RESPONSIBLE PURCHASING **GUIDE**

fluorescent lighting

Responsible Purchasing Network
Center for a New American Dream

About the Guide

The Responsible Purchasing Guide for Lighting is published by the Responsible Purchasing Network in print, as a PDF file, and on the web. Print and PDF copies are available to the public for purchase. The online edition includes additional resources available to members of the Responsible Purchasing Network, including: searchable product listings, multiple policy and specification samples, comparisons of standards, and related documents. Visit www.ResponsiblePurchasing.org to purchase a copy or to access the members-only web-based edition of the Guide.

About the Responsible Purchasing Network

The Responsible Purchasing Network (RPN) was founded in 2005 as the first national network of procurement-related professionals dedicated to socially and environmentally responsible purchasing.

RPN is a program of the Center for a New American Dream (www.newdream.org) and guided by a volunteer Steering Committee of leading procurement stakeholders from government, industry, educational institutions, standards setting organizations, and non-profit advocacy organizations.

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Overview

This guide covers fluorescent lamps, including compact fluorescent bulbs, ballasts and tubes and outlines best practices for a responsible lighting system. The following areas will be covered in this Guide.

Social and Environmental Issues

Generating electricity for the United States' lighting requires the equivalent of one hundred large power plants and releases more than 553 million tons of carbon dioxide. That energy use is linked to global climate change, air pollution and mining fatalities. Beyond the energy implications, lighting products are manufactured with persistent bioaccumulative toxins, like lead and mercury, and produce tons of hazardous and solid waste at the end of their lives. Social responsibility implications affect the workers who manufacture the lamps and those who work under the lights. Effectively managing an institution's lighting program and purchasing energy efficient and less-toxic lighting equipment saves money, reduces environmental impacts, and improves conditions for workers.

Best Practices

This section outlines how to form a dedicated team that will gather data on current consumption and impacts, set reductions goals, adopt a policy, evaluate standards and draft bid specifications. Best practices for a successful lighting program also includes management strategies such as using natural lighting and light wall finishes to conserve energy; reducing eye strain to improve worker satisfaction and consequently raise productivity; and establishing recycling and take-back programs to prevent the release of PBTs like lead and mercury into the environment.

Cost, Quality and Supply

CFLs are typically reliable, cost-effective, and widely available. Because of the long life of CFLs, buyers need to purchaser fewer bulbs, which use less energy than conventional incandescents. Often rebates from local utilities can offset the initial cost premium of CFLs and because of their superior efficiency, CFLs pay back their higher purchase price in just a few months. Besides having a useful lifespan of up to 15,000 hours, current models silently produce smooth light output at a pleasant color rendition index (CRI). Over 2000 ENERGY STAR rated products are available on the market, including some that are low-mercury or lead-free. CFLs come in a variety of sizes and shapes and for a variety of applications. ENERGY STAR qualified models designed for dimming, outdoor fixtures, and enclosed fixtures are now available. This section also discusses the advantages of pin-based over screw-based CFLs and more generally compares CFLs and linear fluorescent lamps.

Policies

This section includes a model policy (full version available in Addendum I) created by RPN and the Green Purchasing Institute that includes provisions on energy conservation and efficiency, PBTs including lead and mercury, supplier mercury content disclosure, and lamp recycling. Additional examples from federal, state, county, cities and universities are also covered here.

Specifications

Bid solicitations should include require for ENERGY STAR qualification, lamp life greater than 10,000 hours, mercury and lead content disclosure and restrictions, verification of automatic dosing techniques and sweat-free operations in manufacturing, and take-back provisions. This section provides examples from a variety of institutions where such contract language has been used.

Products

There are over 2000 ENERGY STAR qualified CFL products available. Before searching the RPN online database of certified products, review these guidelines on choosing the right CFLs.

1. Determine light output needed.
2. Make sure the CFL is ENERGY STAR-qualified.
3. Choose the CFL with the highest efficacy in the shape and size you want.
4. Look for long-lasting CFLs.
5. Specify low-mercury CFLs.
6. Look for lead-free CFLs.
7. Ask lamp manufacturers and vendors to offer collection and recycling services.

Standards

RPN recommends three environmental standards for CFLs: ENERGY STAR for CFLs, EcoLogo's CCD-014, and Green Seal's GS-5. The ENERGY STAR standard covers energy efficiency but not mercury limits, whereas the CCD-014 requires a six milligram mercury limit in addition to the ENERGY STAR standards. GS-5 covers mercury content and efficiency standards but is under revision and is expected to be reissued in March 2008. No products are certified under CCD-014 or GS-5 as of October 2007. Other standards covered in this section include the European Union's restriction on hazardous substances, which sets a 5 milligram cap for mercury in CFLs and the U.S. Green Building Council's LEED rating system, which covers energy efficiency, mercury reduction and daylighting.

Social and Environmental Issues

Selecting, using, and disposing of fluorescent lighting is accompanied by a number of serious environmental impacts and social concerns. Key issues include wasteful energy consumption, greenhouse gas emissions, mercury and lead use and disposal, and working conditions in lighting equipment manufacturing facilities.

Energy

According to a 2002 DOE report, lighting is the number one energy consumer in commercial buildings, and accounts for 22% of all electricity generated in the United States (EERE, 2006). Energy efficient lighting is therefore of critical importance when viewed in the context of global warming and world conflict over energy security.

There are almost 17,000 electricity generating facilities in the United States that produce nearly 4 billion megawatt hours of electricity each year (DOE, 2005; DOE, a). Commercial buildings consume more than one-third of this electricity for such purposes as lighting; heating, cooling, and ventilation; and the operation of office equipment and elevators (DOE, b).

Half of the electrical energy produced in the U.S. comes from coal. Much of the rest is generated from natural gas, petroleum, and nuclear sources. In addition to contributing to global warming, these production sources factor into an array of adverse human health and environmental impacts, including mining injuries and fatalities, air and water pollution, radioactive waste, and landscape/habitat disruption.

It takes the equivalent of one hundred large power plants to generate the electricity required for America's lighting needs, at a cost of about $58 billion (EERE, 2006). The generation of this electricity releases more than 553 million tons of carbon dioxide; 871,000 tons of nitrogen oxides; and 2.3 million tons of sulfur dioxides (EIA, 2006). These figures do not include all the efficiency losses at mines and power plants, and through the electric grid. Nor do they include the electricity needed to manufacture the lighting products themselves. Approximately 40 of those 100 plants power the 4.2 billion incandescent lamps in use, by far the least efficient of the common lamp types (NEMA, 2003). Energy efficient compact fluorescent lamps (CFLs) have long been available as an appropriate replacement for conventional incandescent bulbs. They are typically 3-4 times more efficient because they produce light by fluorescing phosphors rather than heating filaments. On average, switching one bulb to a CFL can prevent more than 450 pounds of power plant emissions (including greenhouse gasses) over the lifetime of the bulb (ENERGY STAR, c). CFLs that replace higher-wattage incandescent lamps and that last longer prevent more pollution than those that replace lower-wattage light bulbs or have a shorter rated life.

Hazardous Substances

Three hazardous substances are associated with fluorescent lighting: mercury, lead, and PCBs. These persistent, bioaccumulative and toxic (PBT) chemicals tend to linger in the environment for a long time, concentrate in the food chain, and are capable of causing serious health effects such as brain damage, heart disease and cancer.

Mercury

Mercury (Hg) is associated with lighting in two ways:

1) Energy use is linked to the release of mercury into the environment, most often at the point of generation. The largest source of mercury in air is from coal-burning electricity generation.

2) All fluorescent light bulbs, including CFLs contain mercury, in varying amounts. When electricity is applied to a fluorescent lamp, the mercury turns from a liquid to a gas. The “excited” atoms bump up to higher energy levels, releasing photons when they return to their original unexcited state. The mercury in fluorescent lamps can be released during manufacture and transport; if broken during installation or storage; or when recycled or disposed of in trash incinerators, landfills and metal smelters.

According to 2005 U.S. Department of Energy data, a power plant using an average U.S. fuel mix emits approximately 5.4 milligrams of mercury to generate enough electricity to run a 75-watt incandescent light bulb for five-years. It takes about 1.7 milligrams to run an equivalent CFL for the same time (DOE, c). Actual mercury emissions will vary based on the wattage of the incandescent bulb, the rated life of the replacement CFL, and the percentage of coal in each utility’s fuel mix.

Airborne mercury eventually enters water supplies, accumulating in fish, and ultimately is consumed by people. Exposure to high levels of mercury can cause chronic brain, nervous system, heart and kidney damage. The U.S. Environmental Protection Agency has issued over 3000 fish consumption advisories, 80 percent of those concerning unsafe levels of mercury (EPA, 2007). Pregnant women are especially advised to minimize potential mercury exposure due to the harm it can cause to developing fetuses and its ability to pass through breast milk to the child (DHH, 2004). According to a 2004 report by the U.S. Environmental Protection Agency, one in six women of child-bearing age (15.7%) in the United States exceeds “safe” levels for mercury. EPA estimates that approximately 630,000 babies are born with blood mercury levels exceeding the agency’s reference dose, which is the level assumed to be without appreciable harm (Mahaffey, 2004).

Lead

Lead is another persistent, bioaccumulative and toxin (PBT) contained in lighting equipment. Some incandescent and compact fluorescent light bulbs contain lead glass, and lead solder in their screw-in bases. Lead can damage the nervous system, reproductive system, and kidneys. It can also cause blood disorders and affect the mental development and growth of children (EPA, 2000). See the **Cost, Quality, and Supply** section for more information on lead-free lamps.

PCBs

Ballasts, used to power fluorescent lamps (including pin-based CFLs) manufactured before 1979 often used polychlorinated biphenyls (PCBs) in their capacitors (EPA, 2006). Like lead and mercury, PCBs can persist for decades in the environment and concentrate in humans, fish and wildlife. The EPA has classified PCBs as probable human carcinogens. Long-term PCB exposure can cause harm to the nervous and reproductive system, immune system suppression, hormone disruption, and skin and eye irritation (EPA, 2006). See the **Best Practices** section for more details on ballast retrofits.

End-of-Life Management

It takes 10 incandescent bulbs to provide the same lighting over the lifespan of one CFL (ENERGY STAR, b). Choosing longer-lasting lighting technology ultimately reduces the amount of material that needs to be recycled or sent to landfills and incinerators. Still, proper recycling of spent fluorescent bulbs is essential since they contain mercury (GPI, 2007).

The U.S. Environmental Protection Agency has deemed fluorescent and other mercury-containing lamps to be universal waste. Most government agencies and other commercial generators of these items must either recycle them or follow hazardous waste regulations. All lamp generators must collect, store and transport lamps to prevent breakage. A fact sheet summarizing the U.S. EPA's Universal Waste requirements for mercury-containing lamps (including CFLs) is included in the **Related Documents** section below.

According to an internal survey conducted by the National Electrical Manufacturers Association (NEMA), all the lamps sold in the United States by NEMA members in 2003 contained a total of 7 tons of mercury (NEMA, 2005). Additional mercury may be entering the U.S. in imported lamps made by non-NEMA members. Recycling spent fluorescent lamps is one way to prevent mercury from entering the environment. Presently, less than 30% of the more than 600 million fluorescent lamps used by government agencies – and a mere 2% of those discarded by U.S. residents (most of which are CFLs) – are recycled (ALMR, 2004). Similarly, approximately 60 million lamps reach the end of their useful life in Canada each year, and about only 7 percent are recycled (PP, 2005).

Social Responsibility
According to a paper published by the U.S. EPA and the China Certification Center for Energy Conservation Products, "China is the world leader in CFL production, with roughly 75 percent of the global production taking place within its borders. Total annual output is estimated to be running at close to one billion pieces in 2004 and the number is expected to continue to increase in the future" (Banwell and Li, 2005).

Despite the existence of national labor laws in China, factory workers rights are often violated. According to Robert J. Rosoff, director of the China Working Group:

> Workers are often required to work far more than 40 hours a week, have few days off, are paid below the minimum wage, and are not paid required overtime. Improper deductions from wages are common. Some Chinese workers must pay a large sum of money as a "deposit" to their employer, and they may have to pay a "recruitment fee" in order to be hired. These payments can prevent workers from leaving jobs where their rights are violated. Physical abuse of workers, and dangerous working conditions, are also common.

In an effort to better protect workers and the communities surrounding fluorescent lamp manufacturing plants, some companies have begun utilizing encapsulated dosing technologies such as capsules or strips instead of mercury drops or spraying techniques. Purchasers can encourage the use of these more protective technologies by specifying their use in bid solicitations. Wal-Mart now requires its suppliers to use these precise, low-mercury dosing technologies

In the office, indoor lighting impacts people's productivity, mood and comfort level. Evenly-balanced and well-distributed light is conducive to employee satisfaction and well-being. Additionally, an individual's control over personal workspace lighting provides a sense of empowerment in the office. Electronic ballasts can reduce headaches and increase performance in the workplace compared to magnetic ballasts (LRC, 2002). Energy-efficient electronic ballasts can improve employee comfort and franchise by increasing dimming capabilities and reducing start-up time, flicker, noise, and heat output (ILI, 2000). Electronic ballasts are now available for all high-quality fluorescent lighting.

Pleasing, adjustable, and efficient lighting are three keys to worker satisfaction and improved performance. Over the past decade research has shown that employees who experience positive moods solve problems more quickly and come up with more creative solutions than subjects in either neutral or negative moods (LRC, 2002). Upgrading the lighting system in an office or work space has the potential to improve productivity and morale. See the **Cost, Quality, and Supply** section of this Guide for more information on how fluorescent light quality addresses employee health issues.

Related Documents

U.S. Environmental Protection Agency, Office of Solid Waste, "Environmental Fact Sheet: Some Used Lamps Are Universal Wastes," July 1999

TetraTech, Factsheet: WEE and RoHS Directives, 2007

European Lamp Companies Federation, "The Lamp Industries Commitment to Support a Government Shift to Energy Efficient Lighting Products in the Home: Questions and Answers," April 20, 2007

Best Practices

A successful program follows best practices for procuring and recycling lighting products, and planning energy efficient and comfortable lighting systems. Best practices include forming a team dedicated to the task, establishing baseline data, setting goals, adopting a policy, evaluating standards and specifications, improving current behaviors, and measuring and reporting progress.

Form a Team

The first step in developing a successful "Responsible Purchasing" strategy for lighting should be to assemble a dedicated team to work on the issue. The team should include an appropriate range of stakeholders, such as construction and facilities staff, procurement staff, representatives from energy and environmental departments, officials from management, and possibly representatives from the local power provider or a certified lighting expert. It might be a subcommittee of an existing "green" team or an ad hoc committee developed expressly for this purpose. In any case, the committee should be balanced by having administrators or executive staff, facility and/or energy managers, specifiers and end-users all working together. The team should be tasked with planning and making and/or delegating decisions and implementation actions related to the procurement, use and recycling of fluorescent lamps and other energy efficient lighting systems, and monitoring and reporting on progress toward goals set in the plan.

Establish Baseline Inventory & Impacts

Begin by gathering baseline data on current consumption of light bulbs, energy used on lighting, toxic waste generated from lighting and other baseline data related to your organizational interests and goals. Inventory the products currently in stock and being purchased and their applications, and measure the social and environmental impacts resulting from this inventory and use. Ask lighting vendors to provide periodic lamp usage reports in order to improve and streamline the collection of purchasing data. Include type, quantity, function and energy usage for all building lighting equipment. Record the procurement, energy, maintenance and disposal costs of these items. In compiling an inventory, consider:

- The types of lamps and other lighting products being used.
- The number of lamps purchased annually and how often they are replaced.
- The kilowatt hours of electricity required for lighting and its associated cost.
- The direct costs of lighting products and options for expense reductions through competitive bidding or cooperative purchasing.
- The greenhouse gases, such as CO_2, and toxic pollutants, such as mercury, that result from the energy used for lighting.
- Lamp recycling needs and the associated environmental impacts, benefits and costs.

In order to gather this data, consider conducting a survey. Note that many utility companies will pay for professional lighting audits. For example, record the types of lighting and calculate the energy use of conference room lighting. Based on this pilot inventory, analyze the environmental impacts and costs of the lighting system and compare these to proposed alternatives. Use this baseline data as a comparative tool to set goals and measure progress.

To get started on an inventory, use the Green Purchasing Institute's "Lighting Equipment Audit Form." See Appendix III or download a copy from **www.ResponsiblePurchasing.org**.

Use the following equation to calculate the amount of mercury released from power plants providing the electricity for lamp lighting. Based on the national average fuel mix (DOE, c):

$$\text{bulb wattage} \times \text{hours bulb lit or rated life in hours} \times \text{0.0000197 milligrams of mercury per watt/hour} = \text{milligrams of mercury released}$$

Set Goals
Critically examine the baseline, identify areas of improvement, and determine goals for improvement. Establish target dates to evaluate, test and select responsible lighting options and to phase out inefficient lighting. Set explicit goals and firm deadlines for the following:

- Number or portion of lamps and ballasts to replace
- Energy reductions and consequent dollar savings
- Carbon dioxide and other greenhouse gas reductions
- Toxics reductions
- Solid waste reduction

Consider running a pilot test, for instance, to switch all conference room incandescent lights to CFLs. Determine whether to replace them with bare or covered CFLs and evaluate potential replacements for efficacy, lamp life, mercury and lead content and other factors. The energy and dollar savings are quantitative ways to assess the success of the pilot. Also consider the resultant carbon dioxide savings and employee feedback on the ambient quality of the lighting. A small test offers pragmatic information on the staff-hours and money needed to improve institutional lighting. If the pilot is a success, set a further target for changing all indoor lighting. Conversely, energy usage, greenhouse gas emission reduction, and toxics reduction targets can be set at the beginning of a program. Use target reductions to calculate number of incandescent bulbs to switch.

Adopt Policy
Formalize your institution’s commitment to purchasing socially and environmentally preferable lighting by adopting an institution-wide lighting policy. If a policy on energy efficiency, landfill diversion, or employee health and safety already exists, update it to include conservation practices, lamp replacement, and vendor take-back provisions. In the policy, include measures that enhance the environmental and money-saving benefits of buying responsible lighting products. Since energy efficient light bulbs often have a higher initial price than less efficient lighting products, you may need to change existing procurement guidelines to allow for choosing products that offer the “best overall value” as opposed to lowest purchase price. Also, address the use of funds saved from the new lighting program. You may want to put this money back into other energy efficiency programs or larger environmental efforts. To get started drafting a policy, see the **Policy** section of this guide for a model policy and multiple samples from other organizations.

Evaluate Standards and Specifications
Once the best lighting system and product options have been determined through product evaluation and pilot testing, the next step is drafting specifications for a lamp and ballast bid solicitation. Rather than starting from scratch, evaluate standards and specifications used by other institutions for purchasing responsible lighting products. An existing standard or another

institution's specification language for responsible lighting equipment may meet your institution's needs. See the **Specifications** section for model specifications.

Improve Practices

Implement these energy- and money-saving strategies, to begin a responsible lighting program:

- **Turn off the lights.** Do not light any regularly unoccupied spaces, e.g. closets and offices after-hours.

- **Automate lighting systems**. Install timers and motion and light sensors where there is little traffic or good natural lighting. Ensure new lighting products are compatible with these technologies. This will ensure that lights in infrequently utilized spaces are turned off during nights and weekends.

- **Use natural lighting.** Open the blinds and let in the sunlight. Install skylights and "moon tubes". These let in, and in the case of moon tubes, amplify, natural light when installed in the ceiling.

- **Switch to electronic ballasts.** All fluorescent lamps require ballasts, which regulate the flow of electricity into the lamp. Electronic ballasts are more energy efficient than magnetic ballasts and reduce heat, noise, flicker and start-up time (ILI, 2000). ENERGY STAR-qualified CFLs contain integrated electronic ballasts, while pin-based fluorescent lamps typically have replaceable ballasts. Two-pin CFLs are typically powered by magnetic ballasts, while four-pin CFLs usually use electronic ballasts. For a further comparison of pin-based and self-ballasted CFLs refer to the **Cost, Quality and Supply** section of this guide.

- **Use pin-based CFLs where practicable**. Pin-based CFLs have a longer lamp life than self-ballasted screw-in and prevent waste. For a further discussion of the advantages to using pin-based CFLs instead of screw-in CFLs, refer to the **Cost, Quality, and Supply** section of this guide.

- **Replace incandescent-lit exit signs with new LED exit signs or use a retrofit kit**. There are approximately 100 million exit signs in operation across the United States, most of which are lit using inefficient incandescent light bulbs. Each existing incandescent exit sign replaced with a LEDT sign or lamp saves approximately $10 per year in electricity costs and significantly reduces the number replacement lamps needed (ENERGY STAR, d).

  LED exit signs typically use 80–95% less energy than incandescent exits signs and last 10–60 times longer. LED exit signs use approximately <1-5 watts of electricity compared to 30-40 watts for a conventional incandescent-lit exit sign (GPI, 2007b). Incandescent exit sign bulbs (15T6 or 20T6) are rated at 1500-7000 hours and must be replaced every 3-10 months since they are on 24 hours a day, 7 days a week. In comparison, LED exit sign lamps are typically rated at 50,000-100,000 hours and can last up to 10 years. LED exit signs are widely available and the cost has dropped considerably in the last few years as they have become the dominant technology on the market. The cost can range from about $20 to several hundred dollars, depending on the features and quality of the sign. An inexpensive option that facility managers can consider is the use of LED exit sign retrofit kits, which replace each incandescent lamp with an LED lamp and an adapter (GPI, 2007b).

Prior to widespread availability of LED exit signs, some facilities replaced their incandescent exit signs with fluorescent-lit models. These typically use 10-20 watts of electricity. Fluorescent exit sign lamps (usually PL-5 or PL-7) are typically rated for 10,000 hours and must be replaced annually. These 2-pin CFLs contain mercury, usually in the 5-10 mg range. A few companies offer LED retrofit kits for fluorescent-lit exit signs (GPI, 2007b).

To improve employee well-being, consider these elements of conscientious design suggested by the Light Right Consortium (LRC, 2002):

- **Brighten rooms**. Use light-colored finishes on the walls and ceilings.
- **Reduce glare**. Ceiling lighting should not appear so bright as to appear in computer monitors. Some lamps, such as modern T5s, must be well-shielded or used for indirect or wall lighting.
- **Provide personal control.** Install lighting fixtures at each workstation where possible. Personal control of shared lighting fixtures can be problematic due to differences in preferences. Consider LED task lights, which have a long rated life (50,000-100,000 hours and are mercury-free.
- **Choose adaptable lighting systems and layouts**. This way, when the space plan changes, the lighting can remain pleasant.

To improve the overall quality of the light and reduce eye strain:

- **Choose fluorescent lighting with a high color rendering index (CRI)**. Fluorescent lamps with a high CRI (close to 100) mimic natural light; this can improve overall light quality and reduce eye strain.
- **Consider scotopically enhanced lighting**. Fluorescent lamps with a 5000K temperature or higher are considered “scotopically enhanced”. These bulbs emit more blue colors in the spectrum than pink, which enables the human eye to see more clearly. Research sponsored by the U.S. Department of Energy has concluded that “light sources with more energy in the blue wavelengths that match the rod sensitivity (scotopic content) provide higher levels of brightness perception and visual acuity. With this premise, it is possible to reduce lighting levels using scotopically enhanced lighting while maintaining equal visual effect. Thus, using scotopically enhanced lighting in commercial office building may possibly provide significant energy savings throughout this United States” (EERE, 2004).

Prevent mercury and lead from being dispersed into the environment when fluorescent lamps are transported or managed at the end of their useful life by carefully recycling them.

- **Encourage your vendors to take back spent lamps.** Some large distributors already have take-back programs in place. Give preference to vendors that offer lighting products from companies with an established recycling program and require recycling in the contract. An emerging strategy is to contractually require lamp vendors (or the manufacturers they represent) to take back and recycle spent lamps. These producer accountability programs help to encourage the development of a much-needed nationwide recycling infrastructure for mercury-containing lamps. They may also spur manufacturers to redesign their products to be more long-lasting, less toxic and more easily recyclable.

In Taiwan, since November 2004, about 2000 shops that sell fluorescent light bulbs have been required to collect and recycle these products as a way to prevent mercury pollution, according to the Taiwan Environmental Protection Administration (TT, 2004).

- **Negotiate a recycling contract.** If manufacturer or vendor take-back is not an option, negotiate a contract with a private firm to recycle spent light bulbs that contain mercury. Check online listings (**www.earth911.org** or **www.lamprecycle.org**) for local mercury or fluorescent lamp recyclers or hazardous waste disposal facilities. The Association of Lighting and Mercury Recyclers (ALMR) has comprehensive recycling information for a variety of stakeholders.

  Manufacturer-financed recycling programs have been developed in other countries. For example, under the European Union's Waste Electrical and Electronic Equipment (WEEE) Directive, manufacturers are responsible for setting up and financing recycling programs for lighting equipment (including CFLs) and reaching a recovery rate of 70% by 2006 (TetraTech, 2007).

  According to the European Lamp Companies Federation, which represents many of the same multinational companies as NEMA, "the industry has set up a European-wide recycling infrastructure for all gas discharge lamps…capable of recycling mercury, as well as other metals, glass, etc. as part of its obligations on the WEEE [Waste Electrical and Electronic Equipment] Directive" (ELC, 2007).

- **Create a collection program for fluorescent lamps and other mercury-containing lamps**. Your agency, school, business or community can offer recyclers an incentive to come into the neighborhood. This will also create an opportunity to educate employees, students and community members. Encourage retailers to participate in community collection and recycling programs as much as possible. Some states, such as California, strictly prohibit mercury-added lamps from going into the trash and require that all generators, including individual consumers, recycle them. Others buy fluorescent lamp recycling kits (offered by Grainger, Home Depot and other lamp suppliers) or use their municipal household hazardous waste program.

- **Train employees**. Provide workshops, manuals or fact sheets on specifying high-efficiency, low-toxicity fluorescent lighting equipment as well as responsible handling, disposal, and recycling of new, spent and broken CFLs and other mercury-added lamps.

- **Safely remove and dispose of pre-1979 ballasts as hazardous waste**. You should assume that all ballasts that do not state on them "Do not contain PCBs" contain polychlorinated biphenyls (PCBs). The entire lighting fixture does not need special handling and disposal as long as the ballast is not leaking. The non-leaking ballasts can be removed and disposed of properly. Self-ballasted CFLS contain no PCBs. See the **Related Documents** at the end of this section for the EPA guides on handling, removing and disposing these hazardous ballasts.

Measure Progress
Regularly assess and document the success of your institution's lighting program. Check to see if predetermined benchmarks, like energy and toxics reduction goals, are being achieved and

report baselines for the year. Use consistent measures of success, such as kilowatt-hours of electricity conserved, tons of CO_2 and pounds of mercury emissions reduced, number of lamps recycled, waste reduced and/or dollars saved due to lower energy, replacement and maintenance costs. Reward or recognize the stakeholders responsible for the program's achievements. If necessary, identify and address any obstacles that may be limiting the program's success.

Related Documents

ENERGY STAR, Information on Compact Fluorescent Light Bulbs (CFLs) and Mercury, 2007
This fact sheet answers basic questions about mercury in CFLs and includes instructions on how to properly clean up a broken fluorescent bulb.

EPA, Guide for School Administrators: Removing PCBs from Light Fixtures, 2001
This guide addresses the danger of PCBs in ballasts, a discussion of the safety and cost benefits of lighting retrofits, and information about funding available for such a project.

EPA, Guide for School Maintenance Personnel: Removing PCBs from Light Fixtures, 2001
This guide addresses the danger of PCBs in ballasts and details best practices for identifying and removing dangerous fixtures.

Green Purchasing Institute, Lighting Equipment Auditing Form, 2007
Use this form to create an inventory of lamps and their specifications. See **Addendum III.**

Cost, Quality, and Supply

One way to minimize the amount of mercury entering the environment is to reduce demand for electricity generation by replacing incandescent lamps with more energy efficient fluorescent lamps or light-emitting diodes (LEDs). The U.S. market for light bulbs, ballasts, lighting fixtures, and lighting controls is about $12 billion (NEMA, 2003). Fluorescent lighting is low-cost over the life of the lamp, high quality and easy to procure.

Cost

Overall, compact fluorescent lamps (CFLs) are more cost effective than incandescent bulbs. Lighting costs include purchase price, maintenance, energy consumption, and disposal/recycling. Most of the costs associated with lighting equipment can be attributed to its energy use. Although CFLS have a higher purchase price, one CFL can do the job of approximately 10 incandescent bulbs. Furthermore, due to their improved efficacy, CFLs trim electricity costs considerably. Because CFLs last much longer, they can save on maintenance costs. However because they contain hazardous substances, disposal and/or recycling costs can be higher.

Purchase Price

A typical 60-watt incandescent light bulb has a retail price of about $0.60, while a 20-watt energy-saving CFL, which emits about the same amount of light, costs almost $6.00 (GPI, 2007c). Though payback time will vary based on initial lamp and electricity prices, a CFL usually pays for itself in five months and saves about $30 over its six or more year lifespan (Case, 2006; ENERGY STAR, c).

CFLs vary in price based on a number of factors. The least expensive models tend to be bare twist types designed to replace commonly used incandescents. Remember that the rated life of CFLs range from 6,000 to 15,000 hours. When calculating cost, rated life should be considered.

Lower prices for CFLs can be secured by ordering in bulk and negotiating a competitively-bid contract. Many vendors offer relatively high discounts on incandescent light bulbs and other inefficient lighting equipment, making it hard for CFLs and other high-performance fluorescent lamps to compete. It is important to design bid solicitation and evaluation processes to give preference to bidders that offer you the lowest prices on CFLs and other environmentally preferable lighting products.

Rebates

Additionally, in many areas electrical utilities issue rebates to government agencies, businesses and residential customers buying CFLs or other energy-efficient lighting equipment. In some states, retail stores sell CFLs with the rebates awarded at the point-of-sale. Some utilities only issue rebates for pin-based compact fluorescent lamps in order to prevent reversion to incandescent lamps.

Case Studies

Retrofitting lighting systems has proven to be a financial success for a number of institutions. The City of Washington, DC estimated in 2004 that it could save over 11,000,000 KWh or nearly $700,000 annually by converting from incandescent lighting and T-12 fluorescent tubes to CFLs and T-8 fluorescent tubes. The analysis, conducted by the DC office of Contracting and Procurement estimated that the city would save about $1.5 million over 5 years. Besides energy savings, efficient lighting systems yield tangential financial benefits through performance improvements, increased resale value of property and enhanced ability to rent the space (LRC, 2002).

A number of faith-based institutions nationwide have completed retrofits and are reaping significant annual savings. The Islamic Education Center (IEC) of Potomac, MD, is both saving money and preventing pollution by using energy management practices. In addition to some heating and cooling system best practices, the center also installed high efficiency T8 fluorescent lamps with electronic ballasts in their newly built addition.

Another congregation, First Christian Church in Des Moines, Iowa, upgraded its 72,000 square foot facilities with highly efficient designs including CFLs and T-8 fluorescent lamps with electronic ballasts. The church also installed occupancy sensors, light emitting diode (LED) exit signs, and timers for outdoor lights. Their payback is $6,000 in annual cash savings (ENERGY STAR, a).

Quality

In order for compact fluorescents to be practical replacements for incandescents they must offer sufficient light quantity that is aesthetically pleasing. Fortunately, most of the barriers to substitution have been eliminated. Many of the past nuisances of CFLs (poor color, flicker, buzzing and slow start-up issues) have largely been addressed. Today, ENERGY STAR qualified CFLs produce a steady soft white light, and thanks to built-in energy efficient electronic ballasts, new lamps are noiseless and quick to turn on. Nevertheless, there are a few performance issues that purchasing agents should be aware of when deciding whether CFLs are a practical choice and which types are most appropriate. Below are some the most important quality issues associated with CFLs with suggestions for how they can be effectively addressed.

Lamp Life

ENERGY STAR's current specification is 6,000 rated hours. Because it was established over 15 years ago, almost all CFLs sold in the U.S. meet that standard. According to the ENERGY STAR website, over half of the ENERGY STAR-qualified CFLs have a rated life of at least 8,000 hours and some have a rated life up to 15,000 hours. Canada has set a 10,000-hour minimum rated life on all CFLs that can qualify for its EcoLogo certification as an environmentally preferable product.

Purchasing low-mercury, long-life lamps is an effective strategy to minimize the amount of mercury entering the environment. Consider product longevity as an important product attribute that helps reduce manufacturing, transportation, and disposal impacts. Choosing lighting technology with a longer rated life ultimately reduces material to be recycled or sent to landfills or incinerators. It also reduces replacement, installation, and disposal or recycling costs.

Smooth Light Output

ENERGY STAR-qualified CFLs have at least two features which ensure the delivery of high-quality light that reduces eye strain. First, their built-in ballasts are electronic, which provides smooth, consistent light output. In contrast, the CFLs that entered the market early had magnetic ballasts and tended to flicker. Second, modern CFLs emit light that more closely mimics natural light than models of the past because they have a relatively high color rendering index (CRI). CRI is a measurement of a lamp's ability to emit light that is a true color (without yellowing or other "color shifting"). Lamps with a CRI of 80 or higher (on a scale of 1-100) enable the human eye to see more clearly with fewer lumens because the light is closer to natural light. In contrast, lamps with a low CRI cause the eye to strain to see detail accurately.

Early CFLs had CRIs in the 60s and 70s, whereas all new ENERGY STAR qualified lamps must have a CRI of at least 80.

Noise
Modern CFLs equipped with electronic ballasts do not make the humming noise that was common in the CFLs of the past.

Dimmability
Most self-ballasted CFLs are not designed to be dimmable. According to the U.S. Department of Energy, the CFL must have a dimming electronic ballast to operate on dimming systems. When purchasing a dimmable CFL, make sure the lamp is labeled for such use. Unless paired with a compatible dimming system, dimmable CFLs may fail prematurely. Consult a lighting professional and test CFLs on your existing or recommended dimming system. Consider using 4-pin-based CFLs with a dimming ballast, cold cathode CFLs or LEDs, which work reliably on dimmer systems.

Overheating
Self-ballasted CFLs, particularly high-wattage models, may overheat and prematurely fail if they are installed in recessed can fixtures, especially if they are closed (WSU, 2003). Consider 4-pin-based CFLs, opening up recessed cans or changing fixtures if high-wattage models are needed. Some self-ballasted CFL reflector floods can be used in recessed cans and offer an alternative to an exposed bare bulb. Users can find over 300 models suitable for recessed cans by using the advanced search feature on the ENERGY STAR website.

Operation in Cold Temperatures
Fluorescent lamps need a minimum temperature to start and operate a full light output. The U.S. Department of Energy explains:

> Compact fluorescent lamps are designed to start and operate within a specific temperature range. This temperature range affects how efficiently (and if at all) a CFL will light. At low temperatures, it is more difficult for the ballast that is driving the lamp to create and maintain the gas arc necessary to produce illumination. Changes in ballast and lamp components can increase a lamp's ability to start at lower temperatures (FEMP, 2007).

For outdoor applications, look for models labeled for low temperature start-up or outdoor use. Currently, there are about 50 ENERGY STAR-qualified models designed for low-temperature applications. Refer to the Responsible Purchasing Network **online database** for these product listings. Enclosed fixtures can sometimes improve the performance of CFLs in cold outdoor applications by trapping heat from the bulb. Consider using LEDs for some outdoor applications because they hold up better than CFLs in cold temperatures.

Interference with Electrical Equipment
This can happen, but very infrequently, according to several lighting manufacturers. One explains, “Many electronic devices, such as radios, televisions, wireless telephones, and remote controls, use infrared light to transmit signals. Infrequently, these types of electronic devices accidentally interpret the infrared light coming from a compact fluorescent bulb as a signal, causing the electronic device to temporarily malfunction or stop working. (For example, your television might suddenly change channels.) Fortunately, this only happens when light is produced at the same wavelength as the electronic device signals, which is rare.” (GE, n.d.). To

reduce the possibility of interference, keep compact fluorescent bulbs away from the above-listed electronic devices or plug the light fixture and electronic device into different outlets

Size and Shape

Although some CFLs may not fit in conventional fixtures, especially those that are sealed or are designed to accommodate small decorative bulbs, the tremendous variety of new lamp and fixture options provide simple solutions to pleasant and efficient lighting design (LRC, 2002). ENERGY STAR requires package labeling to advise consumers of each lamp's recommended uses. Many qualified miniature models are now available. Also, consider using "cold cathode" fluorescent bulbs, which tend to be smaller and lack integrated ballasts.

Mercury Content

Mercury is added to all fluorescent lamps, but the amount varies by lamp type and manufacturer. According to data provided by major U.S. lighting manufacturers, fluorescent lamps with the lowest amount of mercury are also the most popular models because manufacturers tend to use low-mercury dosing technologies in the manufacture of their most modern and popular lamp models. Fortunately, that means that consumers don't have to choose between low-mercury and high-performance.

Mercury Rules of Thumb:

- Generally, older fluorescent lamps such as T12s and fluorescents that use preheat starters – such as those commonly found in modular furniture – contain more mercury than modern T8s and T5s that run on electronic ballasts.
- Fluorescent lamps with odd shapes (such as circular and u-bent models) tend to have more mercury than straight linear fluorescents.
- Linear fluorescents with uncommon sizes – such as 5-foot and 6-foot – usually contain more mercury than the most popular 4-foot models.

Using manufacturer-supplied data from these and other sources, the Green Purchasing Institute estimated the amount of mercury in various types of lamps, as reported below:

Lamp Type	**Lowest**	**Highest**
4', Linear T8, (Low-Hg)	3.5 mg	10 mg
8' Linear T8	3.5 mg	31-65 mg
4' T12, (Low-Hg)	4.4 mg	10 mg
U-bent T8	3.5 mg	31-65 mg
Compact fluorescent	1.2 mg	11-30 mg
Preheat T8	1.4 mg	11-30 mg

See the **Standards** section for more information on the mercury content in fluorescent lighting.

Pin-based Versus Self-ballasted CFLs

Self-ballasted CFLs can easily serve as drop-in replacements for incandescent light bulbs because they can be screwed into the existing fixture socket. They have integral electronic ballasts, whereas pin-based CFLs and other fluorescent lamps require the purchase and installation of separate ballasts. Another advantage of self-ballasted CFLs is that they are available in shapes that closely mimic incandescent light bulbs, including standard “A” models, decorative globes and candelabras and covered reflector floods. Most pin-based CFLs are only available as “bare” bulbs.

However, there are some distinct advantages to using pin-based CFLs instead of those with a screw-in base such as:

- **No “snap back”.** With self-ballasted CFLs there is an opportunity to revert back to incandescent light bulbs when the CFL reaches the end of its useful life. Some utilities will only offer rebates when pin-based CFLs are installed. This will entail changing the fixture.
- **Longer lamp life.** Pin-based CFLs (particularly those with four pins that run on electronic ballasts typically have a rated life of 12,000 hours, which is longer than the 8,000-hour rated life of the average ENERGY STAR-qualified CFL and twice as long as the 6000 minimum rated life under the ENERGY STAR program. It is not advisable to use 2-pin CFLs, unless the ballast is already installed, because they run on magnetic ballasts and generally have a lower rated life of 10,000 hours.

  While CFLs tend to last 5-7 years, depending on their rated life, the ballasts often last twice as long. However, with a self-ballasted model, the ballast is usually discarded with the light bulb at the end of its useful life. A few screw-in CFL models are modular; they come in two pieces allowing a separate replacement CFL bulb to be attached to the small ballast and base. With pin-based CFLs, the bulb can be replaced several times before the ballast, which is completely separate, needs to be replaced.
- **Dimmable**. Four-pin CFLs, which can run on electronic dimming ballasts, are easily dimmable; they also compatible with occupancy sensors. (Note: 2-pin CFLs, which run on magnetic ballasts are not dimmable.) Some self-ballasted CFLs are dimmable but they need to be equipped with an electronic dimming ballast and can sometimes be relatively expensive.
- **No lead solder.** Lead solder is often used on CFLs and other light bulbs with screw-in bases. While a growing number of self-ballasted CFLs are being made with lead-free solder, pin-based CFLs are almost always lead-free because they are welded instead of soldered.

CFLs Versus Linear Fluorescent Lamps

While CFLs offer substantial energy savings compared to incandescent lamps with minimal upfront investment, it is important to remember that they are not as energy efficient as modern linear fluorescent lamps. For example, according to the ENERGY STAR specification, bare CFLs must have an efficiency of 45-60 lumens per watt (L/W) depending on its wattage. Covered and reflector flood CFLs have lower efficacies (33-55 L/W). A standard incandescent typically has an efficacy of around 15 L/W according to light output and wattage data published in several manufacturers’ lamps catalogs. In comparison, linear fluorescents such as 4-foot T8s generally have efficacy ratings in the 80s to standard-grade models to up to 100 for high-performance “Super T8s” (ACEEE, 2004). More information on the efficacy of CFLs is available in the ENERGY STAR specification. See the Specifications section of this guide for more details. You can also calculate the efficacy of specific CFLs and other types of light bulbs by dividing the lumen output by the wattage. For fluorescent lamps with separate ballasts, it is important to calculate a system efficacy by including the energy it takes to operate the ballast.

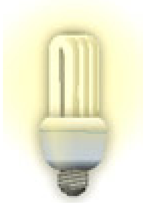
Light-emitting diodes (LEDs) Versus CFLs
LEDs are a type of solid state lighting (SSL) that generates light using semi-conductors. LEDs generally are more efficient than incandescent lamps and CFLs. While they are much more expensive than CFLs, they offer some benefits compared to some CFLs such as:

- Longer life – they are often rated at 20,000 to 50,000 hours
- Lower toxicity – they contain no mercury (although there may be other heavy metals used in the manufacture of LEDs and their drivers)
- More easily dimmable
- More reliable performance in cold temperatures.

LEDs are widely used in exit signs, traffic signals and flash lights. As their price drops and their availability increases, government agencies, and consumers more generally, can expect to see LEDs more commonly used in task and track light fixtures, elevators, signs, pathway lights and other low-wattage lighting applications.

Supply
Self-ballasted CFLs
CFLs made by numerous manufacturers are available in a wide array of shapes, sizes and wattages. Supplies increased dramatically with the advent of the federal government's ENERGY STAR lighting program in the late 1990s. At the beginning of 2001, the program included 17 manufacturers offering 161 qualifying products. By the end of the year, that list had grown to include 94 manufacturers and 455 certified products (EERE, 2003). Currently, nearly 140 manufacturers with over 2000 self-ballasted products qualify under ENERGY STAR's CFL specifications. In addition to the bare, covered and reflector shapes shown in the chart below, the following types of ENERGY STAR qualified CFLs are available:

- Three-way bulb (over 50 products)
- Dimmable models (over 40 products)

Bare Products		Covered Products			Reflector Products
Mini-Spiral or Twist	Tube or Universal	Incandescent/ A-line	Globe G25, G30, G40	Candelabra, Post or Bullet Shape	Indoor and Outdoor R20, R30, R40, PAR38
					

Pin-based

There are no pin-based CFLs available from RPN's recommended certifiers, however, ENERGY STAR lists thousands of qualified fixtures, from over one hundred manufacturers, designed for pin-based products.

Lead-Free

Many manufacturers are eliminating lead from their light bulbs because the European Union is phasing out lead solder under its Restriction on Hazardous Substances Directive. As a result, an increasing number of lead-free lamps are now available in the marketplace.

Low Mercury

Limited information is available to the public concerning the mercury content of fluorescent lamps. Although all fluorescent lamps sold in the U.S. are voluntarily labeled with mercury warnings packages, bulbs and material safety data sheets (MSDSs) rarely reveal the exact amount of mercury contained in the product. Consequently, it is difficult for buyers to compare brands to find low-mercury models. Over the last couple of years, government entities such as the State of New Jersey and the City of San Francisco have played a critical role in making numerical mercury content data available to the public. Both of these jurisdictions have required their vendors to disclose the maximum amount of mercury (in milligrams) in each lamp model offered on their lighting equipment contract. See the **Standards** section for more information on the mercury content in fluorescent lighting.

Policies

State and local governments, educational facilities, and businesses have adopted responsible lighting policies addressing procurement, use, and recycling. These policies outline principles for minimizing the environmental, social, and economic impacts associated with lighting equipment, describing the importance of buying products that are energy-efficient, long-lasting, low-toxicity and made according to socially responsible guidelines; and establishing recycling requirements for spent mercury-added lamps.

Model Policy

Drawing on current policies adopted by the City of New York, San Francisco and the State of Washington, we have developed a model policy (see **Addendum I**) that emphasizes setting organizational goals to improve lighting programs by cutting electricity use and reducing toxics. It is designed to align institutional purchasing practices with climate protection, green building, toxics reduction and zero waste goals. It may be appropriate to make explicit exceptions in the policy for specialty lighting needs. See below for further sample policies.

More Sample Policies

Federal

White House, Executive Order 13423 on Environment, Energy and Transportation, 2007.
Requires attention from heads of agencies on issues of energy efficiency, hazardous substances, environmentally preferable purchasing, and high-performing buildings. It sets specific energy reduction goals of 3 percent per year until 2015 and requires federal agencies to purchase energy-efficient goods.

European Union, RoHS Directive, 2003
In the Annex of the directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment, the EU has adopted a 5 milligram limit on mercury in all CFLs sold throughout Europe as well as mercury caps on, other fluorescent lamps.

State

Connecticut, An Act Concerning Global Warming (Substitute Bill No. 1432), 2007
Directs the CT Department of Environmental Protection to classify inefficient incandescent products to be phased out through sales restrictions and fines on prohibited sales statewide.

Washington, Executive Order 04-01 on Persistent Toxic Chemicals, 2004
Requires agencies to choose mercury-free and low-mercury products when mercury-free replacements are not offered in the marketplace.

Washington, Governor’s Directive on Recycling Fluorescent Lamps, 2004
Directs State agencies and institutions to recycle fluorescent and other mercury containing lamps at the end of their useful life.

California, Assembly Bill 1109 – Lighting Efficiency and Toxics Reduction Bill, 2007
Mandates local fluorescent lighting recycling programs and sets following goals for increasing efficient lighting.

Ontario, Canada, Energy Efficiency Act, 2006
Establishes energy efficiency standards for lighting products, with the objective of eliminating the least energy-efficient products from the Ontario market.

County
King County, WA, Mercury-Containing Lamp Recycling, 2003
Requires all County facilities to recycle mercury-containing lamps.

Alameda County, CA. Resolution Establishing a Policy on Persistent, Bioaccumulative Toxins and Their Effects on Public Health and the Environment, 2002
Declares the County's commitment to implement PBT pollution prevention policies and practices wherever practicable in County operations as well as healthcare institutions, other government facilities, businesses and households in the County. The County implemented this policy, in part, by undertaking a countywide lighting retrofit with high-performance, low-mercury fluorescent, HID and LED technologies.

City
New York, NY, Energy-Efficient Product Purchasing Law (Local Law 119)*,* 2005
Directs City agencies to purchase lamps, ballasts and lighting fixtures that meet minimum recommended energy-efficiency standards established by the ENERGY STAR program and the Federal Energy Management Program (FEMP). In addition, the law states that "No lamp purchased or leased by any agency shall be an incandescent lamp if a more energy efficient lamp is available that provides sufficient lumens and is of an appropriate size for the intended application.

New York, NY, Law for the Reduction of Hazardous Substances (Local Law 120), 2005
Stipulates that "Any mercury-added lamp purchased or leased by any agency shall achieve no less energy efficiency than the minimum required by the director through rulemaking and among lamps meeting such energy efficiency requirements, shall contain the lowest amount of mercury per rated hour."

Palo Alto, CA, Mercury and Dioxin Elimination Policy, 2000.
Calls for the purchase of low-mercury fluorescents and the recycling of fluorescents in city facilities. Includes implementation strategies for city purchasers, facilities management and residents.

Educational Institutions
University of California, Chancellor's Policy on Sustainable Practices, 2007
Promotes a variety of sustainable practices that facilitate greater use of energy-efficient, low-toxicity and long-lasting lighting equipment as well as producer responsibility for lamp recycling. Specific directives support:

- Efficient energy use (by exceeding Title 24 building codes by at least 20% and purchasing/negotiating better prices for ENERGY STAR-rated equipment),
- Minimization of greenhouse gas emissions (with a goal of making campus facilities "Climate Neutral"),
- Working toward "zero waste" and committing to work with suppliers to establish reuse or recycling "takebacks" at no extra cost to the university; and
- Development and implementation of plans to build and maintain campus that meet green building standards

University of North Carolina at Chapel Hill, Energy Efficient Purchasing Policy, n.d.

UNC Chapel Hill sets guidelines for bid documents and requires ENERGY STAR products.

Weill Cornell Medical College, Light Bulb Disposal, n.d.
This environmental health and safety policy sets guidelines for safe disposal of fluorescent lamps and specifies the responsible internal departments.

Specifications

Any bid specifications for compact fluorescent lighting products should include the following:

- ENERGY STAR qualification;
- Minimum rated lamp life of 10,000 hours when possible
- Mercury content disclosure and limitations;
- Lead content disclosure and preference for lead-free products;
- Verification of automated dosing techniques in manufacturing process;
- Verification that CFLs were not made under sweatshop conditions; and
- Manufacturer or vendor take-back provisions.

See the sample specs below to learn how a variety of institutions have addressed these different issues in their bids.

Sample Specifications

Federal
Federal Green Guide for Specifiers: Section 26 50 00 (Section 16500) – Lighting, 2005
References LEED and ENERGY STAR standards and includes guidance in specifying the following attributes in lighting products and systems:

- Local and regionally sourced materials
- Energy efficiency in products and operations
- Quality assurance
- Take-back and recycling programs

ENERGY STAR Program, Sample Procurement Language, 2007
Covers performance, durability and efficiency specifications for CFLs, lighting fixtures, exit signs and retrofit kits, and electronic ballasts. ENERGY STAR recommends the following language, which can be inserted into a bid solicitation for CFLs. Bidders shall, "provide compact fluorescent bulbs (CFLs) and lamp systems that earn the ENERGY STAR and meet the ENERGY STAR specifications for energy efficiency."

State
CA, Fluorescent Lamp Bid Specification, 2005
The State of California Department of General Services (DGS), with technical support from the Green Purchasing Institute, issued the nation's first statewide bid specification for low-mercury, high performance fluorescent lamps. Among the environmental and performance requirements, this specification states:

- All CFLs shall contain no more than 5 milligrams mercury.
- All self-ballasted CFLs shall be ENERGY STAR qualified.

- All fluorescent lamps offered shall be compliant with the U.S. EPA Toxicity Characteristic Leaching Procedure (TCLP).

DGS asked major U.S. lamp manufacturers to submit mercury content data for the most commonly purchased fluorescent lamps on the State contract during the pre-bid period. It then used that information to establish numerical limits on the mercury content of all CFLs as well as the most popular T8 and T12 fluorescent lamp models ranging from 5-10 mg. The specification stipulates that, "All references to the amount of mercury (Hg) found in fluorescent lamps identifies the maximum amount of mercury the state would expect to find in any one lamp. If a lamp manufacturer provides a range of mercury content due to the manufacturing process, the state will use the maximum amount from the range provided as the set amount of mercury the state would expect to find in any one lamp." Bidders were required to submit independent test results verifying the mercury content of each lamp model offered in their bid for which mercury limits were established.

The specification also includes minimum lamp life requirements and sets a minimum color rendering index (CRI) of 80 for several commonly used fluorescent lamp models.

The final State lamps contract also includes a requirement that vendors offer fluorescent lamp collection, recycling and disposal services. This provision states:

> The Contractor(s) shall provide services for the disposal and recycling of fluorescent lamp being offered for each applicable category or group on this contract. This service shall be made available on a non-mandatory basis to any participating State and local agency under the California Lamps Contract.
>
> The service shall include availability of containers for the safe return by a using agency of fluorescent lamps to the contractor(s). The contractor(s) shall also assure the State that, once received, the lamps will be properly recycled and/or disposed of.

NJ, Mercury-content Disclosure Requirement in Statewide Lamps Contract, 2003
New Jersey was the first state in the nation to require bidders to disclose the amount in milligrams of mercury in each model sold on the contract.

City/County
City and County of San Francisco (CCSF) requires mercury content and presence of lead disclosure for all fluorescent and HID lamps and sets a mercury content limit on all compact fluorescent lamps sold on their contract. Bidders were directed to offer only compact fluorescent lamps (CFLs) with 5 mg or less of mercury.

A major impetus for San Francisco's decision to add environmental criteria in general – and toxics disclosure in particular – to its bid solicitation for lighting products is the City's Precautionary Purchasing Ordinance. The contract references the following portion of the law:

> Contractor aggress to comply fully with the provisions of the San Francisco Environment code including chapter 1: Precautionary Principle Policy Statement, which provides that 'The community has a right to know complete and accurate information on potential human health and environmental impacts associated with the selection of products, services, operations or plans. The burden to supply this information lies with the proponent, not with the general public.

> Pursuant to this policy, the City and county of San Francisco requires all contractors to provide…full disclosure to the satisfaction of the purchaser, of the amount of mercury or range of mercury in milligrams, for each mercury added product sold.

Based on the information provided by their existing vendors, San Francisco is planning to increase the number of lamp models with mercury content limits when its contract is scheduled to be re-bid in 2008.

Babylon, NY, Bid #06G Compact Fluorescent Lamps, 2006.
A concise request for ENERGY STAR-qualified compact fluorescent bulbs with 8000 hour lamp-life minimum.

Business
In May 2006, Wal-Mart announced that it had negotiated new contracts for low-mercury CFLs sold through its stores as well as Sam's Club. All CFLs sold will be ENERGY STAR-qualified. In addition, according to the Wal-Mart news release, "To reduce the amount of mercury in its CFLs, Wal-Mart worked closely with its manufacturers GE, Royal Philips, Osram Sylvania and Lights of America. All four suppliers committed to achieving a greater reduction in mercury content than the 5 mg standard set by the National Electrical Manufacturers Association (NEMA) earlier this year. These suppliers will also adhere to clean production techniques that will minimize mercury pollution from factories manufacturing CFLs."

Wal-Mart's supplier commitments include the following:

- GE Consumer & Industrial will reduce CFL mercury content up to 50 percent from NEMA levels in new products, while maintaining the excellent light quality and long life that GE customers expect.

- Philips currently supplies Wal-Mart with CFLs that have mercury contents 40 to 60 percent below the NEMA level of 5 mg per unit (for CFLs less than 25W). Philips utilizes pellet dosing versus liquid mercury to ensure safe and accurate levels of mercury per bulb, and continues to look for ways to reduce the amount of mercury in its CFL, while still maintaining the lamps' high quality and performance characteristics.

- OSRAM SYLVANIA CFLs currently meet the NEMA standard of 5 mg of mercury, with reflector lamps that are 40 percent lower at 3 mg. CFLs to 4 mg or less by the end of 2007, and to 2.5 mg by the end of 2008.

- Lights of America will reduce the amount of mercury in its CFLs by up to 50 percent. Wal-Mart's new standards have resulted in Lights of America identifying a different metal alloy technology that improves bulb performance while requiring less mercury per bulb. This technology is currently being added to Lights of America CFLs and the company expects all of its bulbs to have no more than 2 mg of mercury by the end of 2007

Standards

The U.S.-based ENERGY STAR program and Canada's EcoLogo both have standards for environmentally preferable compact fluorescent lamps. The ENERGY STAR program is widely accepted as the premier standard on energy efficient compact fluorescent lamps, though it excludes mercury content limits. The EcoLogo standard includes ENERGY STAR criteria and an additional mercury-content restriction.

ENERGY STAR

ENERGY STAR, a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy, helps residents, public entities, and businesses save money and protect the environment by labeling energy efficient products, including CFLs and other lighting equipment. ENERGY STAR's standard for CFLs, version 3.0 outlines performance requirements for self-ballasted, screw-in CFLs only (not for pin-based models). ENERGY STAR-qualified products must meet relevant standards established by the American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers, International Commission on Illumination (CIE), Illuminating Engineer Society of North America (IESNA), and Underwriters Laboratory (UL). Additional ENERGY STAR requirements are set forth in the following categories: photometric performance, electrical performance, and lifetime performance and packaging. Some of the key parameters of ENERGY STAR-qualified CFLs include:

- Rated life: Lamps must have a rated life of at least 6,000 hours (which is slated to increase to 8000 hours for some models)
- Efficacy (lumens per watt): Minimum varies by model wattage
- Lumen maintenance: Lamps must maintain at least 80% of their initial lumens (light output) after 40% of their rated life.

The ENERGY STAR program tests a small portion of the industry self-certified products each year and disqualifies those that fail to meet its voluntary minimum standard.

ENERGY STAR's CFL standard, version 3.0 does not establish mercury or lead restrictions or take-back programs. However, the standard is under revision and expected to be re-released in November 2007 as version 4.0. The new standard would require manufacturer mercury disclosure and source reductions, high-heat testing, and off-the-shelf third party quality assurance.

See David Ryan's presentation from the November 5, 2007 RPN Webcast: Fluorescent Lighting for detailed information on the ENERGY STAR lighting standards. The presentation if available for download at **www.responsiblepurchasing.org/purchasing_guides/_lighting**.

EcoLogo

Canada's Environmental Choice Program has established an EcoLogo certification for environmentally preferable products, including CFLs. Its standard for Energy Efficient Lights or Compact Fluorescent Lamps (CCD-014) builds upon ENERGY STAR's performance criteria. CCD-014 is notably different from the ENERGY STAR standard in the following ways:

- It covers both self-ballasted and modular units (i.e., pin-based CFLs and other fluorescent lamps without built-in ballasts),

- It sets a higher minimum lamp life of 10,000 hours and restricts the mercury content to 3 milligrams per bulb.

In comparison, the U.S.-based ENERGY STAR program has a minimum rated hour requirement of only 6,000 hours and no maximum mercury requirement.

Green Seal

Green Seal is a non-profit environmental standards-setting and certification agency based in Washington D.C. Its Environmental Standard for Energy Efficient Lighting – Compact Fluorescent Lights (GS-5) establishes environmental and performance standards for CFLs, E26 medium screw ballast adaptors, E26 medium screw fluorescent self-ballasted, and E26 medium screw lampholder conversion kits in the following categories:

- Efficacy
- Lamp life
- Mercury levels
- Radioisotopes
- Color Rendering Index
- Color Temperature
- Operating temperature and starting characteristics
- Safety
- Power quality designation
- Packaging

There are currently no products certified under 1997 edition of GS-5. A proposed revised standard is expected to be available for public review in early November. Timely updates on the revision process will be made available on the Responsible Purchasing Network website.

Other Standards and Programs

European Union

Restriction on Hazardous Substances Directive

In January 2003, the European Union (EU) adopted the RoHS Directive, which restricts the sale of lighting products, computers and other types of electronic equipment containing lead, mercury and other PBT chemicals. CFLs containing more than five milligrams of mercury cannot be sold throughout Europe. While the EU currently exempts lead in CFLs and other light bulbs from this toxic chemical elimination policy, a growing number of manufacturers, particularly those based in the EU are offering lead-free CFLs and other lighting products. RoHS limitations have become a standard for institutional and industry specifications, as they are stringent and attainable. For example, the State of California, when it established the specification for its lighting contract, adopted the EU's five milligram cap on mercury in CFLs.

U.S. Green Building Council (USGBC)

Leadership in Energy and Environmental Design (LEED) Green Building Rating System

The USGBC awards buildings LEED certification at the Certified, Silver, Gold, and Platinum levels, based on the number of credits earned in a variety of categories such as Energy and Atmosphere (EA), Indoor Environmental Quality (IEQ), and Materials and Resources (MR). LEED standards that reference energy efficiency, mercury reduction, and daylighting have been developed for:

- Existing Buildings (LEED-EB)

- Commercial Interiors (LEED-CI, v. 2.0)
- New Construction (LEED-NC, v. 2.2)
- Core and Shell Development (LEED-CS, v. 2.0)
- Schools and Health Care Facilities

LEED-EB contains both a prerequisite and credit for the use of low-mercury replacement lamps. MR Prerequisite 2 (Toxic Material Source Reduction: Reduced Mercury in Light Bulbs) sets a weighted average mercury limit of 100 picograms per lumen-hour for all fluorescent and high-intensity discharge (HID) lamps that are acquired for existing buildings and associated grounds. Facilities get an extra credit if the average mercury content of their lamps is below 80 picograms per lumen-hour. This prerequisite and credit include instructions for calculating picograms per lumen-hour.

Facilities can also receive LEED credit for recycling their fluorescent lamps. The LEED-EB MR 5.1 credit is given when there is a waste reduction and recycling program in place that collects and recycles, among other things, 95% of the fluorescent light bulbs used in a building.

LEED's Energy and Atmosphere category includes more general specifications on optimizing energy efficiency, and recommending the use of ENERGY STAR products and energy-efficient lighting as implementation strategies to earn LEED credits. See the **Calculators** section of this guide for more information on Sylvania and Philips LEED-EB calculators.

Products

RPN's online product database includes listings of hundreds of ENERGY STAR-qualified compact fluorescent light bulbs. See the **Standards** section for more information on ENERGY STAR. These listings are updated regularly, but may not reflect the most recent lists of approved products. Please check directly with the certifying agency to verify product certification status.

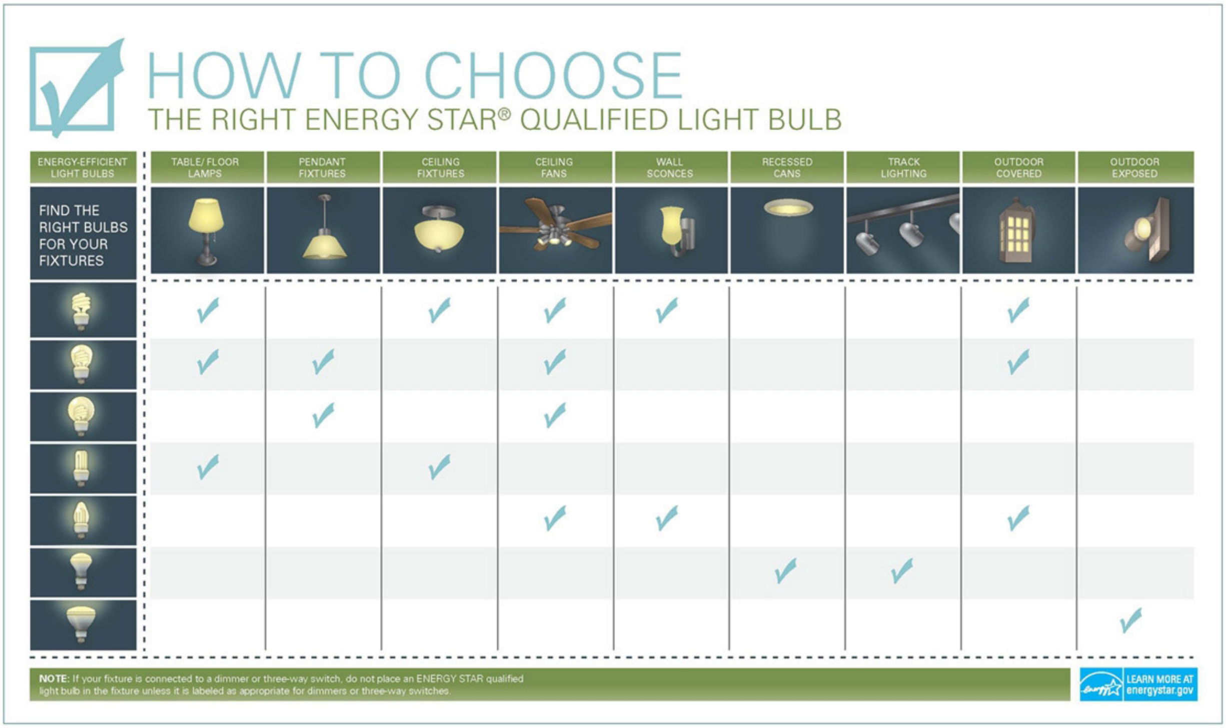
Before searching the RPN product database, review these seven steps on how to choose suitable, high-performance, and environmentally preferable compact fluorescent lamps to replace incandescents.

1. Determine light output needed.
The light output in lumens should be available either on the product packaging or in the manufacturer's catalog. Incandescent light bulbs tend to emit a relatively constant amount of light throughout their short life, while CFLs experience "lumen depreciation", which causes them to fade over time. ENERGY STAR-qualified bulbs are required to demonstrate "lumen maintenance" of at least 80% over the first two years of a CFL's life. To ensure that the replacement CFL emits sufficient light over its anticipated lifetime, look for models with at least a 20% higher lumen output rating than the incandescent light bulb you are replacing. For example, if the incandescent emits 1,000 lumens, replace it with a CFL with an INITIAL lumen output of 1,200 or more. Alternatively, look for a CFL with a MEAN lumen output of 1,200 or more.

2. Make sure the CFL is ENERGY STAR-qualified.
ENERGY STAR-qualified products must meet standards that ensure their performance and quality. A list of qualified products is available on at www.ResponsiblePurchasing.org. See the **Standards** section of this Guide for more information on ENERGY STAR

3. Choose the CFL with the highest efficacy in the shape and size you want.
There are probably several ENERGY STAR-qualified CFLs to meet any given lumen output requirement. Bare bulbs are more efficient than covered models but may not be appropriate for every application. First decide the type of CFL, for example bare twist, covered globe, or reflector flood. Compare available models to determine which one has the lowest wattage to meet your light output requirements. While ENERGY STAR sets minimum efficacy requirements (lumens per watt), some CFLs are more efficient than others.

The chart below from ENERGY STAR can help match fixtures with the appropriate bulb shapes.



4. Look for long-lasting CFLs.
Long-lasting CFLs reduce replacement, installation and recycling costs. Among the ENERGY STAR-qualified bulbs with the lowest appropriate wattage, compare their rated life. While ENERGY STAR sets a minimum lamp life requirement for qualified CFLs at 6,000 hours, some models are rated at 8000, 10000, 12000 and 15000 hours. Bare spiral CFLs are often available with a lamp life of 10,000 hours or more (which is Canada's EcoLogo standard), while small, specialty CFLs such as bullet- or candle flame-shaped models typically are not. A CFL's rated life is listed on the product's package, in the manufacturer's catalog, on the ENERGY STAR website and in the product listings in the online version of this Guide.

5. Specify low-mercury CFLs.
The mercury content can vary widely among CFL manufacturers and models. Some models contain less than one milligram of mercury while others have up to 30. While a CFL's mercury content is not usually printed on the bulb, packaging or material safety data sheet (MSDS), some states and local governments have secured industry content data by requesting the information their bid solicitations or contract requirements. Specify models with the lowest mercury content that meet your needs or to establish numerical mercury caps, similar to the European Union's 5 milligram maximum on all CFLs sold throughout Europe, or EcoLogo's 3 mg standard. In the United States, the State of California, San Francisco, and New York City have established 5 mg mercury limits on CFLs sold on their municipal contracts.

To determine how much mercury is in the fluorescent lamps available on the market, require bidders to submit independently-verified data about the mercury content of their lighting products. See the **Specifications** section of this Guide for sample contract language on mercury disclosure

6. Look for lead-free CFLs.

Most self-ballasted CFLs have lead in solder used on the base, in the glass, or both. If all else is equal, choose models that are devoid of lead in either or, preferably, both of these applications.

7. Ask lamp manufacturers and vendors to offer collection and recycling services. While lamp recycling programs are offered by manufacturers of environmentally preferable computer equipment, lamp manufacturers currently do not offer this service. Encourage companies to establish a fluorescent lamp recycling infrastructure by offering to give them preference in the bid negotiation process. See the **Specifications** and **Products** sections of this guide for more information.

Related Documents

Washington State University Energy Program, “Dimmable Compact Fluorescent Lamps,” 2003

Calculators

Use the following calculators from ENERGY STAR and two CFL manufacturers to measure the impact of your institution's lighting in terms of cost savings and mercury content.

ENERGY STAR Lifecycle Cost Estimate
This calculator allows the user to estimate the consequent net energy, maintenance, operating, and purchase cost savings related to switching incandescent bulbs to ENERGY STAR qualified CFLs. Estimates can be adjusted based on electricity rates, hours used per day, lamp wattage, and lamp lifetime in hours. Outputs are provided in cost differentials, energy savings, payback time in years, and air pollution reductions, including equivalent cars taken off the road or acreage of forest saved. Available for download at **www.ResponsiblePurchasing.org**.

Sylvania LEED Mercury Calculator
This tool enables users to find the mercury content of individual lamps manufactured by Sylvania. This website is designed to help architects and specifiers calculate the amount of mercury in each lamp per lumen-hour. Based on the calculations, they can assess if the mercury content of lamps used in an existing building is low enough to qualify the building for Mercury Reduction (MR) LEED-EB prerequisite and credit. Available for download at **www.ResponsiblePurchasing.org**.

Philips' Sustainable Lighting Index Worksheet
Philips maintains an online LEED-EB mercury calculator that enables the user to estimate the picograms of mercury per lumen-hour based on brand and types of lighting. Unlike the Sylvania calculator, Philips' worksheet can estimate mercury content of other brands besides its own. One drawback of this tool is the lack of transparent information on the methodology.

Handy Facts

- Lighting accounts for 22% of the electricity used in commercial buildings, or more than 7% of all U.S. energy consumption (NEMA, 2003; ENERGY STAR, n.d.)
- Replacing incandescent light bulbs with bare compact fluorescents yields about a 66 energy savings for each bulb changed (ENERGY STAR, b)
- Washington, DC estimated it could save over 11,000,000 KWh, $700,000 annually, and $1.5 million over 5 years by converting to fluorescent lighting.
- Over five years, a power plant using an average U.S. fuel mix will emit approximately 5.4 mg of mercury to generate electricity to run an incandescent light bulb, compared to 1.7 mg to run an equivalent CFL (DOE, c).
- It would take 100 large power plants to generate electricity required for today's lighting needs and the cost of this electricity is about $55 billion (NEMA, 2003)
- 70.8% of the mercury-lamps used by business are not being recycled (ALMR, 2003)
- On average, each CFL prevents 450 pounds of emissions from a power plant over its lifetime
- The EU, State of California and the San Francisco limit mercury in CFLs to five milligrams
- Canada's EcoLogo program set a 3 milligram cap on the mercury content of lamps
- LED exit signs use 80–95 percent less energy than incandescents, last 10–20 times longer and pay back in less than 3 years (ASE, 2005)
- Compared to CFLs, LED replacement lamps for exit signs last 5-10 times longer, use about 1/10th the energy and are mercury-free

ENERGY STAR CFLs (ENERGY STAR, b) do the following:

- Use at least 2/3 less energy than incandescent bulbs and can last to 10-20 times longer
- Save $30 or more in energy costs over each bulb's lifetime
- Generate 70 percent less heat, so are safer to operate and can cut energy costs associated with cooling.
- Turn on instantly, produce no sound, and fall within a warm color range or are otherwise labeled as providing cooler color tones.
- Are available in different sizes and shapes to fit in almost any fixture, for indoors and outdoors.

Definitions

Automatic dosing	techniques in which precise amounts of mercury are inserted into fluorescent and high-intensity discharge (HID) lamps using capsules, alloy strips, metered sprays and other methods that protect workers from hazardous exposure
Ballast	device used with an electric discharge lamp to obtain necessary circuit conditions to start and operate it
Baseline	basic information gathered before a program begins that is used later to provide a comparison for assessing program impact
Bioaccumulate	process whereby harmful substances concentrate or magnify as they move up the food chain.
CFL	see "compact fluorescent lamp"
Cold cathode fluorescent lamp (CCFL)	a cathode lamp that operates at ambient temperature, resulting in longer lamp life and greater optimal temperature range
Color rendering index (CRI)	measurement of a lamp's ability to emit light that is a true color, i.e. without yellowing or other color shifting
Compact fluorescent lamp (CFL)	fluorescent light bulb designed to replace incandescent light bulbs, see also "incandescent" and "fluorescent lighting"
Daylighting	using sunlight to illuminate indoor spaces
Efficacy	light output of a lamp divided by its wattage, expressed in lumens per watt
ENERGY STAR	energy efficiency standard managed jointly by the U.S. Environmental Protection Agency and Department of Energy
Environmentally preferable	products and services that have a lesser or reduced effect on human health and the environment when compared to other products and services that serve the same purpose
Fluorescent lighting	gas-discharge lamps that require ballasts and use electricity to excite mercury vapor in argon or neon gas, producing ultraviolet light that causes a phosphor to fluoresce, producing visible light
Hazardous substance	1. material posing a threat to human health and/or the environment, that can be toxic, corrosive, ignitable, explosive, or chemically reactive, 2. substance that must be reported to the EPA if released into the environment.
Incandescent	inefficient technology that produces light by passing an electrical current through a thin filament
LED	light-emitting diode; high efficiency lighting that uses semiconductor technology; aka solid state lighting

Lifecycle cost	adjusted annual cost of a product that accounts for capital, installation, operating, maintenance and disposal costs
Mean lumen output	amount of light that is emitted when a lamp reaches 40% of its rated life
Mercury	a heavy metal used in fluorescent, HID and neon lamps that can cause short-term and chronic nervous system impairment, cancer, heart disease and other serious health damage to exposed individuals
Mercury vapor lamp	a high intensity discharge (HID) lamp typically used for street lighting and high-bay applications. They are relatively inefficient, tend to depreciate quickly, and often have a low CRI
Persistent, bioaccumulative, toxins (PBTs)	toxic chemicals that persist in the environment and increase in concentration through the food chain; transferred easily through air, water and land ; EPA list includes 4 chemical groups and 16 chemicals.
Polychlorinated biphenyls (PCBs)	mixtures of up to 209 individual chlorinated compounds (known as congeners)
Scotopically enhanced	Describes fluorescent lamps with a 5000K temperature or higher
T12	a type of fluorescent lamp with a 5/8" diameter tube; when paired with an electronic programmed start ballast, it is a highly efficient, modern lighting technology
T5	a type of fluorescent lamp with a 12/8" (or 1.5") diameter tube; it is a relatively old and inefficient technology that runs on a magnetic ballast
T8	a type of fluorescent lamp with an 8/8" (or 1") diameter tube; when paired with an electronic ballast, it is a relatively efficient, modern lighting technology
Toxic substance	a chemical or mixture that may present an unreasonable risk of injury to health or the environment

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Addendum I: Model Policy

Responsible Purchasing Network
Center for a New American Dream
www.ResponsiblePurchasing.org

Green Purchasing Institute
www.greenpurchasing.org

Model Lighting Procurement Policy

This model policy, developed by RPN and the Green Purchasing Institute, will assist in setting organization-wide goals to improve a lighting purchasing program, cut electricity use, and reduce toxics. It is designed to align an institution's purchasing practices with its climate protection, green building, toxics reduction and zero waste goals. It may be appropriate to make explicit exceptions in the policy for specialty lamps or lighting needs. The following language has been adapted from current policies adopted by the City of New York, San Francisco and the State of Washington.

[Jurisdiction/Organization] shall:

1) Establish efficiency standards for all new lighting equipment it will purchase or lease including fixtures, ballasts and lamps.
   a) All lamps, ballasts and fixtures lamp purchased or leased by [Jurisdiction/Organization] shall achieve no less energy efficiency than the minimum required by the director through rulemaking. At a minimum, all lighting equipment shall be ENERGY STAR-qualified, when applicable, or meet or exceed efficiency recommendations made by the U.S. Department of Energy's Federal Energy Management Program.
   b) Other inefficient lighting technologies shall be excluded from all contracts as detailed below:
      i) Fixtures: No new fixtures offered on [Jurisdiction/Organization]'s contracts may contain magnetic ballasts or preheat starters. In addition, none shall be designed to hold mercury vapor lamps,T12s, or T9 circular fluorescent lamps. All new fixtures shall be ENERGY STAR-qualified and all new exit signs shall be LED-lit and ENERGY STAR-qualified.
      ii) Ballasts: No magnetic ballasts or preheat starters may be purchased; all ballasts must be electronic. In addition, no ballasts designed to power mercury vapor lamps shall be purchased.
      iii) Replacement lamps: No lamp purchased or leased shall be an incandescent lamp if a more energy-efficient lamp is available that provides sufficient lumens and is of an appropriate size for the intended application. No incandescent or fluorescent exit sign lamps or mercury vapor lamps may be purchased. Vendors must offer LED exit sign lamps and retrofit kits.
2) Establish energy conservation goals and develop and implement management strategies to meet those goals.
3) Purchase lighting products that do not contain persistent, bioaccumulative and toxic chemicals (PBTs, including mercury and lead) unless there is no feasible alternative. In circumstances where a PBT-free product is not available (such as in the case of energy-efficiency fluorescent lamps), preference shall be given to the purchase of products that

contain the least amount of PBTs. Any mercury-added lamp purchased or leased shall contain the lowest amount of mercury per rated hour.

a) Mercury and Lead: [Jurisdiction/Organization] shall establish mercury- and lead-content standards for all new lighting products it purchases or leases.

   i) It is the policy of this [jurisdiction/organization] that consumers have the right to know about the presence of potentially hazardous materials contained in consumer products and that the burden to supply such information lies with the supplier of such products. Therefore, the maximum mercury content in milligrams and presence of lead of each lamp model shall be disclosed in all bids submitted to [Jurisdiction/Organization] and in vendor periodic lighting equipment usage reports.

   ii) To the greatest extent practicable, lighting equipment shall be designed to meet the prerequisites and earn credits detailed in the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) standards.

4) Establish minimum rated life requirements for all lamps purchased or leased by [Jurisdiction/Organization] in order to reduce manufacturing, transportation and disposal impacts associated with these products.

5) Expand lighting recycling by:

   a) Requiring all vendors that bid on contracts for lighting equipment to offer lamp recycling services, preferably at no additional cost to [Jurisdiction/Organization].

   b) Requiring vendors to certify that the lamps they collect from [Jurisdiction/Organization] are recycled following the Basel Action Network's Electronics Industry Pledge of True Stewardship, which can be found at **http://www.ban.org/pledge/electronics_recycler_pledge.pdf**.

   c) Requiring all mercury-added lamps generated by [Jurisdiction/Organization] to be recycled (even if not legally required to do so because it qualifies for a small quantity generator exemption.)

   d) Requiring vendors to offer employee education on the proper management of and recycling options for all mercury-containing lighting equipment.

Addendum II: Model Specifications

Any bid specifications for compact fluorescent lighting products should include the following:

- ENERGY STAR qualification;
- Minimum rated lamp life of 10,000 hours when possible
- Mercury content disclosure and limitations;
- Lead content disclosure and preference for lead-free products;
- Verification of automated dosing techniques in manufacturing process;
- Verification that CFLs were not made under sweatshop conditions; and
- Manufacturer or vendor take-back provisions.

See the samples in the **Specifications** section to learn how a variety of institutions have addressed these different issues in their bids.

Addendum III: Lighting Equipment Audit Form

The following form was developed by the Green Purchasing Institute. The original form is available for download on the Responsible Purchasing Network's website.

Please provide as much information as you can about the lamps you purchase most often for your facilities. Information can be found on the lamp or its packaging, or in the manufacturer's or vendor's catalog. Do not worry if you do not have all the information about each lamp.

1.	Lamp Type *(fluorescent, etc., see options below)*	
2.	Lamp Shape *(e.g., linear tube, u-bent, bulb, etc)*	
3.	Manufacturer *(GE, Sylvania, Philips, etc.)*	
4.	Application *(e.g., parking lot, stairwell)*	
5.	Wattage	
6.	Color temperature *(e.g., 4100K, 3500K)*	
7.	Rated lamp life *(e.g., 20,000 hours)*	
8.	Low-mercury designation *(e.g., ALTO, ECO)*	
9.	Model Number *(e.g., F32T8/TL741 ALTO, F32T8/SP41/ECO, FO32/741/ECO)*	
10.	Vendor *(name of retailer, lighting supply store)*	
11.	Catalog order number	
12.	Price per bulb	
13.	Approximate number purchased annually	
14.	Purchase method *(phone, in person, internet)*	
15.	Additional comments (such as # of lamps/fixture)	

LAMP TYPES

1. Fluorescent tube	2. Screw-in compact fluorescent	3. Incandescent
4. Halogen	5. HID: High-pressure sodium	6. HID: Metal halide
7.HID: Mercury vapor	8. Light-emitting diode (LED)	9. Neon
10. Exit sign	11. Low-pressure sodium	12. Other (describe)

________________________________ ____________________________

Name, Department **Date**