PCBs
in Lighting Fixtures in Schools

Presentation by Judith Enck, EPA Regional Administrator, US EPA Region 2
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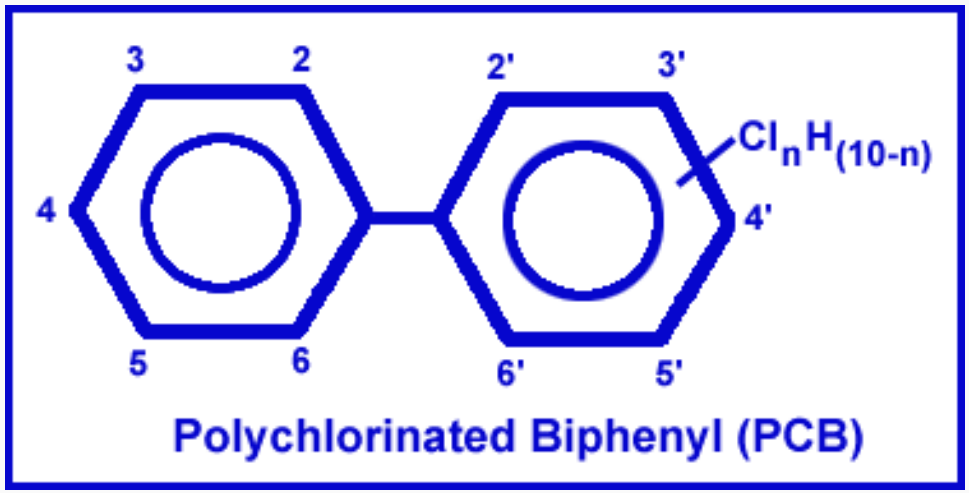
Win-Win-Win-Win

Save energy and save tax dollars—Prevent exposure to cancer causing PCBs—Create jobs—Private sector funding source

What are PCBs?

- Polychlorinated biphenyls
- Man-made organic chemicals
- Industrial and commercial applications



Health Effects of PCBs

- Probable human carcinogen
- Cause cancer in animals
- Serious non-cancer effects on the immune, reproductive, nervous and endocrine systems
- EPA banned the processing or use of PCBs in 1979

PCB-Containing Ballasts

- Schools built prior to 1979
- Possible leaking of PCB-containing lighting ballasts nation wide

PCB-containing Ballast

- Older ballasts have a transformer to reduce voltage, a small capacitor that may contain PCBs, and some have a thermal cut-off switch and/or safety fuse.
- Potting material, a tar-like substance, is used to surround components to muffle the noise of the ballast. This material may also contain PCBs
- If PCBs are present in the capacitor, the amount ranges from approximately 1oz to 1.5 oz
- The ballasts for high intensity discharge (HID) lamps can contain between 3 oz and 14 oz PCBs

2009 EPA/NYC Pilot Study

- New York City identified high levels of PCBs in some caulk and other building materials.
- Their testing also identified ballasts as another potential primary source of PCBs.
- Based on pilot study air testing, levels of PCBs in numerous school spaces were above EPA health-based benchmarks.

2011 EPA Inspections of Lighting

- EPA sampled 10 NYC School facilities at 7 locations
- Classrooms and light fixtures were selected at random
- 113 of 145 samples from fixtures tested above EPA regulatory limit of 50 ppm
- Lights still worked with leaking ballasts
- On most types of lighting fixtures, it is difficult to determine by just looking up from floor level that a ballast is leaking

Summary of EPA Sampling Results

School	Borough	Date of Sampling Event	Number of Samples Taken	Number of Samples > 50 ppm (mg/kg)	Range of Exceedances in ppm (mg/kg)
PS 53	Staten Island	1/8/2011	33	22	51 – 260,000
PS 11	Brooklyn	1/15/2011	28	18	51 – 3,000
PS 13 PS 358	Brooklyn	1/22/2011	7	7	70 - 560
PS 68	Bronx	1/29/2011	13	10	61 – 1,260
PS 206 PS 37 PS 112	Manhattan	2/5/2011	10 1 3 (14 total)	9 1 2 (12 total)	95 – 7,600
PS 45	Brooklyn	2/12/2011	19	19	830 –670,000
PS 306	Brooklyn	2/19/2011	31	25	480 – 1,200,000

Exceeds one million parts per million; pure PCBs

EPA Region 2 Outreach Efforts

- Mailed over 3,500 information packages to school districts and individual non-public schools encouraging inspections to identify school buildings at risk

- Continue to provide outreach and technical assistance to districts and schools requesting our assistance

EPA National Outreach Efforts

- In December 2010 EPA released national guidance recommending that schools remove older PCB-containing lighting ballasts

http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/ballasts.htm

- EPA's Office of Research and Development continues work to identify and evaluate encapsulation products, in place PCB containing materials and remediation methods

Lighting Fixture Warning Signs

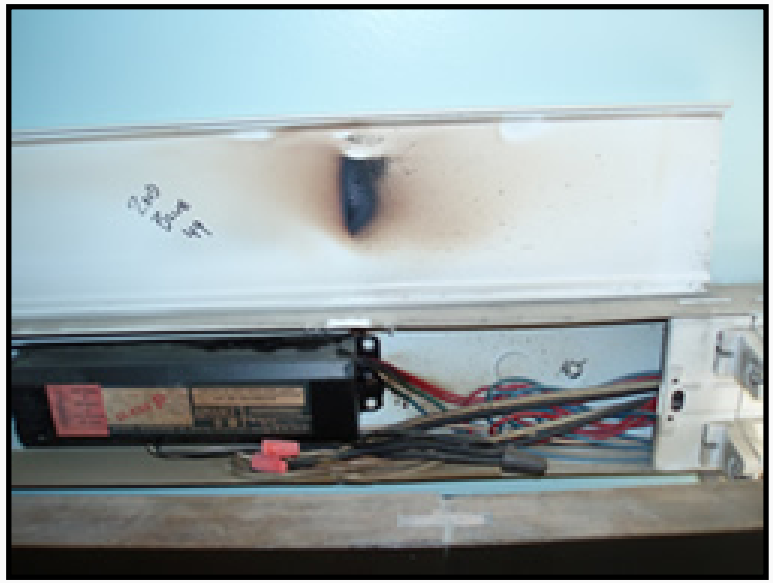
- Burned –out lights that don’t work after bulbs are changed
- Evidence of oil stains on light fixture housing, floor tiles or carpeting below light fixtures
- Previous incidents of smoke or burning odors requiring custodians to service lights
- Previous incidents where custodians removed or took apart a fixture to replace parts.

T- 12 Fixtures with smoke, Burning Odors or Dripping Oil

- Evacuate room and isolate: close doors and open windows to ventilate space including ventilate prior to re-occupancy
- Fan to exhaust through windows can help
- Prevent recirculation of air
- Turn off power to fixture; remove bulbs
- Inspect fixtures and follow steps for PCB fixture remediation (done by an environmental consultant/contractor)

Types of Ballast Failures

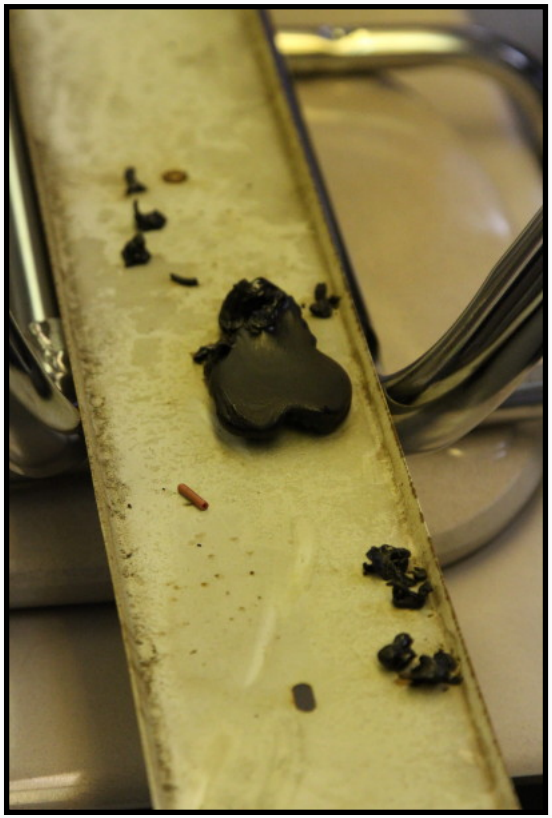
This ballast sparked a fire at a southern California school in 1999



An old ballast that burst unexpectedly

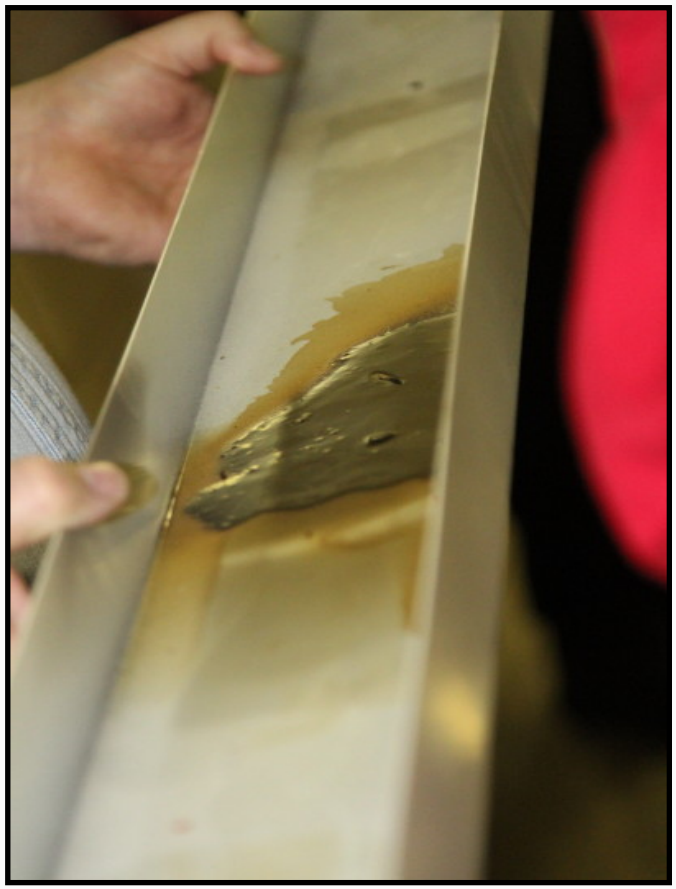
Material Leaking From Corner of Ballast

Tar-like Globules



Leaked Potting Material

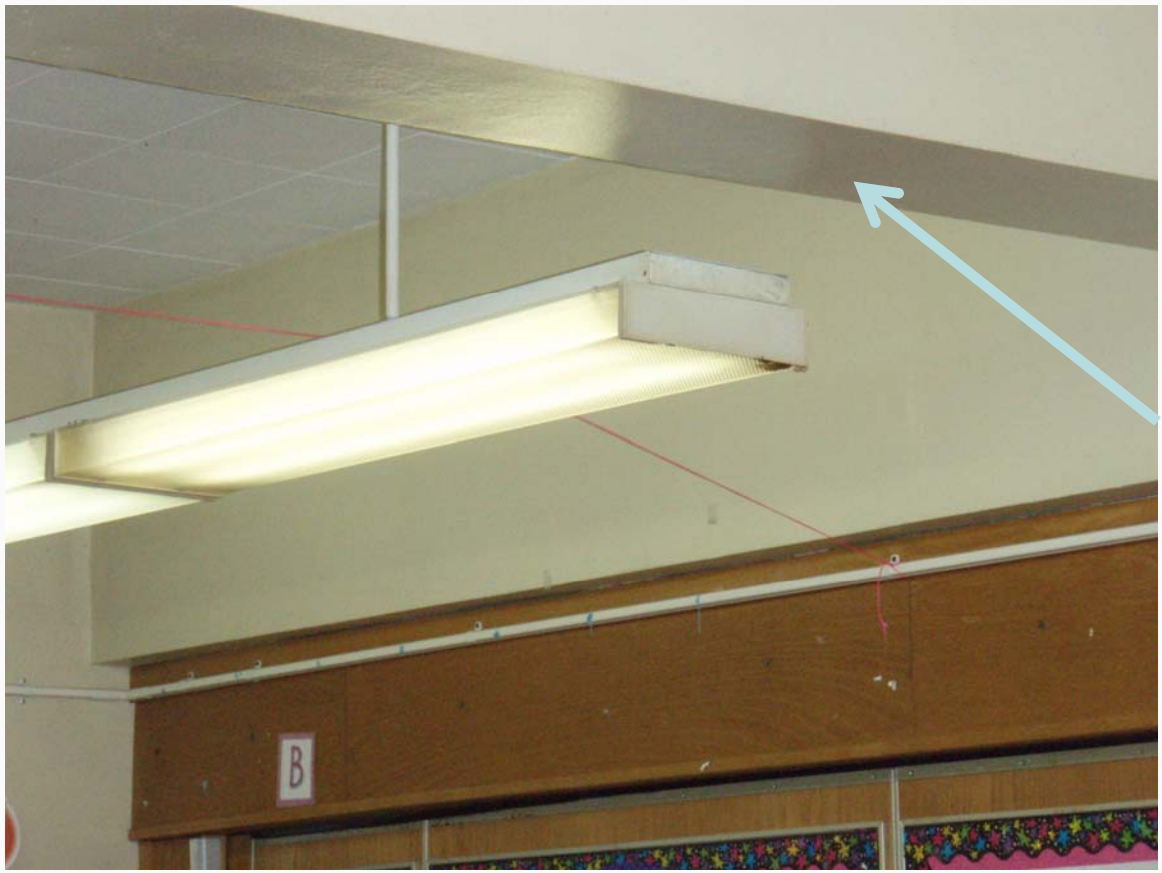
Oily Stains



Ballasts Come in Various Sizes

“Box” Type Fixture

“Wrap Around” Type Fixture



“Egg Crate” Type Fixture

“Honeycomb” Type Fixture

Ballast Location

Health and Safety Issues

- Only an experienced contractor or specially trained staff should be the only ones working on potential PCB light fixtures
- Follow standard operating procedures for working around electrical fixtures as required
- Follow all requirements and precautions if there are asbestos issues.
- Move desks and equipment from underneath the fixture
- Place plastic sheeting under the work area

Personal Protective Equipment

At minimum wear:

- Eye Protection – Safety glasses
- Skin Protection – Nitrile gloves, long-sleeve shirt, hat

When working with leaking PCB lighting fixtures, additional protection may be necessary based on the specific situation. If unsure how to proceed, you should contact the Health and Safety manager for the facility

Proper Storage and Disposal

- Disconnect and remove all ballasts and fixtures as appropriate as well as incidental PCB-contaminated items, fluorescent tubes from the light fixture housing and compartments;

- Provide the appropriate containers and packing materials for packaging and storing the four possible types of waste streams:

  - Intact, non-leaking, PCB-containing ballasts;
  - Leaking PCB-containing ballasts and cleanup wastes generated by handling and decontaminating areas where leaking ballasts were discovered;
  - Ballasts that contain no PCBs; and
  - Fluorescent light bulbs.

Proper Storage and Disposal, Cont.

- Maintain a record for each space where lighting fixtures are removed including how many leaking vs. non-leaking PCB-containing ballasts were removed from each space

- Package and label drums according to federal, state, and local regulations.

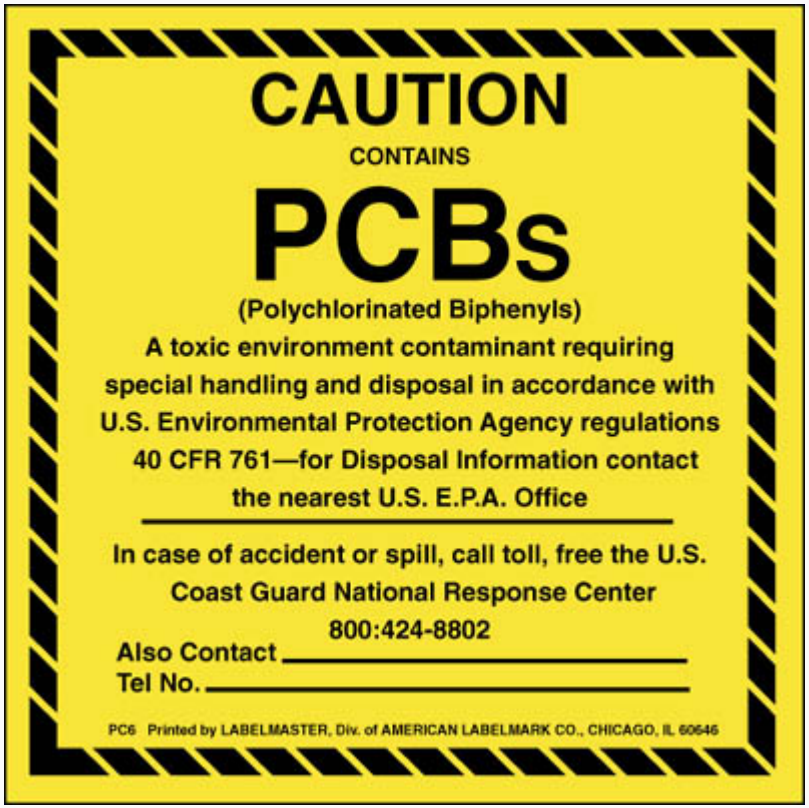
- Store the drums until a transporter currently licensed for transportation of PCB waste removes them to the appropriate disposal facility.

- Ballasts that are totally enclosed and not leaking can currently be disposed of in a solid waste landfill. However, most landfills will not accept such waste so most will be disposed of in a TSCA approved landfill or destroyed using chemical or thermal destruction methods.

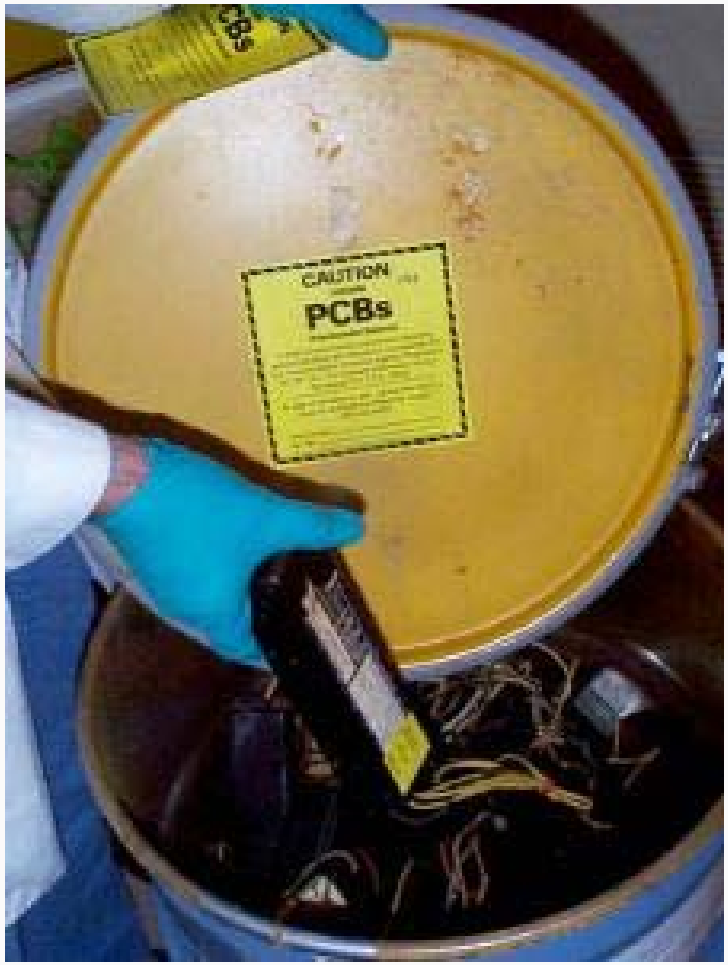
Improper Storage of Old Ballasts

Removed Fixtures not Labeled or Stored Properly

Proper PCB Identification Sticker



Proper Methods for Storing Ballasts



Benefits of PCB Light Fixture Replacements

- A significant reduction of PCBs in the air
- Expected reduction in energy consumption and saving tax dollars
- Improved classroom lighting
- Job creation

Comparing Different Light Fixtures and Efficiency

The case for upgrading!

Retrofit option	Base case: Energy-saving T12 lamps with magnetic ballasts	Case 1: T8 lamps with electronic ballasts	Case 2: High-performance T8s with electronic ballasts	Case 3: Case 2 + specular reflector + lens + 50% delamping	Case 4: Case 3 + occupancy sensing and daylight dimming
Average maintained foot-candles	25	30	28	25	26
Power per fixture (W)	156	116	90	45	49
Annual energy use (kWh)	7,507	5,568	4,320	2,160	1,275
Energy savings (%)	NA	26	42	71	83
Annual operating cost ($)	826	612	475	238	175
Upgrade cost ($)	NA	1,165	1,320	1,560	2,150
Simple payback (years)	NA	5.5	3.8	2.7	3.3

Notes: kWh = kilowatt-hour; NA = not applicable; W = watt.

Courtesy: *E SOURCE Lighting Technology Atlas* (2005)

Phase-out of T-12 Fluorescent Lamps

- Since July 1, 2010, a U.S. Department of Energy mandate states that the magnetic ballasts used in many T-12 fixtures will no longer be produced for commercial and industrial applications. Additionally, many T-12 lamps will be phased out of production beginning July 2012.

Switching from T-12 to T-8 Lighting Requires a Ballast Upgrade

Magnetic ballasts (or T-12 magnetic ballast) – older technology with a core of steel plates wrapped in copper windings. Pre-1979 ban on PCBs, these ballasts incorporated a small capacitor that contained PCBs.

Electronic ballasts – considerably more energy efficient than magnetic ballasts. T-8 lamps use electronic ballasts to operate effectively. These are the ballasts used in new and retrofit projects.

ESCOs and Performance Contracts

- ESCOs are “businesses that develop, install, and arrange financing for projects designed to improve the energy efficiency and maintenance costs for facilities” –National Association of Energy Service Companies

- An energy savings performance contract (or simply, performance contract) is an agreement between a building or facility owner or occupant and a performance contractor (i.e. the ESCO). The contractor identifies, designs, and installs energy conservation measures and guarantees their performance.

- “The more energy-cost savings generated, the more the performance contractor earns — and **the more money the school has to put toward other projects**.” –US Dept. of Energy

How Performing Contracting Works

- Payment for financing the energy conservation project is recovered from the energy cost savings
- The ESCO(s) may completely cover the upfront costs of the project and then are repaid by energy saving alone
- Or the building owner/occupant pays a portion of the upfront costs of the project

Summary of K-12 Case Studies on the National Association of Energy Service Companies' (NAESCO) website

ESCO	School District	City	State	Energy Improvement	Cost	Estimated Annual Cost Savings	Estimated Annual Energy Savings
McClure	East Lyoming	Hughesville	PA	Lights, HVAC, hot water	Not Available	Not Available	Not Available
Atlantic Energy	Mechanicville	Saratoga Springs	NY	Lights, HVAC, hot water	$1.27 million	$71,000	546,000 kwh
Chevron	Oxford Community	Oxford	MI	Lights, HVAC, hot water, servers	$2.9 million	$262,000	1,368,000 kwh
PEPCO	Baltimore	Baltimore	MD	Lights, HVAC, hot water, windows	$2.9 million	$114,000	Not Available
Chevron	Hatsboro	Horsham	PA	Lights, HVAC	$1.16 million	$110,000	938,000 kwh
CTS Group	Scotland	Memphis	MO	Lights, HVAC, hot water, heat pump	Not Available	$46,800	Not Available
ConEdison	Windham	Windham	CT	Lights, HVAC, hot water, windows	$5.24 million	$528,000	Not Available

K-12 Energy Improvement Case Studies

- School districts across the country have undertaken energy improvement projects including lighting replacements that have resulted in real cost and energy savings.

- Case studies can be found on the National Association of Energy Service Companies' (NAESCO) web site at: http://www.naesco.org/resources/casestudies/default.aspx

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