited. Solid waste management facilities must inform customers of disposal ban and collection programs for mercury products.	Chapter 164 (May 3, 2005)
Washington		Yes	As of January 1, 2004, all fluorescent lamps must be labeled that the product contains mercury and should be recycled.	HB 1002 (July 27, 2003)
Wisconsin			Bans placing fluorescent lamps in with other solid waste. Requires recycling of all mercury-containing products prior to the demolition of buildings.	AB 877 (February 23, 2004)

Collection and Recycling Infrastructure and Issues

Waste management companies, recyclers, lighting service contractors, and other transporters collect fluorescent lamps from businesses and institutions, local household hazardous waste (HHW) collection sites, retailers, and other locations. In 2006, the companies that comprise the Association of Lighting and Mercury Recyclers processed an estimated 85 percent of the mercury-containing lamps recycled in the U.S. that year. ALMR estimates that there are 35 mercury-waste recycling facilities nationwide.⁴⁷ For a full list of lamp recyclers, see: <http://www.nema.org/lamprecycle/recyclers.html> or <http://www.almr.org>.

There are approximately 20 retorts⁴⁸ that refine mercury in the U.S. These retorts take in all types of mercury wastes, and most do not process lamps directly. The General Accounting Office estimates that 25 million pounds of mercury waste are being exported annually to avoid retorting domestically. There is a general assumption that lamps are being imported and exported for both recycling and landfilling. However, we do not know many lamps are involved.

Recovered Materials

Mercury recovered from the lamp recycling process can be used to make new fluorescent lamps or other mercury products, but it can also be sold by international metals brokers for use in small-scale gold mining in developing countries, which is the second largest source of global anthropogenic mercury emissions. EPA is conducting a federal stakeholder process to address the issue of excess global mercury.⁴⁹ The glass, aluminum, and zinc components of fluorescent lamps can also be recycled. Most major lamp manufacturers now use lead-free solder for many of their products.⁵⁰

Recovery and Recycling Programs

Commercial

Commercial generators and handlers of fluorescent lamps are regulated by state adoption of the U.S. EPA's Universal Waste Rule, as discussed above. However, not all lamps are required to be recycled as this requirement is based on the TCLP test. Small businesses may purchase pre-paid mailers to send their lamps to a recycling facility or take them to the appropriate facility in their area. In larger buildings, a lamp contractor service may be used to install and remove lamps and may provide recycling as well, or the business may have a contract with a recycling company to pick up spent lamps on-site. For example, Sylvania Lighting Services includes recycling in all of its lighting services contracts with universities, retailers, and other clients. Recycling of spent fluorescent lamps from commercial generators is limited because—many lamps do not need to be legally recycled if they do not exhibit TCLP

⁴⁷ Paul Abernathy, ALMR via email February 28, 2008.

⁴⁸ A retort is a vessel where substances are distilled or decomposed by heat.

⁴⁹ Linda Barr, Office of Solid Waste, EPA, "Recycling 101." Presentation at U.S. EPA meeting hosted by ICF International, Washington DC, May 22, 2007.

⁵⁰ Mark Kohorst, NEMA letter to Sierra Fletcher, PSI, March 24, 2008.

characteristics. In addition, there is a poor understanding of the regulations, and there is weak enforcement in states with disposal bans.⁵¹

Mail-back Options Available to Residential and Commercial Users

Recyclers, manufacturers, and other stakeholders have developed several options for residences or businesses to mail their fluorescent lamps to a recycling facility through a common carrier. These services provide a high level of convenience, although they are relatively expensive depending on the number of lamps shipped. All of the services sell containers online with pre-paid mailing labels. After filling the containers, consumers ship the lamps to a recycling service via a common carrier such as the U.S. Postal Service or FedEx. Examples of this type of program are presented in Table 3.

Table 3. Mail-back Lamp Recycling Services

Recycler/Project Partners	Shipper
<p>RECYCLEPAK⁵² Veolia Environmental Services http://www.recycleabulb.com/</p> <ul style="list-style-type: none"> This option is promoted via several different groups and partnerships, including Service Concepts (electrical cooperative members), OSRAM SYLVANIA, TCP, Efficiency Maine and Focus on Energy (energy efficiency program administrators), Illinois EPA, and Partners in Planet Protection. 	<p>USPS and FedEx</p>
<p>LampTracker (owned by Waste Management) http://www.wmlamptracker.com</p>	<p>FedEx, UPS</p>
<p>CRS http://www.bulbs.com/recycle.aspx Philips, U.S. EPA Energy Star, National Association of Electrical Distributors, and the National Association of Independent Lighting Distributors</p>	<p>FedEx</p>
<p>Philips, Earth Protection Services Inc (EPSI) http://www.nam.lighting.philips.com/us/recycle/?PHPSESSID=8b75a898524c79ca797e98ff757936ad</p>	

Collection at HHW Facilities for Residential Consumers

Nearly all municipal-run HHW programs collect mercury-containing products such as lamps, although there is a general lack of convenient collection locations for households. Some

⁵¹ Paul Abernathy, ALMR via email April 2, 2008. Mercury can be also recovered from mercury phosphor/calcium phosphate powder. After the mercury has been recovered from the powder it can be used as a soil additive. Illinois and Wisconsin’s state contract for fluorescent lamp recycling explicitly prohibits this. Most major lamp manufacturers now use lead-free solder.⁵¹

⁵² Information provided in part by Jennifer Dolin, OSRAM SYLVANIA, via email, February 6, 2008.

HHW recycling programs offer collection only once or twice a year, while others are only open for limited hours or may not be conveniently located for most residents.

Collection at Retail and Other Locations for Residential Consumers

In the past few years, state and local governments have worked with retailers, utilities, and recyclers to develop recycling options for fluorescent lamps that are more convenient for consumers. Program management, recycling, and publicity costs are often borne by local, state, or federal agencies, or by utilities, while retailers and recyclers have offered in-kind or discounted recycling services. In some cases, consumers pay some or all of the cost by paying a \$0.50 to \$2.00 fee to recycle a bulb at a drop-off point; in other cases, the service is free or includes a coupon or other financial incentive to promote recycling. While these pilot projects have generally shown that lamps can be safely collected in a variety of settings, several key challenges remain, including evaluating the performance of these programs, creating model programs, setting overall collection and recycling goals, using incentives to increase collection, and the need for a sustainable financing mechanism.

Local and County Programs

Project: Dane County Lamp Retail Collection Project⁵³ (Wisconsin)	
Participants: Dane County Department of Public Works, retailers (Ace Hardware, Copps Grocery, TrueValue, The Home Depot, Pick-n-Save, Wal-Mart, others), various recyclers	Implementation Dates: Ordinance adopted and collection begun in 2002 (ongoing)
	Mandatory/Voluntary: Mandatory. County ordinance requires any retailer selling fluorescent lamps to collect them. The City of Madison (about half the County’s population) has adopted a similar ordinance.
	Cost to Consumer: Varies among retailers from free drop-off to charges up to \$2.00 per 4-ft. tube
Collection Method: Over 60 retailers collect and recycle lamps, hiring a contractor to remove and recycle the lamps.	Estimated Cost/Unit: Not available.
	Funding Source: Stores, customers, electric utilities
	Contact/Website: http://www.countyofdane.com/pwht/recycling.aspx
Comments: An estimated 4,200 fluorescent lamps were collected in 2005 and 18,000 in 2006, though not all stores reported data. The 2007 survey is underway. Incandescent and other non-fluorescent lamps may be collected as well, though some retailers take only CFLs. The County is working to increase recovery and has established a subcommittee to develop a marketing and education/promotion plan.	
Focus on Energy, a statewide program funded by electric utilities, is covering the cost of recycling for those stores that are also part of a “buy fluorescent” promotion program.	

⁵³ Information provided by John Reindl, Dane County, Wisconsin via email, January 9, 2008. Information for consumers is available on the Dane County website at: http://countyofdane.com/pwht/recycle/lamps_bulbs.aspx.

Project: King County, Snohomish County, City of Seattle: Take it Back Network (TIBN)⁵⁴	
Participants: King County, the City of Seattle, and Snohomish County solid waste agencies, the Local Hazardous Waste Management Program in King County, and retailers, haulers, and recyclers.	Implementation Dates: September 2006 - present
	Mandatory/Voluntary: Disposal ban in King County, Snohomish County, and the City of Seattle for both residences and businesses
	Cost to Consumer: Free-\$1.35 per lamp
Collection Method: Participating hardware, lighting, and other retail stores collect spent fluorescent lamps for recycling. Some vendors only offer pick-up service.	Estimated Cost/Unit: N/A
	Funding Source: The Local Hazardous Waste Management Program in King County pays for promotion (TV ads, brochures) and staff time for recruitment of TIBN members. Most retailers charge an end-of-life fee to pay recycling, transportation and labor costs.
	Contact/Website: Lauren Cole www.takeitbacknetwork.org
Comments: This is an interim program until a manufacturer-financed system is implemented voluntarily or through legislation. It is unique in the fact that it charges an end-of-life fee to the consumer, whereas most programs cover recycling and other costs with public and/or private program funds.	
In 2006, a total of 8,920 lamps were collected of which the vast majority (6,411) were linear tubes and 1,774 were CFLs. In 2007, the number of linear tubes increased to 41,090 lamps collected, of which 33,611 were linear tubes. The number of CFLs also increased to 5,383.	

Project: Illinois Pilot CLF Recycling Program (ComEd Service Area)⁵⁵	
Participants: ComEd, Ace, Illinois Environmental Protection Agency (IEPA), agency-approved contractor and recyclers	Implementation Dates: October 1, 2007 – June 30, 2008
	Mandatory/Voluntary: Voluntary
	Cost to Consumer: Free
Collection Method: 148 Ace hardware stores collect spent CFLs and mail them to an Illinois EPA contractor that transfers the lamps to state-approved recycling facilities. Ace is provided with lined 5-gallon buckets, which are shipped via UPS using pre-paid labels provided by IEPA.	Estimated Cost/Unit: \$125 per 5-gallon bucket (about 90 CFLs), including delivery, return postage, and recycling.
	Funding Source: ComEd is providing 75 percent of total cost. IEPA will provide 25 percent.
	Contact/Website: David Walters, IEPA (email: david.walters@illinois.gov) www.epa.state.il.us
Comments: As of early April 2008, 40 5-gallon buckets had been returned for recycling. ComEd and Ace report receiving good publicity and indicate a high level of enthusiasm for the project.	

⁵⁴ Information provided by Lauren Cole, King County Solid Waste Division via email, January 10, 2008.

⁵⁵ Information on this project was provided by David Walters, IL Environmental Protection Agency via email, January 7, 2008 and Becky Lockart, IL Environmental Protection Agency via email, April 18, 2008.

Project: Lane County Lamp Recycling Coalition Retail-based Program (Oregon)⁵⁶	
Participants: Blachly-Lane Electric Cooperative, Emerald Public Utility District, Eugene Water and Electric Board, Lane County Public Works (Waste Management Dept.), Lane Electric Cooperative, Oregon Department of Environmental Quality, Springfield Utility Board, The Energy Outlet, Northwest Energy Efficiency Alliance	Implementation Dates: Launched October 2004 (ongoing)
	Mandatory/Voluntary: Voluntary
Collection Method: 13 retailers (hardware stores, utility-run outlets, lighting merchants, and a home improvement store) collect lamps from consumers, which are then collected by the county's waste management division on a quarterly basis and picked up by Earth Protection Services for recycling. Recycling costs are covered by Lane County.	Cost to Consumer: Free
	Estimated Cost/Unit: N/A
	Funding Source: Utilities, Lane County DPW
	Contact/Website: Bob Lorenzen, Eugene Water and Electric Board bob.LORENZEN@EWEB.Eugene.OR.US
Comments: Prior to this recycling initiative, consumers had to take spent bulbs to the county's HHW collection center on the one Saturday each month that it is open. In 2007, 24,243 lamps (74 percent of which were 4-ft. tubes, and 14 percent were CFLs) were collected. Surveys of consumers using the program showed that 78 percent had previously disposed of fluorescent lamps in the trash. The program is advertised as being for residential users only.	

Project: Salt Lake Valley Fluorescent Lamp Recycling Project (Utah)⁵⁷	
Participants: Salt Lake Valley Health Department's HHW program, county and city libraries	Implementation Dates: Launched July 1, 2007 (ongoing)
	Mandatory/Voluntary: Voluntary
	Cost to Consumer: Free
Collection Method: Consumers take spent lamps to 15 libraries county-wide (some accept only CFLs). Health Department staff picks up the containers from libraries and consolidates the lamps at HHW where they are picked up by Veolia Environmental Services for recycling.	Estimated Cost/Unit: \$0.09/foot for tubes and \$1.13/CFL (just recycling cost)
	Funding Source: Health Department funds program with a permit fee assessed on both public and private landfills in the Salt Lake Valley based on tonnage.
	Contact/Website: Dorothy Adams, Salt Lake Valley Health Department http://www.slvhealth.org
Comments: As of mid-January, about 400-450 4-ft. tubes have been collected and approximately 320 CFLs. The program was launched with a press release and press conference with the County's Mayor. Educational flyers are distributed through communities as well. Libraries are instructed to call a 24-hour phone number operated by the County if a bulb breaks, but this has not happened yet. Consumers can also take bulbs to HHW facilities, Monday-Saturday 8:00 am – 5:00 pm.	

⁵⁶ Information provided by Larry Gibbs, Lane County Public Works via email, January 8, 2008, and "Lane County Lamp Recycling Coalition Retail-based Pilot Program Final Report" Zero Waste Alliance, March 2006. Available at: http://www.zerowaste.org/cfl/cfl_index.htm

⁵⁷ Information provided by Dorothy Adams, Salt Lake Valley Health Department via email, January 22, 2008.

Project: Santa Clara County Lamp Recycling (California)⁵⁸	
Participants: Santa Clara County Household Hazardous Waste, 35 retailers	Implementation Dates: May 2007- present
	Mandatory/Voluntary: -Voluntary. In May 2007 the County adopted an Extended Producer Responsibility resolution supporting manufacturer take-back programs for their products. California has a disposal ban for all fluorescent lamps.
	Cost to Consumer: Free
Collection Method: Participating retailers collect lamps in designated boxes. When full, Household Hazardous Waste staff picks them up and transports them to the recycler.	Estimated Cost/Unit: N/A
	Funding Source: PG&E allocated \$26,000 to promote the program in newspapers and \$10,000 for 50,000 CFL recycling bags, which includes the recycling and transportation. Ongoing cost for collection and recycling are paid by taxpayers/ratepayers through the County program.
	Contact/Website: Rob d'Arcy, Santa Clara County
Comments: Over 70 percent of the fluorescent lamps managed by the County program are collected at retail. This fact demonstrates that retailers are providing the level of convenience to residents that makes recycling successful. In addition, the County is avoiding significant collection costs associated through normal HHW collection events.	

Statewide Programs

Project: Maine CFL Recycling Program⁵⁹	
Participants: Maine Public Utilities Commission, Maine Department of Environmental Protection (DEP), large and small retailers.	Implementation Dates: Launched June 2007
	Mandatory/Voluntary: Voluntary for retailers; Mandatory for homeowners and businesses to recycle all fluorescents
	Cost to Consumer: Free
Collection Method: 200 retailers throughout the state collect spent CFLs in DOT approved shipping containers and ship them to a Veolia facility in Massachusetts for recycling.	Estimated Cost/Unit: \$0.97 total cost
	Funding Source: Efficiency Maine
	Contact/Website: http://www.energymaine.com
Comments: As of early January 2008, over 5 full containers have been returned with Field Staff reporting that all stores have some CFL's in the buckets.	

Project: Minnesota Fluorescent Lamp Recycling⁶⁰	
Participants: Roughly 100 retailers (including Ace, Hardware Hank, TrueValue, The Home Depot, Sam's Club, and local hardware, lumber, and farm stores); utilities (Connexus Energy, Great River Energy, Minnesota Power, Ottertail Power, Xcel Energy).	Implementation Dates: N/A
	Mandatory/Voluntary: Mandatory, as there is a disposal ban that applies to both residential and commercial lamp users. Utilities are required to collect lamps if they serve 200,000+ customers
	Cost to Consumer: \$0.50-\$1.00 per bulb without a utility-issued coupon

⁵⁸ Information provided by Rob d'Arcy, Santa Clara County Department of Environmental Health via email, February 4, 2008.

⁵⁹ Information provided by Ann Pistell, Maine Department of Environmental Protection via email, January 17, 2008.

⁶⁰ Information provided by Jennifer Volkman, Minnesota Pollution Control Agency via email, January 9, 2008.

Collection Method: Utilities typically contract with HHW facilities or a retailer to collect lamps. Coupons are available; otherwise the consumer pays a fee upon depositing spent lamps at a collection site.	Estimated Cost/Unit: N/A
	Funding Source: N/A
	Contact/Website: Jennifer Volkman, MN Pollution Control Agency Jennifer.Volkman@state.mn.us http://www.pca.state.mn.us/waste/lightbulbs.html
	Comments: Areas of the state served by smaller utilities (under 200,000 customers) are unlikely to have retail collection available.

Project: New Hampshire Pilot Retail Collection⁶¹	
Participants: 29 TrueValue stores; Ace to join in 2008	Implementation Dates: Launched October 2006 (ongoing)
	Mandatory/Voluntary: Voluntary
	Cost to Consumer: Free
Collection Method: Participating stores collect spent lamps in boxes supplied at no cost by the lamp recycler and ship by reverse distribution to the same Manchester, NH TrueValue warehouse that receives lamps from Vermont for recycling.	Estimated Cost/Unit: \$0.65/linear foot for straight tubes; \$0.35/CFL, U-tube, etc.
	Funding Source: Utility company license fee
	Contact/Website: Paul Lockwood Paul.lockwood@des.nh.gov http://www.des.state.nh.us/nhppp/Mercury/default.asp?link=lamp
	Comments: This program is a direct spin-off from Vermont's.

Project: Vermont Pilot Retail Collection⁶²	
Participants: Vermont Department of Environmental Conservation (VT DEC), Do it Best, TrueValue & Ace hardware stores ⁶³	Implementation Dates: TrueValue began in August 2005; Ace began in August 2006; Do it Best began September 2007 (all ongoing)
	Mandatory/Voluntary: Mandatory recycling for both businesses and homeowners under Vermont Mercury Law
	Cost to Consumer: None
Collection Method: Participating hardware stores collect spent fluorescent lamps (limit 6 per customer) and ship by reverse distribution to a central company warehouse for consolidation and transport to Complete Recycling Services (CRS). The TrueValue warehouse is in New Hampshire,	Estimated Total Cost/Unit: Recycling costs are negotiated by contract and varies across the state.
	Funding Source: The state's Supplemental Environmental Project (SEP) provided \$22,500 on two occasions. SEP funds come from an environmental settlement.

⁶¹ Information provided by Paul Lockwood, NH Department of Environmental Services via email, January 9, 2008.

⁶² Information on this project was provided by Kam Knaebel, Vermont DEQ Mercury Education and Reduction Coordinator via email, January 9, 2008.

⁶³ Almost all of the 23 Ace and 40 TrueValue hardware stores in the state participate.

<p>while the warehouses for Do it Best and Ace are in New York.</p> <p>CRS provides standard recycling boxes. Mixed bulb containers have been used, but the program will switch to a combination of a smaller box for tubes and a 5-gallon pail for CFLs.</p>	<p>Contact/Website: Karen Knaebel, VT DEC Mercury Education and Reduction Coordinator</p>
<p>Comments: As of mid-January 2008, participating stores had collected almost 207,000 linear feet of straight tubes and 8,344 CFLs, Circline, and U-tubes. SEP funding will expire on or before 2010, depending on recycling costs. No sustainable financing system has been established, but this pilot project has demonstrated the success of the retailer reverse distribution system in this context.</p> <p>Under a separate program, Efficiency Vermont is in the process of funding 150-200 retail lighting partners to collect CFLs at the stores and ship them via mail to the recycler. This will include all Aubuchon stores. Efficiency Vermont has also assisted by distributing posters and bill stuffers through their retail account managers.</p>	

Regional and Nationwide Programs

Project: IKEA CFL Recycling Program	
<p>Participants: All IKEA stores in U.S.</p>	<p>Implementation Dates: N/A</p>
	<p>Mandatory/Voluntary: Voluntary (though disposal bans in some states)</p>
	<p>Cost to Consumer: Free</p>
<p>Collection Method: Customers return spent fluorescent lamps (purchased anywhere) to IKEA stores for recycling.</p>	<p>Estimated Cost/Unit: N/A</p>
	<p>Funding Source: IKEA</p>
	<p>Contact/Website: N/A</p>
<p>Comments: PSI was unable to reach IKEA for information on this program; however, it is notable as the only “big box” store collection across the U.S. IKEA’s website at: http://www.ikea.com/ms/en_US/about_ikea/social_environmental/environment.html</p>	

Project: PSI Region 8 Pilot Retail Collection (Montana, South Dakota, Utah)	
<p>Participants: Product Stewardship Institute (PSI), Women’s Voices for the Environment (WVE), Ace hardware stores, U.S. EPA, Veolia Environmental Services, Black Hills Power (tentative), Flathead Electric Cooperative, Rocky Mountain Power, Montana DEQ</p>	<p>Implementation Dates: May 1-December 31, 2008</p>
	<p>Mandatory/Voluntary: Voluntary</p>
	<p>Cost to Consumer: Free</p>
<p>Collection Method: Participating Ace Hardware stores in Montana, South Dakota, and Utah will collect tubes up to 4-ft., CFLs, and miscellaneous lamps (Circline, U-tube, small tubes) up to 2-ft. long. Once the boxes in the stores are filled, they</p>	<p>Estimated Cost/Unit: To be determined</p>
	<p>Funding Source: U.S. EPA Region 8 grant pays for planning, implementation, and evaluation. Transport and recycling paid for by utilities and state government.</p>

will be shipped via FedEx for recycling by Veolia Environmental Services.	Contact/Website: Sierra Fletcher, PSI (617) 236-4886, sierra@productstewardship.us or Jamie Silberberger at Women’s Voices for the Earth (Jamie@womenandenvironment.org)
Comments: This project is still in the design phase. The results of this pilot project will be summarized in a “how-to” document for wide dissemination in spring 2009.	

Project: The Home Depot (Canada) Retail Collection⁶⁴	
Participants: 160 The Home Depot stores across Canada and the Store Support Center	Implementation Dates: Launched November 22, 2007 (ongoing)
	Mandatory/Voluntary: Voluntary
	Cost to Consumer: Free
Collection Method: Participating stores collect spent lamps in a specially-designed carton located near the returns desk in the store. Cartons are checked weekly and, when full, emptied into a plastic container at the back of the store which is shipped back to the distribution center, then on to Fluorescent Lamp Recyclers, which sends an empty container back to the store immediately. The program is intended only for CFLs, but the recycler has committed to recycle anything placed in the container.	Estimated Cost/Unit: N/A
	Funding Source: The Home Depot pays for recycling of lamps; Philips does some promotion activities
	Contact/Website: Paul Berto, The Home Depot Canada
Comments: The Home Depot has challenged Canadians to recycle 1.4 million fluorescent bulbs by the end of 2012, the year by which Canada will have phased out incandescent bulbs (The Home Depot has pledged to stop selling incandescent bulbs in 2011). Municipalities play a role in publicizing the recycling opportunity. Each store has a “green team” that is responsible for implementing the program within their store. This program is an entirely voluntary component of The Home Depot’s corporate social responsibility strategy.	

Project: Wal-Mart Fluorescent Lamp Recycling Pilot Days⁶⁵	
Participants: 350 Wal-Mart stores and Sam’s Clubs in California, Massachusetts, Minnesota, Rhode Island and Oklahoma, LampTracker/Waste Management (recycler), state environmental agencies	Implementation Dates: June 23, 2007 8:00 am - 4:00 pm (one-time event in multiple locations)
	Mandatory/Voluntary: Voluntary
	Cost to Consumer: Free
Collection Method: Lamp collection areas and signage were set up outside the store/club entrance (depending on weather). LampTracker provided boxes which, when filled, were shipped via UPS for recycling. Wal-Mart announced the opportunity with signs in stores/clubs; state agencies advertised more widely.	Estimated Cost/Unit: Average over \$1.00/lamp (Cost varied by site and was based on the fact that some boxes were sent back before being filled as it was a 1-day collection.)
	Funding Source: Wal-Mart Stores Inc.
	Contact/Website: Kerry Gobel, Wal-Mart

⁶⁴ Information provided by Paul Berto, The Home Depot (Canada) via email, January 16, 2008.

⁶⁵ Information provided by Kerry Gobel, Wal-Mart, via email, January 15, 2008.

Comments: As was expected, the number of CFLs collected in this one-time demonstration was low, but Wal-Mart reports that the events successfully demonstrated the feasibility of a large-scale collection, as well as customer interest.

At the request of the Fort Collins Utilities and the Platte River Power Authority in Colorado, Wal-Mart stores and Sam’s Clubs in the cities of Fort Collins, Longmont, and Loveland also provided collection bins for CFLs in October-December 2007. This service was not advertised, but consumers contacting the utility with interest in recycling CFLs were informed of the option to take them to their local Wal-Mart store or Sam’s Club. This was done in partnership with a CFL promotional campaign led by the utility companies.

XIII. Options for Shared Responsibility

As demonstrated by the projects described previously, there are many ways for companies, agencies, and organizations committed to the product stewardship of fluorescent lamps to share responsibility. Table 4 shows some examples, many of which have already been demonstrated in the projects described above. These are focused on small generators and/or residential users.

Table 4. Potential stakeholder contributions (options for discussion)

Stakeholder	Potential Contributions to Product Stewardship of Fluorescent Lighting
Manufacturers	<ul style="list-style-type: none"> ✓ Reduce amount of mercury in each fluorescent lamp. ✓ Continue to develop and promote more environmentally-preferable lighting products to replace less efficient, shorter-lived, and higher-mercury products. ✓ Increase public awareness of the importance of, and opportunities for, recycling lamps through packaging/labeling and other means. ✓ Cover the cost of collection and recycling of lamps. ✓ Include the cost of lamp collection and recycling in product purchase price. ✓ Provide incentives for the collection and recycling of lamps.
Retailers	<ul style="list-style-type: none"> ✓ Inform customers of importance of recycling lamps and where to recycle. ✓ Collect spent lamps on site. ✓ Provide coupons as incentive to recover spent lamps and increase customer traffic. ✓ Provide recycling only with purchase of new lamp(s). Promote environmentally-preferable lighting products and stop selling less efficient, shorter-lived, higher-mercury products.
Utilities/Energy Efficiency Groups	<ul style="list-style-type: none"> ✓ Increase public awareness of the importance of, and opportunities for, recycling lamps. Provide financial support for collection and recycling of lamps (interim or long-term). ✓ Establish specifications for lighting equipment or give rebates that address mercury content, lamp life, and/or other environmental attributes ✓ Facilitate and participate in lamp recycling projects
Local, State, and Federal Government	<ul style="list-style-type: none"> ✓ Coordinate recycling, procurement, or other projects locally, state-wide, or nationally. ✓ Increase public awareness of the importance of, and opportunities for, recycling

Stakeholder	Potential Contributions to Product Stewardship of Fluorescent Lighting
	lamps. Recognize companies/groups taking leadership roles. ✓ Procure environmentally-preferable lighting options. ✓ Regulation/enforcement to level playing field and maintain fairness. ✓ Program planning, including establishing performance goals.
Environmental Organizations	✓ Increase public awareness of the importance of, and opportunities for, recycling lamps. ✓ Promote environmentally-preferable lighting options. ✓ Coordinate recycling, procurement, or other projects. Recognize company leaders and laggards.

XIV. Sustainable Financing Options

Sustainable Financing⁶⁶

Currently, most end-of-life management costs for HHW in the United States (e.g., collection, reuse, recycling, disposal) are largely borne by state and local agencies through government programs, and are paid for through taxes. In some cases, electric utilities may pay for collection and recycling of spent fluorescent lamps through public benefit charges or by recovering costs in their rate base. Other ways of funding programs are through end-of-life fees charged to consumers when they return a product for recycling or disposal, or through solid waste utility rates. There are two basic types of product stewardship financing systems that seek to cover end-of-life product management costs by incorporating these costs into the purchase price of a new product: (1) Advanced Recycling Fees and (2) Cost Internalization (or “producer responsibility”). This section discusses general product stewardship models for sustainable financing, *it does not purport to make recommendations applicable to fluorescent lighting*. Financing will be a key focus of the dialogue process and the relative merits of different options will be discussed by participants.

Europe and Japan have developed systems that share financial responsibility. In those countries, producers usually are financially responsible for the portion of the process on which they have influence, namely transportation and recycling of scrap products. Municipalities and retailers often pay for the collection of products at municipal depots or at retail, parts of the process on which they have most influence. In the U.S., producer responsibility systems are by far the dominant financing mechanism, and have been implemented for electronics, thermostats, rechargeable batteries, and paint. For each of these products, manufacturers have taken responsibility for the collection, transportation, and recycling of the products by creating an industry-run stewardship organization to contract for services, collect payments from producers, and manage the overall system.

⁶⁶ Parts of this section appeared in a chapter called “Product Stewardship: Shared Responsibility for Managing HHW,” in *Household Hazardous Waste*, edited by Amy Cabaniss, Government Institutes (Lanham, Maryland) 2008.

Advanced Recycling Fee

An advanced recycling fee (ARF) is a separate charge placed on a new product and paid by a consumer at retail to cover the cost of the product's eventual end-of-life management. An ARF is paid in advance so that when a consumer is ready to recycle the product, a "free" system is available for its collection, transportation, and management. Buying a product and paying an ARF is like buying that product's recycling service in advance. In reality, the ARF paid on a current product pays for the recycling of a product bought years before. One advantage of ARF systems is that the fund created can immediately cover the costs of recycling these past products.

An ARF can be either visible or invisible to the consumer. In the U.S., many state governments have placed visible ARFs on products such as tires, motor oil, and lead acid batteries. California's 2003 electronics scrap recycling law, the first electronics product stewardship system in the U.S., is also based on a visible ARF. Some Canadian ARFs, however, are invisible to the consumer.

Funds collected in ARF systems can go into a government-managed fund or an industry-managed fund (handled through a producer responsibility organization). While most ARFs in the United States are paid into government funds, ARFs in Canada are most often paid into an industry fund and managed by a stewardship organization. A key disadvantage of government-managed funds is the possibility of state legislatures seizing these dedicated funds for other funding purposes. Another downside is the need for additional government staff to manage the fund collection, grant distribution, contractor services, and other operational functions. Many people believe that, for an ARF to be considered as a product stewardship system, funding must be handled by industry, and that industry must play a significant role in managing the system.

Those supporting industry-managed funds believe that these functions can be provided more cost effectively when managed by the private sector. Some in Europe, however, believe that ARFs that pay into a single organization – whether public or private – provide little incentive to improve efficiency since central funds act as monopolies. These proponents believe that the most efficient systems are ones that provide competition among private organizations, which would exclude an ARF.

Cost Internalization

A second type of financing system involves manufacturers and importers that internalize end-of-life management costs into the cost of doing business so that they are invisible to the consumer, even though the costs may be passed on to the consumer. These are called "producer responsibility" systems. By internalizing end-of-life management costs, manufacturers and importers have direct management ability to increase efficiency, improve service, and cut costs. The ability to control management decisions is the biggest advantage for a producer responsibility system compared to an ARF, which does not become part of a company's profit and loss statement and therefore does not result in company actions toward greater efficiency.

The two most common voluntary industry-wide programs in the U.S. are run by the Rechargeable Battery Recycling Corporation (RBRC) and the Thermostat Recycling Corporation

(TRC). Both of these programs were developed by manufacturers to fund collection and recycling programs that are free to consumers, who can bring their batteries and thermostats to participating public and private collection sites. These products do not have to be sorted by brand since the programs accept all manufacturer brands. Manufacturers' costs to collect and recycle the batteries and thermostats, and to publicize the programs, are included in the purchase price of the products. The entire program is paid for by funds derived from manufacturers that pay according to a formula based on market share and established by RBRC and TRC. Of the 13 scrap electronics recycling laws recently enacted in the U.S., all but one follow the producer responsibility model.

In most European countries, the Waste Electrical and Electronic Equipment (WEEE) Directive is implemented through cost internalization, which fosters competition among several stewardship organizations in one country. For example, the establishment of four stewardship organizations in Austria in 2005 has reduced the take back cost from 75 cents per kilogram of electronic product placed on the market to 8 cents per kilogram within a 6-month period.⁶⁷

Deposits

Deposit systems create an extra incentive for residents to bring their used product in for collection. Under such a system, consumers pay an extra charge, similar to an ARF, at the time the product is purchased at retail. However, unlike an ARF, if the consumer returns the used product, they will receive a return deposit, or a portion of the deposit. Deposits have been effective at increasing the rate of recycling, although they add significant costs and complexity to the program since part of the revenue must be paid back to consumers who return their products. Examples of deposit-related systems include state laws on beverage containers, and some state laws on automobile batteries, pesticide containers, and used motor oil.

End-of-Life Fees

End-of-life fees are charged by some government agencies and private entities at the point where a product is collected for recycling or disposal. They are used to obtain program revenue to collect used products. Government officials usually view these fees as inadequate long-term solutions because they charge residents for “doing the right thing” and often result in illegal disposal. Given a mandatory fee for collection, many consumers dispose of products in the garbage, a vacant lot, or the woods rather than take the product to a collection location. Fees are best used to jump-start programs, as a supplement to a product stewardship system, or to gain experience on a pilot project basis. In 2007, Staples became the first retailer to announce that it would take back computers, for an end-of-life fee, in all of its stores nationally.⁶⁸ This program is viewed as a supplement to, but not a substitute for, a funding system that will collect and recycle electronics equipment without an extra fee from residents.

⁶⁷ Hans Korfmacher: “Some Learnings from the establishment of the first pan-European WEEE Compliance Scheme: The European Recycling Platform,” presentation at Product Stewardship Institute Forum, San Francisco, May 2007, <http://www.erp-recycling.org>.

⁶⁸ For more information, see the Product Stewardship Institute's website at <http://www.productstewardship.us>.

Retail Coupons

Retail coupons offer additional incentives to the consumer to have them return the product. These could be provided by a retailer or manufacturer at a retail outlet, or at a municipal collection event or depot and would provide an incentive for recycling. For example, a customer returning spent bulbs to a retailer may receive a coupon for a discount off the purchase of replacement bulbs.

XV. Key Issues and Potential Strategies

PSI identified key issues, solutions and potential strategies in general terms based on interviews with key stakeholders and other input received. Table 5 shows these key issues in general terms. Participants will jointly determine which strategies show the most promise, identify associated issues, and develop specific steps for pursuing the highest priority strategies.

Table 5. Issues, solutions, and strategies for consideration by stakeholders

Issue	Solution	Strategies
<p>#1. Source control Lamp manufacturers have reduced significantly the amount of mercury used in fluorescent lamps. However mercury is still required for the lamps' efficient function. Mercury is also released through the manufacturing process, although some manufacturing methods are more efficient in their use of mercury than others.</p>	<p>Reduce the amount of mercury used in the manufacture of fluorescent lamps, including the amount per lamp and the amount released during manufacture.</p>	<ul style="list-style-type: none"> a) Identify and encourage (with incentives) or mandate use of most effective method for mercury insertion to ensure accurate/minimal dosage in lamp manufacturing. b) Encourage (with incentives) or mandate manufacturers to reduce amount of mercury per lamp. c) Mandate manufacturers to improve life span and efficiency of lamps. d) Encourage (including through procurement) manufacturers to improve life span and efficiency of lamps.
<p>#2. Collection, consolidation, and transportation infrastructure There is currently uneven and inadequate infrastructure for the collection of spent lamps for recycling. Efficient consolidation and transportation may require lamp crushing, but the safety of these systems is questioned. (Recycling infrastructure is considered adequate and will grow with market demand.)</p>	<p>Increase convenient and cost-effective opportunities for the collection, consolidation, and transportation of spent lamps for recycling.</p>	<ul style="list-style-type: none"> a) Study existing infrastructure and new infrastructure needed to provide convenience for collection and lower system costs <i>for small generators/residential consumers</i>. b) Study existing infrastructure and identify whether new infrastructure is needed to provide recycling services <i>for large generators (businesses and institutions)</i>. c) Develop collection and recycling performance targets and a methodology for measuring them.

Issue	Solution	Strategies
<p>#3. Information and motivation for recycling Many people do not know that fluorescent lamps contain mercury, or how/where to recycle them and why. Even in the case of large buildings/businesses that are required to recycle lamps, information and enforcement are inadequate. Lack of understanding of the environmental/health impacts, lack of regulation or enforcement, and lack of incentives to recycle decrease recycling of fluorescent lamps.</p>	<p>Inform public of reasons for recycling fluorescent lamps and provide incentives/disincentives to encourage recycling.</p>	<p>a) Identify options for improving public awareness.</p> <p>b) Determine the role of incentives and/or disincentives required to increase recycling (including compliance/enforcement) <i>for small generators/residential consumers</i>.</p> <p>c) Determine the role of incentives and/or disincentives required to increase recycling (including compliance/enforcement) <i>for large generators (businesses/institutions)</i>.</p> <p>d) Improve enforcement of existing recycling requirements.</p>
<p>#4. Sustainable financing A sustainable financing system is needed to conduct large-scale lamp recycling; current funding of pilot/small-scale projects is not sustainable, particularly in light of the anticipated future increase in the number of fluorescent lamps used.</p>	<p>Develop a financing system that covers the collection, transportation, and recycling costs for fluorescent lamps now and in the future.</p>	<p>To be identified by participants.</p>

APPENDIX A

INTERVIEWS, COMMENTS, AND CONTRIBUTIONS

The list below represents those who PSI has formally interviewed from April 2007 through June 2007.

Manufacturers

- Mark Kohorst, National Electrical Manufacturers Association (NEMA)
- Jennifer Dolin, OSRAM SYLVANIA, Inc.
- Joe Howley, General Electric

Processors

- Paul Abernathy, Association of Lighting and Mercury Recyclers (ALMR)
- Mike Welsh, Partners in Planet Protection
- Barry Jordan, Veolia Environmental Services

Federal Government

- Wendy Reed, U.S. Environmental Protection Agency, Energy Star Program

State Government

- Terri Goldberg, Northeast Waste Management Officials' Association (NEWMOA) representing seven states
- Karen Knaebel, VT Department of Environmental Conservation
- Paul Lockwood, NH Department of Environmental Services
- Laurie Tenace, FL Department of Environmental Protection
- John Price, FL Department of Environmental Protection
- Abby Boudouris, OR Department of Environmental Quality

Local Government

- Jen Holliday, Chittenden County, VT
- Rob d'Arcy, Santa Clara County, CA
- Lauren Cole, King County WA

Environmental Groups

- Erin Thompson, Women's Voices for the Earth (WVE)
- Bill Sheehan, Product Policy Institute (PPI)

Other

- Vicki Calwell, ECOS Consulting
- Patrick Scanlon, Waste Management Inc./Wheelabrator
- Brad Steele, Energy Federation Inc. (EFI)

In addition to the individual listed above, we would like to thank the following people for providing information for this document and comments on early language or drafts.

Dorothy Adams, Salt Lake Valley Health Department
Linda Barr, U.S. Environmental Protection Agency
Michael Bender, Mercury Policy Project
Paul Berto, The Home Depot (Canada)
Alicia Culver, Green Purchasing Institute
Cynthia Dunn and Renee Lawver, CA Integrated Waste Management Board
Ric Erdheim, Philips
Larry Gibbs, Lane County Public Works
Kerry Gobel, Wal-Mart
Steven Kratzer, MI Department of Environmental Quality
Rachel Laderman, Thurston County Environmental Health (Washington)
Dave Lennett, PSI consultant
Paul Lockwood, NH Department of Environmental Services
Melissa Lucas, Northeast Energy Efficiency Partnership
Enid Mitnik, ME Department of Environmental Protection
Ann Pistell, ME Department of Environmental Protection
John Reindl, Dane County
Jennifer Volkman, Minnesota Pollution Control Agency
David Walters, IL Environmental Protection Agency
Adam Weinert, IMERC Coordinator, NEWMOA
Jeri Weiss, U.S. Environmental Protection Agency

APPENDIX B

Universal Waste Handler and Hazardous Waste Generator Requirements (from U.S. EPA's Introduction to Universal Waste)

	SQHUW (Small Quantity Handlers of Universal Waste)	LQHUW (Large Quantity Handlers of Universal Waste)	CESQG (Conditionally Exempt Small Quantity Generators)	SQG (Small Quantity Generators)	LQG (Large Quantity Generators)
Quantity Limit	<5,000 kg on site §273.9	> 5,000 kg on site §273.9	< 100 kg/month < 1 kg acute/month §261.5(a) and (e)	Between 100 and 1,000 kg/month §262.34(d)	> 1,000 kg/month or > 1 kg acute/month Part 262 and §261.5(e)
EPA Identification Number	Not required §273.12	Required §273.32	Not required §261.5	Required §262.12	Required §262.12
On-site Accumulation Limit	< 5,000 kg §273.9	No limit	< 1,000 kg < 1 kg acute < 100 kg spill residue from acute §261.5(f)(2) & (g)(2)	< 6,000 kg §262.34(d)(1)	No limit
Storage Time Limit	1 year, unless for proper recovery, treatment, or disposal §273.15	1 year, unless for proper recovery, treatment, or disposal §273.35	None §261.5	< 180 days or < 270 days §262.34(d) & (e)	< 90 days §262.34(a)
Manifest	Not required §273.19	Not required, but must keep basic shipping records §273.39	Not required §261.5	Required §262.20	Required §262.20
Personnel Training	Basic training §273.16	Basic training geared toward employee responsibilities §273.36	Not required §261.5	Basic training §262.34(d)	Full training (as outlined in §265.16) §262.34(a)

Introduction to Universal Waste. As mandated by Subtitle C of the Resource Conservation and Recovery Act (RCRA), Solid Waste and Emergency Response (5305W) EPA530-K-05-019, (September 2005).
www.epa.gov/epaoswer/hotline/training/uwast05.pdf