



UNEP GLOBAL MERCURY PARTNERSHIP

Mercury in
products Area*

Mercury waste
management Area*

Phasing out mercury-added lamps: the path to product substitution and end of life management

Online webinar, 7 December 2021



Views expressed are those of speakers and do not reflect those of UNEP or the Global Mercury Partnership Secretariat

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AGENDA

Opening by **Rodges Ankrah**, United States Environmental Protection Agency, Co-chair of the Partnership Advisory Group and **Eisaku Toda**, Secretariat of the Minamata Convention on Mercury

Session 1: Accelerating the phase out of mercury-added lamps by switching to mercury-free lighting, introduced by **Thomas Groeneveld**, United States Environmental Protection Agency, Coordinator of the Global Mercury Partnership Area on Mercury in Products

- ❖ **Key findings from a new report “Mercury in Fluorescent Lighting: Unnecessary Health Risks & Actionable Solutions”** by Michael Bender, Mercury Policy Project and Report Co-Author
- ❖ **Policy pathway towards phasing out fluorescent lamps in the European Union** by Peter Bennich, Swedish Energy Agency
- ❖ **Mercury-free LED Alternatives to Fluorescent lamps: analysis of new market data from Africa, Latin America and South-East Asia** by Ana-Maria Carreño, Clean Lighting Coalition
- ❖ **Steps that Africa is taking to eliminate mercury-added lamps** by Chris Kanema, Zambia Environmental Management Agency
- ❖ **Question and Answer Session**

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AGENDA (continued)

Session 2: Ensuring the environmentally sound management of waste from mercury containing lamps, introduced by Misuzu Asari, Kyoto University, co-lead of the Mercury Waste Management Partnership Area

- ❖ Overview of tools and guidance under the Waste Management area and the Basel Convention by Yuri Kato, Ministry of the Environment, Japan
- ❖ Past, Present and Future of Lamp Recycling by Paul Abernathy, Association of Lighting and Mercury Recyclers (ALMR)
- ❖ Example of technologies and international cooperation for ensuring the environmentally sound management of mercury-containing lamps in Asia by Hiroki Iwase, Nomura Kosan Ltd
- ❖ Sustainable financing for environmentally sound management and processing, recycling, disposal of mercury-added lamps by Michael Bender, Mercury Policy Project
- ❖ Question and Answer Session

Closure by Teeraporn Wiriwutikorn, Ministry of Natural Resources and Environment, Thailand, co-chair of the Partnership Advisory Group



Opening Remarks

*Rodges Ankrah, United States Environmental
Protection Agency
Co-chair of the Partnership Advisory Group*



Opening Remarks

*Eisaku Toda, Secretariat of the Minamata
Convention on Mercury*



Session 1: Accelerating the phase out of mercury-added lamps by switching to mercury-free lighting

Introduced by Thomas Groeneveld, United States Environmental Protection Agency, Coordinator of the Global Mercury Partnership Area on Mercury in Products

UNEP Global Mercury Partnership Lamp Webinar

December 7, 2021

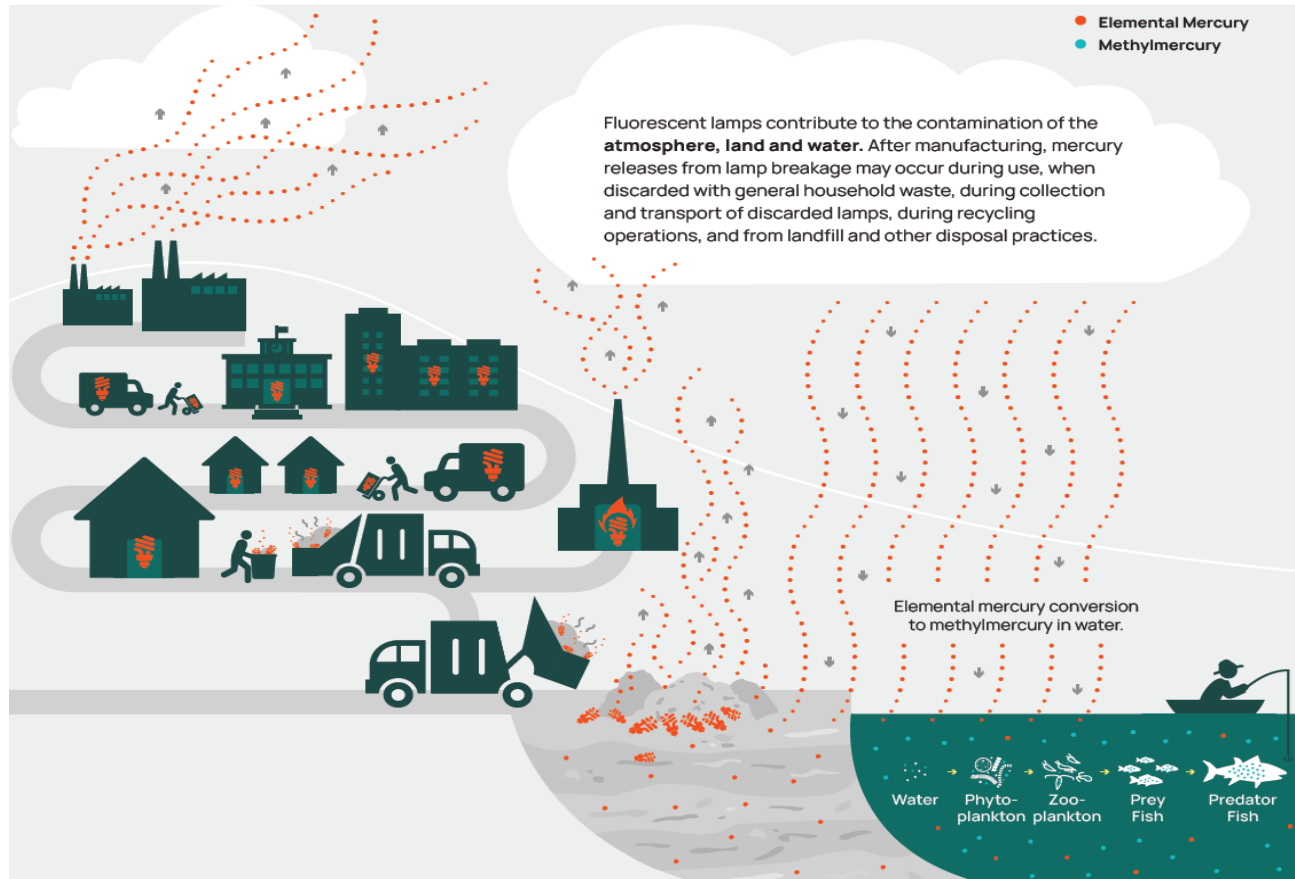
Michael T. Bender
Executive Director
Mercury Policy Project
and Report Co-Author



Clean Lighting Coalition (CLiC)

- Global campaign formed to phase-out mercury in lighting and transition markets to safe, cost-effective, and energy-saving LED lighting.
- The accelerated development of LED technology over last five years means that phasing out fluorescent lamps is now both technologically feasible and economically justified.
- CLiC membership includes industry partners, public health authorities, mercury experts, and NGO partners
- More information on CLiC is available online, including a link to our new report at: <https://cleanlightingcoalition.org/>

Mercury releases into the environment from fluorescent lamp use



Mercury exposure risks from fluorescent lamp breakage: Groups of most concern

- Sensitive populations, esp. developing fetuses, infants, children, and women who are pregnant or breast-feeding
- Vulnerable people, esp. those who have underlying health conditions, are disadvantaged, and/or are chronically exposed to a range of pollutants
- Workers involved in fluorescent lamp manufacturing, transportation, collection, processing, recycling, and disposal

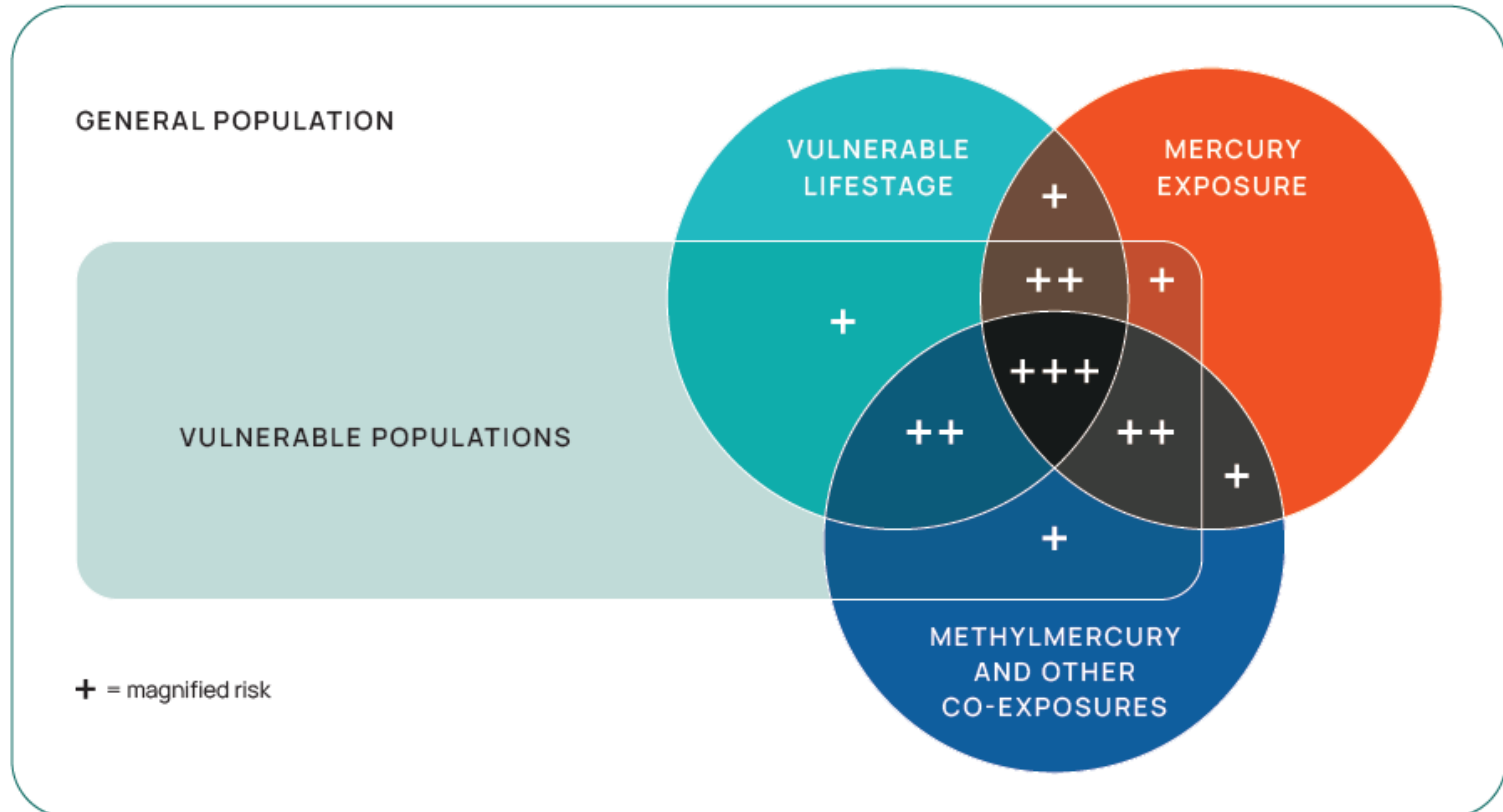


Mercury exposure risks to sensitive populations

- Infants and the unborn are at higher risk of low-level mercury vapor uptake due to a number of factors
- Fetuses and infants are particularly at risk of developmental disabilities
- Initial release of mercury vapor from a broken lamp is the most immediate concern since mercury levels are most likely to be more elevated
- In an unventilated space, infants at floor level are likely to have the highest mercury exposure from a broken lamp
- A broken lamp can generate mercury vapor in indoor air well above state and federal safety guidelines



Magnified health risks of mixed exposures for vulnerable populations



Worker exposure to mercury from a fluorescent lamp's entire life cycle, including during:

- Primary mercury mining
- Lamp manufacturing
- Disposal of lamps into waste bins
- Lamp collection, transport, and recycling
- Municipal waste collection, transport and processing (e.g., at transfer stations)
- Waste disposal (e.g., at the landfill face and incinerator ash disposal sites)



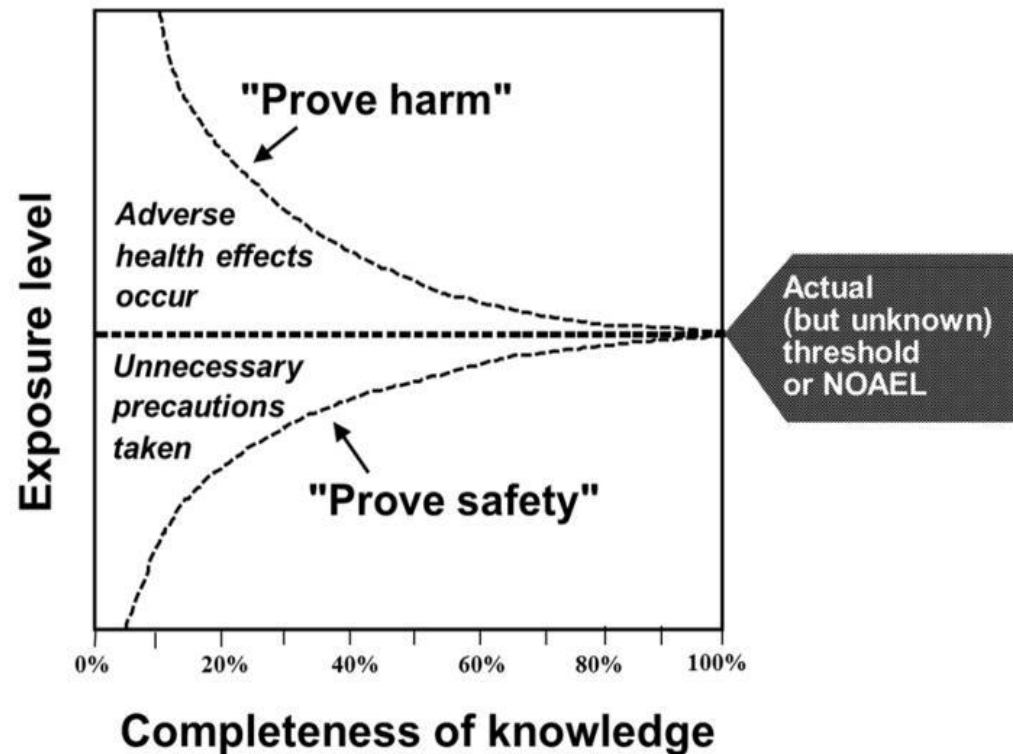
Key mercury exposure pathways and effects

MERCURY FORM	KEY EXPOSURE PATHWAYS	TYPICAL SOURCES	TOXIC EFFECTS OBSERVED IN
Elemental (metallic)	<ul style="list-style-type: none"> Inhalation 	<ul style="list-style-type: none"> Emissions from coal-fired power plants Broken fluorescent lamps Broken thermometers Dental amalgams 	<ul style="list-style-type: none"> Central nervous system Immune system Kidneys Lungs
Inorganic (primarily mercuric chloride)	<ul style="list-style-type: none"> Ingestion Dermal 	<ul style="list-style-type: none"> Laxatives Cosmetic products Antiseptics 	<ul style="list-style-type: none"> Kidneys Skin (acrodynia) Central nervous system Gastrointestinal tract
Organic (primarily methylmercury)	<ul style="list-style-type: none"> Ingestion (oral) Parenteral (other ingestion) Placental 	<ul style="list-style-type: none"> Fish (accumulated through the food chain) Insecticides Fungicides 	<ul style="list-style-type: none"> Central nervous system Cardiovascular system

Mercury exposure limits: declining level of safety over time

Over the years, a variety of mercury exposure limits have been recommended:

- by different government agencies, scientific and standardization organizations
- to protect groups with varying sensitivities and/or vulnerabilities
- to consider exposures over longer (“chronic”) or shorter (“acute”) time periods
- using various safety margins, and
- generally lacking broad consensus.



<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4942381/>

When a lamp breaks...



In research carried out by the State of Maine, following the breakage of a single CFL, the mercury concentration in the study room air often exceeded the Maine Ambient Air Guideline of 300 ng/m^3 , with short episodes over $25,000 \text{ ng/m}^3$, and sometimes exceeding $50,000 \text{ ng/m}^3$.

What NEVER to do when cleaning up a mercury spill



- Never use a vacuum cleaner or broom.



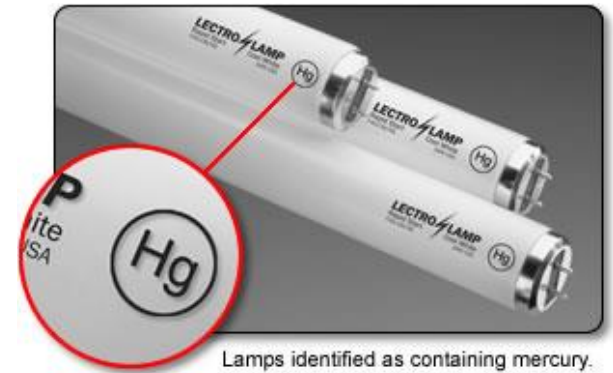
- Never pour mercury down a drain.



- Never allow people who are wearing mercury-contaminated shoes or clothing to walk around the house.



- Never use a washing machine to launder clothing or other items that may have come in contact with mercury.



Lamps identified as containing mercury.

How to clean up a small mercury spill

How to Clean Up a Small Mercury Spill

(a broken thermometer, thermostat or compact fluorescent light bulb)

Step 1 Isolate the spill and ventilate the area right away.



- The person who will clean up the spill should have everyone else, **especially children**, leave the spill area, including pets. **Don't** let anyone touch the mercury on their way out.
- Open all windows and doors that open to the outside of the house.
- Close all doors between the room where the mercury was spilled and the house.
- Close all cold air returns so that mercury vapor is not carried throughout the house.
- Turn down heaters and turn up single-room air conditioners, but don't use air conditioning.
- Use fans to blow mercury-contaminated air outside. Turn off fans that blow air into the room.

Step 2 Get the items needed to clean up a small mercury spill.

You will need the following items:

- 4 or 5 zipper-top plastic bags
- trash bags (2 to 6 mm thick)
- rubber, nitrile or latex gloves
- paper towels
- cardboard or squeegee
- eye dropper
- duct tape, or shaving cream and small paint brush
- flashlight
- powdered sulfur (optional)



Step 3 Cleanup spill.



- Put on rubber, nitrile or latex gloves.
- Pick up any broken pieces of glass and place them on a paper towel, paper towel, place it in a zipper-top bag, and seal the bag.
- Clean up the beads of mercury. Use a squeegee or cardboard to slow beads onto a sheet of paper. An eye dropper can also be used to collect beads. Slowly squeeze mercury from the eye dropper onto a damp paper towel. Put the paper towel, paper, eye dropper, or anything else that has mercury on it into a zipper-top bag, and seal the bag.

Step 4 continued

- After you remove larger beads, put shaving cream on top of a small puddle and gently blot the affected area to pick up smaller hard-to-see beads. Also use duct tape or masking tape to collect smaller hard-to-see beads. Put the paint brush or tape into a zipper-top bag.
- It is **OPTIONAL** to use commercially available powdered sulfur to absorb mercury that is too small to see. The sulfur does two things: (1) it makes the mercury easier to see since there may be a color change from yellow to brown (2) it binds the mercury so that it can be easily removed, and it helps prevent mercury that may have been missed during the cleanup from vaporizing into the room.

Mercury spill kits that contain sulfur can be purchased from laboratory and hazardous materials response supply manufacturers. Read and follow the instructions for use before using.

Note: Powdered sulfur may stain fabrics. Also, when using powdered sulfur, avoid breathing in the powder as it can be moderately toxic.

Step 5 Look for mercury that may have been missed during the cleanup.



- Take a flashlight, hold it at a low angle close to the floor in a darkened room and look for additional glistening beads of mercury that may be stuck to the surface or in small cracks. **Note:** Mercury can move surprising distances on hard and flat surfaces, so be sure to carefully inspect the entire room and surrounding areas.

Step 6 Remove contaminated carpet and throw away.



- Place outside the house in a safe place until household trash is picked up.

Step 7 Remove mercury from shoes, clothing, and skin.



- If mercury had touched your skin, shoes or clothing, remain still and bring you a plastic trash bag and wet paper towels. Wipe off any visible mercury with the wet paper towels and then put them into the trash bag. Put contaminated shoes and clothing and place them in a trash bag. Seal the bag and place it in another bag.

Step 8 Properly dispose of contaminated cleanup materials.



- Place all materials used in the cleanup, including gloves, in a trash bag. Place the zipper-top bags that contain mercury and other objects into the trash bag. Close and seal the trash bag and place it in a safe place outside your house. Label the bag as directed by your local health or fire department.
- Contact your local health department, municipal waste authority, or your local fire department for proper disposal in accordance with local, state and federal laws.

Step 9 Determine if additional action needs to be taken following cleanup of spill.



- Keep the area well ventilated to the outside (i.e., windows open and fans in exterior windows running) for at least 24 hours after cleaning up the spill. Continue to keep pets and children out of the cleanup area. If anyone gets sick, call your doctor or the **Poison Control Center at (888) 222-1222** immediately.
- You may want to hire a contractor who has monitoring equipment to screen for mercury vapors. Consult your local environmental or health agency to inquire about contractors in your area.
- If young children or pregnant people are in the house, seek additional advice from your local or state health or environmental agency.

What to Do for Mercury Spills Greater Than the Amount in a Thermometer, Thermostat or Compact Fluorescent Light Bulb

Mercury is heavy. Just two tablespoons weigh nearly one pound. If more than the amount of mercury in a thermometer or thermostat or a compact fluorescent light bulb is spilled in your house, be sure to follow these steps:



- Have everyone else leave the area; **don't** let anyone walk through the mercury on their way out.
- Open all windows and doors to the **outside**.
- Turn down** the heater in winter and **turn up** the air conditioner in summer.
- Shut all doors to other parts of the house, and leave the area.
- Call your local or state health or environmental agency for help.

- If more than two tablespoons of mercury are spilled, it is mandatory to call the National Response Center (NRC), available 24 hours a day, 1-800-424-8802.
- If you have health-related questions about mercury, call the Agency for Toxic Substances and Disease Registry (ATSDR) at 800-232-4636 or TTY: 888-232-6348, or by email to cdcinfo@cdc.gov.
- If you have questions about cleaning up a mercury spill of any size, call US EPA at 202-564-3850.



LEDs are safer than fluorescent lamps

While LEDs may contain small amounts of toxic materials, unlike fluorescents (which contain mercury), they do not pose a direct danger to users:

- If an LED lamp breaks, the toxic materials in it will not vaporize and thereby expose people to them.
- LEDs are much less prone to breakage because their casings are often made of plastic instead of glass.

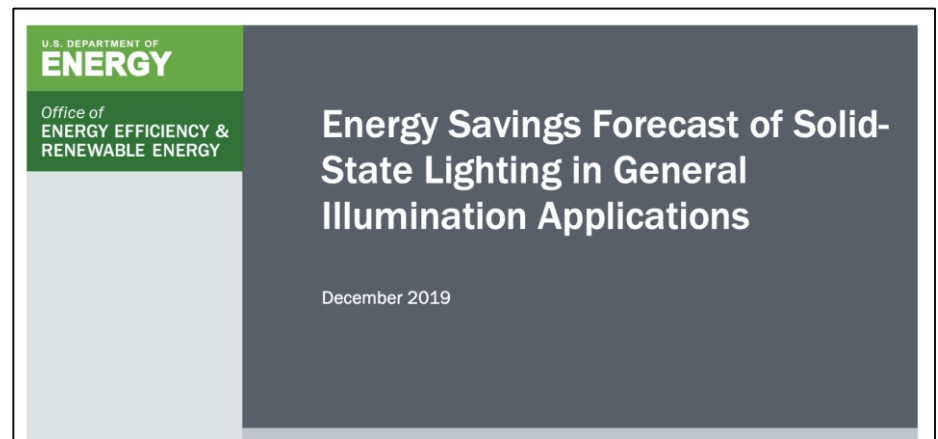


LEDs are a practical alternative to fluorescent lighting

“LEDs have surpassed, or matched, all conventional lighting technologies in terms of energy efficiency, lifetime, versatility, and color quality...”

Going forward, LED technology is expected to continue to improve, with increasing efficacy and decreasing prices...”

US Department of Energy, 2019







Benefits of LEDs (compared to mercury lamps)

- **Lower overall lifecycle environmental impact**
 - Mercury-free
 - More energy-efficient
 - Last 2-3 times longer
- **Save \$: often pay for themselves quickly**
- **Better Performance**
 - Instant on: no flicker or hum
 - Improved light quality
 - More easily dimmable



COMPARISON OF COMMON FLUORESCENT LIGHTING TO LED OPTIONS

LAMP TYPE	 TYPICAL HOUSEHOLD COMPACT FLUORESCENT LAMP (CFL)	 REPLACEMENT LED	 TYPICAL WORKPLACE T8 LINEAR FLUORESCENT LAMP (LFL)	 REPLACEMENT LED
Watts for equivalent light	15W	7.5W	32W	15.5W
Energy efficiency	Low	High	Low	High
Typical lifespan*	4.8 years	10.3 years	5.5 years	13.7 years



For more information, email:
mercurypolicy@gmail.com
Thank you!

Policy pathway towards phasing out fluorescent lamps in the European Union

Eliminating Mercury in Lighting now!

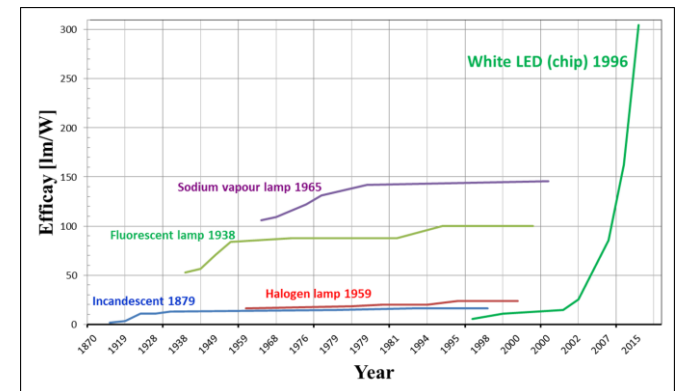
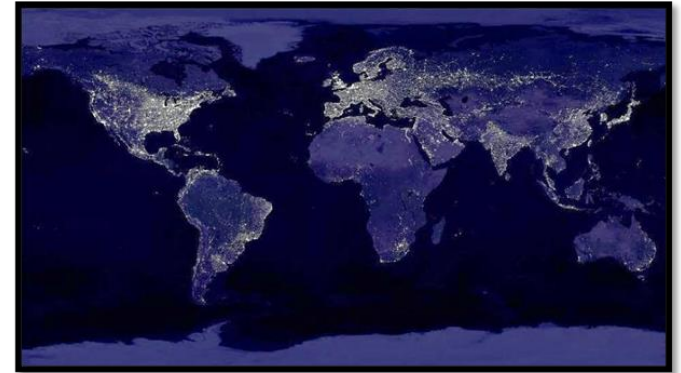
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Peter Bennich

The Swedish Energy Agency

Lighting – An Opportunity

- Lighting was one of the largest end users of electricity – about 3000 TWh/yr in 2005, projected to 5000 TWh/yr in 2030 with no new policies
- Enter LED => a disruptive and transformative technology
- Plus, new knowledge of relationship between light & health
- Legacy lighting companies exposed to competition by new actors => changed the lighting industry
- Conclusion: its important to *distinguish* between legacy companies with an old *and* new product portfolio and new companies *only* focussing on LED-based lighting



Lighting – a Challenge to Policy Makers

- How to assess market development when the market moves so fast - both technology (performance) and sales distributions?
- How to guarantee the quality of lighting when using a new technology (LED) - especially considering new knowledge on light and health?
- How to explain to normal consumers why the incandescent light bulbs were phased out?
- How to ensure legacy companies are able to make the switch?
- How to guide new companies to innovate and provide products with good lighting qualities?
- And so on...



Case Study of Fluorescent Lighting

- A dominant light source for over 50 years; producing roughly 70% of the lumens in 2015
- Fluorescent lighting contains mercury, a known neurotoxin – extremely hazardous to people and the environment
- The lamps are covered under:
 - Restriction of Hazardous Substances (RoHS) Directive
 - Ecodesign Directive (2009/125/EC)
 - Waste Electrical and Electronic Equipment (WEEE) Directive



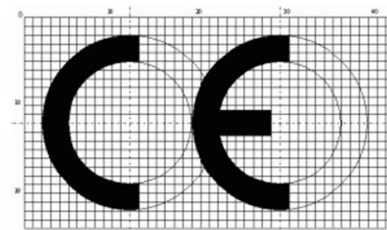
Background on RoHS Directive

- RoHS was passed in 2003 (Directive 2002/95/EC) and took effect in 2006
- It was revised in 2011 (Directive 2011/65/EU), establishing new more stringent limits
- RoHS limits or bans ten substances, one of which is mercury
- For fluorescent lighting, RoHS sets a maximum amount (milligrams) of mercury per bulb
- RoHS is a CE-marking directive, meaning that all suppliers must ensure they comply before placing them on the market



Background on Ecodesign Directive

- Ecodesign was passed in 2005 (Directive 2005/32/EC) and was recast in 2009 (Directive 2009/125/EC)
- Established a public-participative process for developing quality and performance regulations on products
- Lighting products – including fluorescent lamps – were regulated under several regulations, starting in 2009
- Regulations primarily focused on energy-efficiency requirements, but also have quality requirements like lifetime
- Ecodesign is also a CE-marking directive, meaning suppliers must comply before placing them on the market



Differences Between RoHS and Ecodesign

RoHS Directive

- Delegated Act, the Commission (DG ENV) has authority to carry out the regulation
- Expert consultants and Member State advisors (but no Member State vote)
- No public participation
- Letters and information treated as confidential; freedom of information request
- No mandatory deadlines on DG ENV to update, although guidance was 5 years (expired 2016)
- Decisions are driven by toxicity, and calls for exemptions to be phased-out if alternatives exist

Ecodesign Directive

- Follows Comitology, the Commission (DG ENER, DG GROW or DG ENV) manages the process
- Decisions are made by the Member States in the Regulatory Committee
- Expert consultants
- Highly transparent and participative, including Member States, industry, NGOs, civil society
- Decisions are driven by several factors, including least life-cycle cost

RoHS could accelerate mercury-free lighting



“RoHS offers the Commission an opportunity to expand the scope of coverage to lighting products which were excluded from regulation under Ecodesign, and to accelerate their phase-out relative to business-as-usual due to their toxicity rather than on a basis of least life-cycle cost.”

- RoHS expands phase-out to all general-purpose lamps
- RoHS could accelerate phase-out of fluorescent lamps relative to Ecodesign

What are the Benefits?

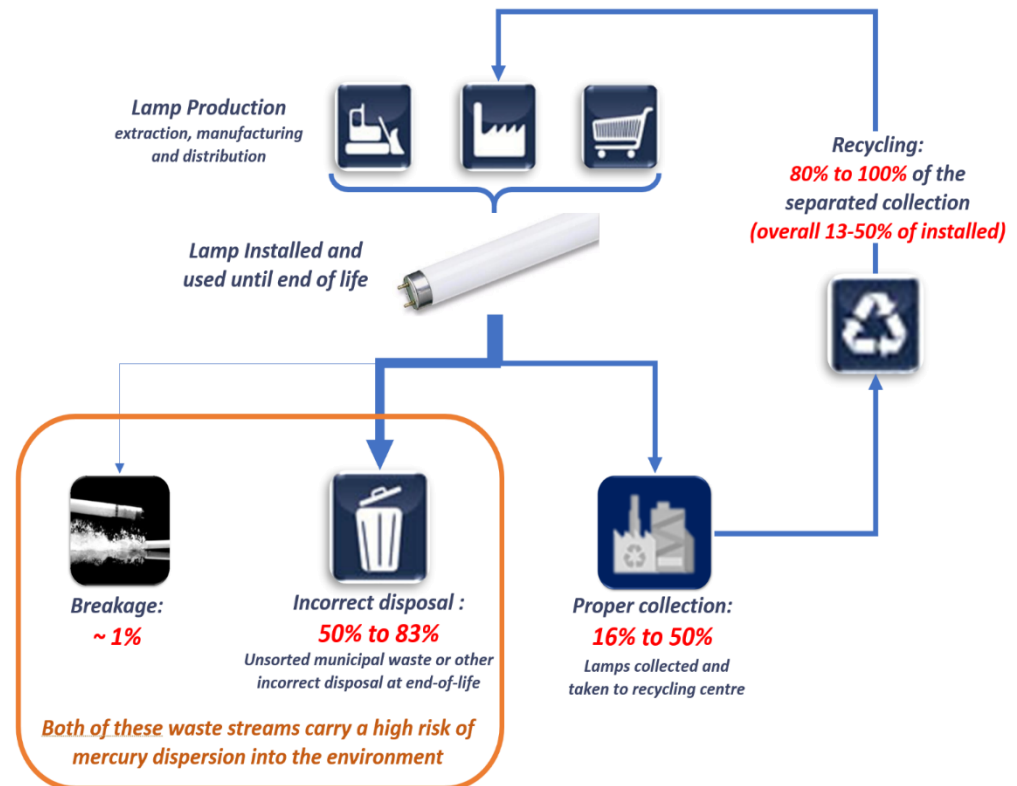
Oko-Institute and VHK study* calculated benefit for T5, T8 and CFLni phase-out	Savings (cumulative to 2035)
Mercury Savings: from lamps (2.9 metric tonnes) and power stations (2.5 metric tonnes).	5.4 metric tonnes Hg
Financial Savings: Euros saved by businesses and consumers on their lighting bills (lamps and energy)	€29.9 billion
Energy Savings: TWh of cumulative energy savings	309.7 TWh
CO₂ Savings: from avoided generation of electricity	92.1 MMT CO₂



* Study to assess socioeconomic impact of substitution of certain mercury-based lamps currently benefiting of RoHS 2 exemptions in Annex III - [link](#)

On-going failure to collect used lamps

- Literature review across multiple Member States
- Claims for 100% recovery are misleading, the definition in the WEEE Directive divides by percentage collected and delivered to a recycling centre
- Bottom line: more than half of the mercury in the lamps is not disposed of properly – “incorrect disposal”
- Plus, more mercury from coal-fired power plants



Minamata Convention on Mercury



- Adopted in 2013 with the goal to **protect human health and the environment from the adverse effects of mercury**, currently has 135 Parties
- Contains provisions to eliminate mercury in products and processes worldwide, but **includes exemptions for certain mercury-based fluorescent lamps**
- Rapid development and increasing accessibility and affordability of mercury-free LED lamps means those exemptions are now unnecessary
- Phasing out fluorescent lighting products will accelerate a transition to LED lighting
- Conference of Parties (COP4) was launched in November 2021 with in-person negotiations in Q1 of 2022

Conclusions

- Ecodesign will remove many fluorescent lamps in Europe on the basis of LCC; and RoHS is poised now to address the products left behind on the basis of toxicity
- 50-83% of fluorescent lamps are *not* disposed of properly in the EU
- LED retrofit are available, and in 91-93% of stock can be installed directly without any rewiring (just change the bulb)
- Öko-Institut calculated benefits through 2035 from RoHS phasing out:
 - €29.9 billion in net savings (bulbs, energy, luminaires);
 - 310 TWh electricity (7 large coal powerplants over 15 yrs – [link](#));
 - 2.9 tonnes of mercury (plus 2.5 tonnes from avoided coal powerplant emissions)
- Minamata is an opportunity to scale up RoHS globally, supporting the African Amendment on Lighting
- **Its time to say farewell to fluorescent...**



Real pros say
**farewell to
fluorescent.**



Mercury-free LED Alternatives to Fluorescent lamps

New market data from Africa, Latin America and South-East Asia

Clean
Lighting
Coalition

Policies Driven by Favourable Economics?

- CLIC sought to understand whether the economics supported a phase-out globally
- Engaged partner organizations in **26 countries** across Africa, Latin America and South East Asia
- Gathered over **1200 models** of both mercury-containing fluorescent and LED
 - General service lamps
 - Linear tube lamps
- Created “matched pairs” of LED equivalent to fluorescent
- Data collection on-going



Policy and market trends roundup

- Europe policy-measures over a decade **move the EU market to mercury-free lighting**
 - Banned incandescent 2009-12; halogen spots 2015 and non-directional 2018
 - **EU No 2019/2020** – bans CFLi, CCFL, EEFL, T12 linear fluorescent in 2021; and 60, 120 and 150 cm T8 linear fluorescent in 2023
 - EU RoHS proposed to ban all general fluorescent (**CFL**, **LFL**) in 12-18 months
- Southern Africa Development Community – 16 countries adopted a **harmonised** standard SADC HT 109:2021 in Q2 2021, **shifts markets to LED**
- East African Community – 6 countries, draft harmonised standard DEAS 1064; final in Q1 2022, **shifts markets to LED**

Europe Timeline



2009-2012



2015



2018



2021

Policy and market trends roundup

- 69 countries* have phased out incandescent bulbs; many have CFL measures
- Other lighting initiatives...
 - UNEP U4E working in 10+ countries; model regulations phase-out CFL and LFL, 2023-25
 - India's ELCOMA published Vision 2024 Roadmap to transition market to LED by 2024
 - IKEA (retailer) – switched to all LED, on shelves and in store, in 2015
 - IEA report Net Zero emissions in 2050 calls for lightbulb sales in 2025 to reach 100% LED in order to make carbon neutral in 2050 (see p.146)

* 69 countries: Argentina, Australia, Bahrain, Bolivia, Brazil, Canada, Chile, China, Cuba, Ecuador, Egypt, EU-27 (27 EU countries), Ghana, Iceland, Israel, Kazakhstan, Kuwait, Malaysia, Montenegro, Nepal, New Zealand, North Korea, Norway, Philippines, Qatar, Senegal, Serbia, Singapore, Solomon Islands, South Africa, South Korea, Switzerland, Taiwan, Tajikistan, Tunisia, United Arab Emirates, United Kingdom, United States, Uzbekistan, Venezuela, Vietnam, Zambia, Zimbabwe

Example of Analysis: Brazil, General Service Lamp

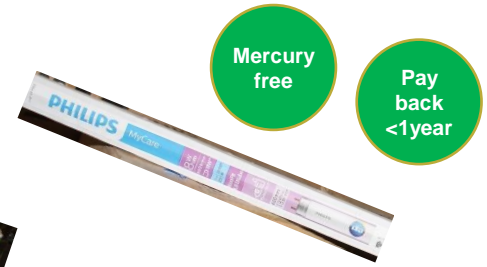
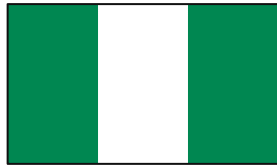
- Three lamps: halogen, CFL and LED
- Same light output
- Life-Cycle Cost analysed over 22 years (LED bulb life)
- LED is 87% less expensive than halogen
- LED price cheaper than CFL
- LED is 44% less expensive than CFL to own



Item	Halogen	CFL	LED
Life	2,000 hrs (2 yrs)	6,000 hrs (6 yrs)	25,000 hrs (25 yrs)
Price each*	BRL 4.59	BRL 10.9	BRL 7.99
Power	70 W	15 W	9 W
Use (3hr/day)*	77 kWh/yr	16 kWh/yr	10 kWh/yr
Elec cost.*	BRL 55.36/yr	BRL 11.86/yr	BRL 7.12/yr
Life Cycle Cost (22 yr)	BRL 1,248	BRL 290	BRL 165
Payback period		7 weeks	4 weeks

* Lamp prices collected in November 2021. All regular prices, no special offers or discounts. Usage assumptions are: 3 hours/day, 365 days/year. Electricity is BRL 0.72/kWh.

Example of Analysis: Nigeria, Tubular Lamp



- Two lamps: fluorescent and LED
- Same light output
- Life-Cycle Cost analysed over 4 years (LED bulb life)
- LED is 45% less expensive than fluorescent
- Payback in 9 months
- Lasts 4 years

Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	13,000 hrs	15,000 hrs
Lamp Price*	NGN 500	NGN 1,500
Power	18 W	8 W
Use (9 hr/day)*	59 kWh/yr	26 kWh/yr
Elec cost.*	NGN 2,464/yr	NGN 1,095/yr
4-year cost	NGN 10,711	NGN 5,880
Payback period		9 months

* Lamp prices collected in September 2021. All regular prices, no special offers or discounts. Usage assumptions are: 9 hours/day, 365 days/year. Electricity is NGN 41.67/kWh.

Snap-Shot of the Market Data

African Region:

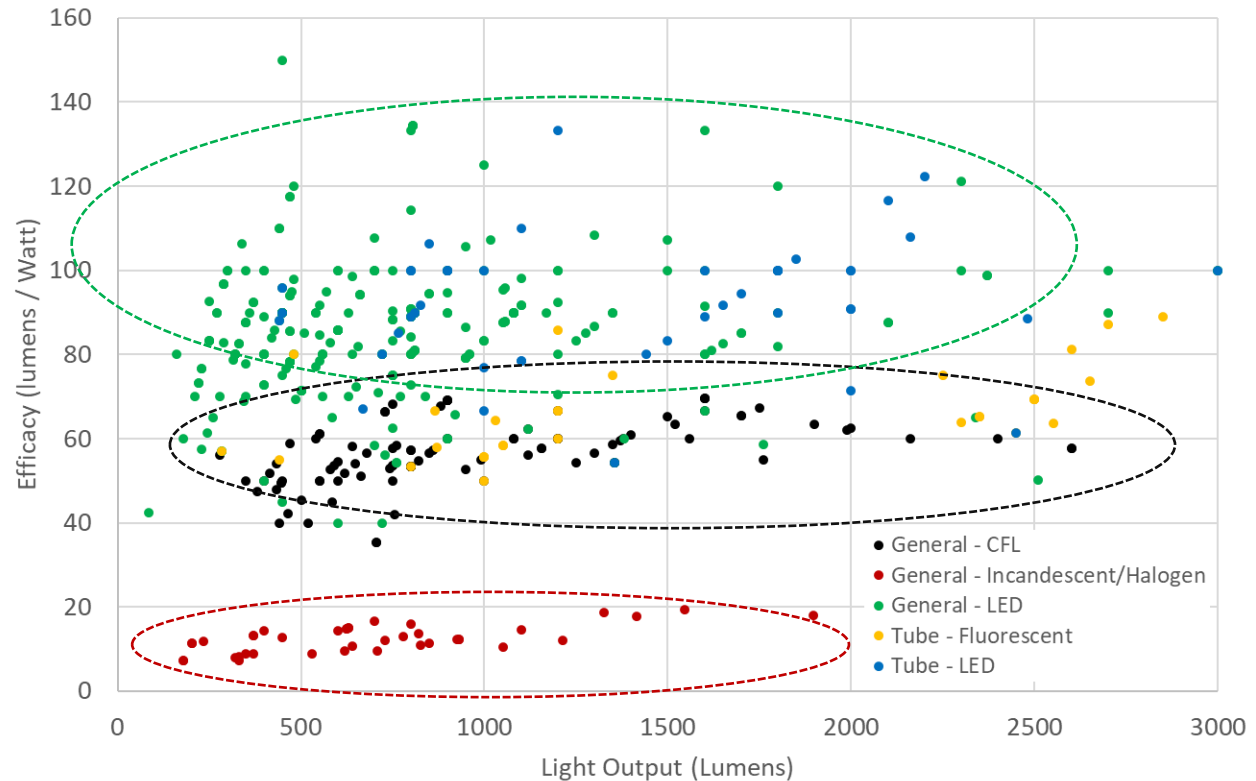
Burkina Faso,
Cameroun, Ethiopia,
Gabon, Ghana, Ivory
Coast, Kenya, Nigeria,
South Africa, Togo,
Uganda, Zambia

South East Asian

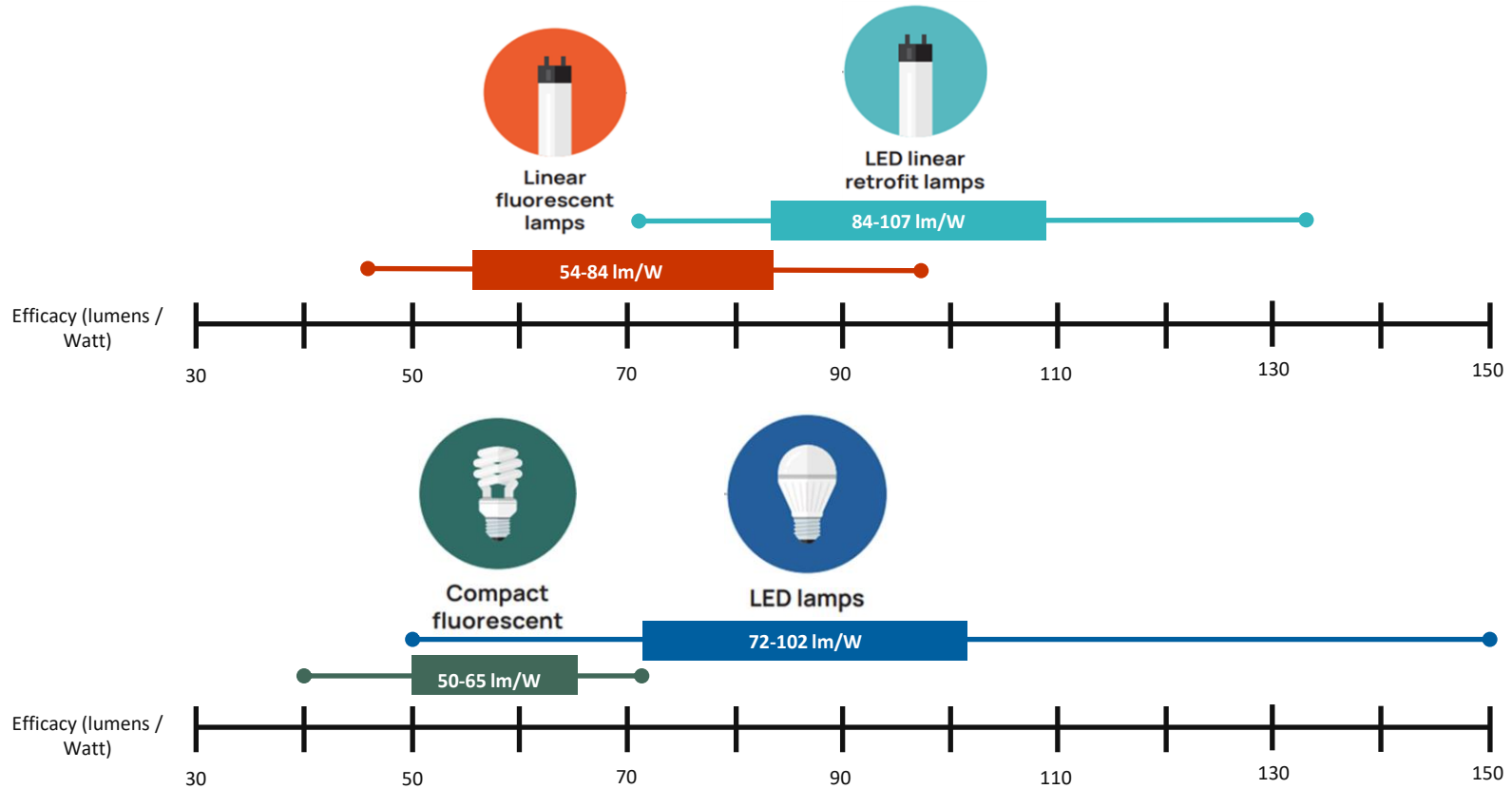
Region: India,
Indonesia, Malaysia
(more coming...)

Latin American

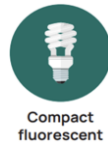
Region: Antigua &
Barbuda, Argentina,
Belize, Brazil, Chile,
Guyana, Jamaica,
Mexico, Panama, Peru,
Trinidad and Tobago



LEDs are More Efficient – Regional Market Data

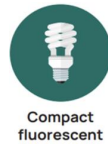


LEDs pay for themselves quickly...African Region



Country	LED payback vs. Inc/Hal	LED savings compared to CFL	LED payback vs. LFL	LED savings compared to LFL
Burkina Faso	Instant	53%	8 months	46%
Cameroun	8 weeks	55%	6 months	55%
Cote d Ivoire	19 weeks	50%		
Ethiopia	7 weeks	54%	11 months	47%
Gabon	18 weeks	54%	8 months	43%
Ghana	Instant	49%	1 month	50%
Kenya	3 weeks	50%	9 months	48%
Nigeria	16 weeks	41%	9 months	45%
South Africa	Instant	48%	Instant	50%
Togo	3 weeks	51%		
Uganda	Instant	57%		

LEDs pay for themselves quickly...Latin America



Country	LED payback vs. Inc/Hal	LED savings compared to CFL	LED payback vs. LFL	LED savings compared to LFL
Antigua & Barbuda	Instant	34%	11 months	47%
Belize	6 weeks	42%	11 months	48%
Brazil	4 weeks	43%	5 months	43%
Jamaica		47%	6 months	53%
Guyana	7 weeks	46%		
Mexico	14 weeks	41%		
Panama		46%	4 months	50%
Peru	2 weeks	61%	4.1 months	51%
Trinidad & Tobago		57%		40%

LEDs pay for themselves quickly...Asia



Compact fluorescent



LED lamps



Linear fluorescent lamps



LED linear retrofit lamps

Country	LED payback vs. Inc/Hal	LED savings compared to CFL	LED payback vs. LFL	LED savings compared to LFL
India				
Indonesia	6 weeks	47%	6.6 months	47%
Malaysia				

Data collection in Asia is on-going at this time

Regional benefits

Region	Mercury avoided (MT Mercury, 2025-2050)	GHG emissions prevented (MMT CO2, 2025-2050)
GRULAC	18	277
ASIA-PACIFIC	117	1,759
AFRICA	5	71
GLOBAL	232	3,500

Thank you!

Ana-Maria Carreño

Deputy Director

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Steps that Africa is taking to eliminate mercury-added lamps

By Christopher Kanema

*Principal Inspector and Head of Pesticides and Toxic Substances,
Zambia Environmental Management Agency*

*Global Mercury Partnership Lighting Webinar
7 December 2021*

Current Lighting situation in Africa

- No African manufacturing of fluorescent lamps; 100% imports
- African nations have to deal with toxic mercury in fluorescent lamps at the end of life, creating a big hazardous waste problem
- Africa is already rapidly moving towards LED lighting because it is highly cost-effective, with **payback periods of 5-11 months**
- New LED lamp assembling is taking place across Africa; businesses are investing in product lines for LED lamps and luminaires:
 - [Savenda Electrical](#) in Zambia
 - [Sahasra Electronics](#) in Rwanda
 - [Tempest LED Lighting](#) in Mozambique
 - Many LED businesses in South Africa, and more.
- An excellent opportunity for local business and entrepreneurs to accelerate markets and invest in manufacturing of LED lighting products



LED assembling in Zambia



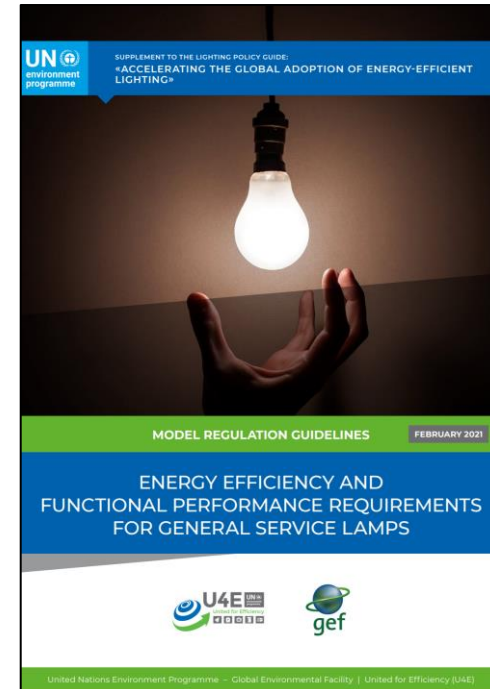
Policy Measures Phasing-Out Mercury-lamps (1 of 2)

- Many governments across Africa are moving to phase-out CFLs and LFLs through energy-efficiency policy measures
- 21 countries participate in UNIDO's "[Energy Efficient Lighting and Appliances](#)" project, developing harmonised lighting performance standards for SADC and EAC; phasing-out CFLs and LFLs by minimum efficacy requirements
 - Southern Africa Development Community – 16 countries adopted [regionally harmonised](#) quality and performance standard HT 109:2021 in June, shifts markets to all LED
 - East African Community – 6 countries - final draft of DEAS 1064; final expected in Q1 2022 (N.B., Tanzania is part of both SADC and EAC)



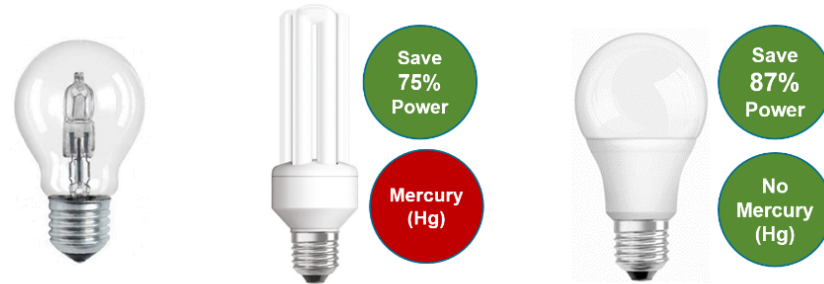
Policy Measures Phasing-Out Mercury-lamps (2 of 2)

- In addition, several countries, such as South Africa, Ivory Coast and Kenya, are updating their national lighting regulations, phasing out fluorescent and transitioning to energy-efficient, mercury-free, LED
- Countries like Burkina Faso, Ghana and Nigeria have strategies to support energy-efficiency under their energy policies
- Internationally, UNEP's United for Efficiency (U4E) published [model lighting regulations](#) earlier this year that proposes to phase-out all CFLs by January 2023 and all LFLs by January 2025



Are Mercury-free LED Lamps Cost-Effective?

- **Yes**, LED lamps are highly cost effective
- Cost-effectiveness is driving the market transition
- In South Africa, payback period is 1-2 months
- Other countries – similar payback periods: Kenya, Madagascar, Uganda, Zambia....
- Least life-cycle cost, LED is:
 - **85% less expensive than halogen**
 - **50% less expensive than CFL**

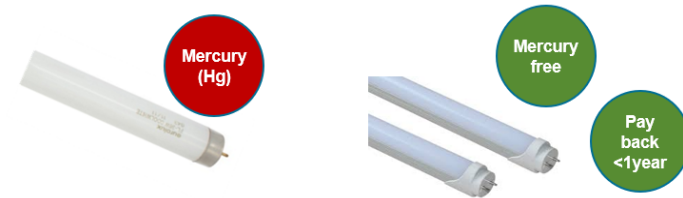


Item	Halogen	CFL	LED
Life	2000 hrs (2 yrs)	6000 hrs (6 yrs)	15000 hrs (15 yrs)
Price each*	21.99 Rand	29.99 Rand	29.99 Rand
Power	60 W	15 W	8 W
Use (3hr/day)*	65.7 kWh/yr	16.4 kWh/yr	8.8 kWh/yr
Elec cost.*	82.10 Rand/yr	20.50 Rand/yr	11.00 Rand/yr
10-year cost	953.20 Rand	265.30 Rand	139.50 Rand
Payback period		7 weeks	6 weeks

* Lamp prices from Pick n Pay in Rosebank, 26 Oct 2018. All regular prices, no special offers or discounts. Usage assumptions are: 3 hours/day, 365 days/year. Electricity is R 1.25/kWh.

Are mercury-free LED Cost-Effective Compared to LFLs?

- **Yes**, LED lamps are highly cost-effective replacements for Linear Fluorescent Lamps (LFLs)
- Cost-effectiveness drives the market transition to LED
- In South Africa, payback period is 10 months; you spend an **70 Rand today to save 800 Rand** on the cost of light
- In Europe payback can be as short as 4-5 months; Uganda it is 5 months
- T5 payback periods are longer, but this lamp isn't common in Africa
- Least life-cycle cost, LED retrofit tubes are:
 - **50% less expensive than LFL**



Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	16000 hrs	40000 hrs (~11 years)
Lamp Price*	R 49.00	R 119.00
Power	36 W	18 W
Use (10 hr/day)*	131 kWh/yr	66 kWh/yr
Elec cost.*	R 164.25/yr	R 82.13/yr
10-year total lighting cost	R 1600	R 862
Payback period		10 months

* Lamp prices for [fluorescent](#) and [LED lamp](#) collected 8 September 2020. Usage assumptions are: 10 hours/day, 365 days/year. Electricity is R 1.25/kWh. 7% discount rate.

Opportunity to Phase-Out Mercury-Containing Lamps Globally



UN
environment



MINAMATA
CONVENTION
ON MERCURY

- The Minamata Convention was adopted in 2013 and **included exemptions for mercury-based fluorescent lighting**
- However, today (2021) – the rapid development, improved accessibility and affordability of *mercury-free* **LED lighting makes these exemptions unnecessary**
- Therefore, the African region has taken the first step to remove these exemptions by tabling [an amendment proposal](#) to phase out fluorescent lighting by 2025
- **Discussion on this amendment** for mercury-containing fluorescent lamps will take place at COP 4.2 in Bali, Indonesia, 21-25 March 2022

Global Impact of the African Lighting Amendment

- The Amendment will have a measurable *positive* impact on lighting markets around the world
- The Minamata Convention has [135 countries](#) who are party to the convention (37 from Africa,), including all the major lighting markets – from a manufacturing and consumption point of view
- The adoption of this measure will provide significant benefits globally
- According to studies:
 - **232 tonnes of mercury** will be avoided (bulbs and power-plants)
 - **3.5 gigatonnes of CO2 emissions** will avoided
 - **US\$1 trillion** in savings on electricity bills



Conclusion: Support the African Lighting Amendment at COP4.2



- LEDs last **2-3 times longer** and uses **half the power** of fluorescent
- LEDs fit into existing fluorescent fixtures without rewiring, a simple “**plug and play solution**”¹
- LED lamps are **safe, two International Electrotechnical Commission (IEC) safety standards** [IEC 62560:2011](#) - self-ballasted LED lamps; [IEC 62776:2014](#) - linear LED retrofit tubes
- The African Lighting Amendment will help countries capture the “**lowest of low hanging fruits**”, accelerating the transition to energy-efficient, mercury-free LED lighting
- Amendment aligns with the IEA’s report for [Net Zero emissions in 2050](#): “The share of light-emitting diode (LED) lamps in total lightbulb sales reaches 100% by 2025 in all regions.” (p. 146)
- Aligns with lighting policies in the OECD, avoiding ‘dumping’ of out-dated, toxic, inefficient lighting in the non-OECD

Conference of the Parties (COP) 4.2 will be held in Bali, Indonesia on 21-25 March 2021

1. [Philips/Signify](#): “No need to change drivers or rewire”, and a “plug and play solution that works straight out of the box”; [OSRAM/LEDvance](#) state “SubstiTUBE” is a “Quick, simple and safe lamp replacement without rewiring”

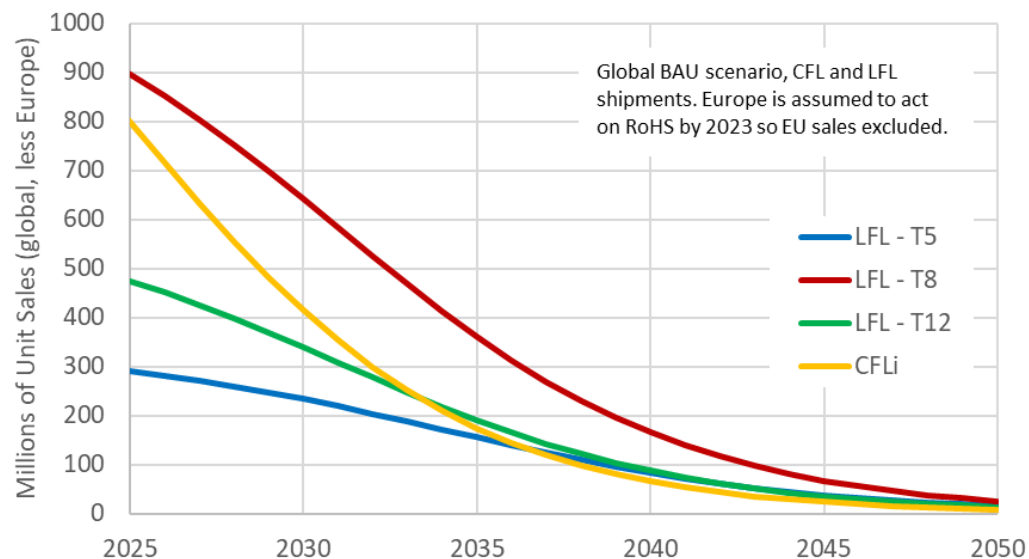
International cooperation is crucial to ensure that a fluorescent phase-out is implemented widely, quickly and cost-effectively by countries, institutions and businesses

Thank you! Any questions?

Christopher Kanema

*Principal Inspector and Head of Pesticides and Toxic Substances,
Zambia Environmental Management Agency*

Savings come from Avoided Shipments of Fluorescent Lamps



- Graph of projected global sales of mercury-containing fluorescent lamps in a 'no policy scenario' (business as usual)
- Global sales of fluorescent are declining as users switch to LED, but still **14.8 billion fluorescent lamps** will be sold and installed if the Minamata Parties do not take action in Bali



Question and Answer



Session 2: Ensuring the environmentally sound management of waste from mercury-added lamps

Introduced by Misuzu Asari, Kyoto University, co-lead of the Mercury Waste Management Partnership Area

Overview of existing tools and guidance under the Waste Management area and the Basel Convention

7th December 2021

Yuri Kato, Ministry of the Environment, Japan



Phasing out mercury-added lamps: the path to product substitution and end of life management



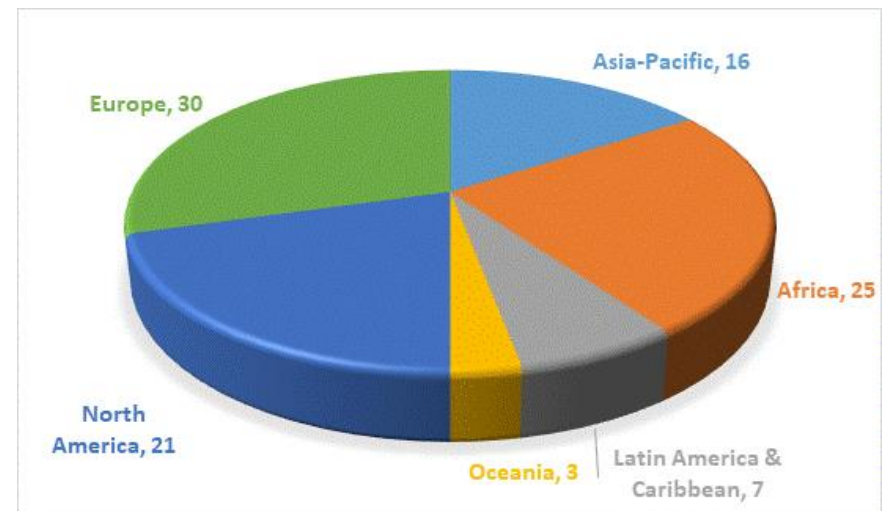
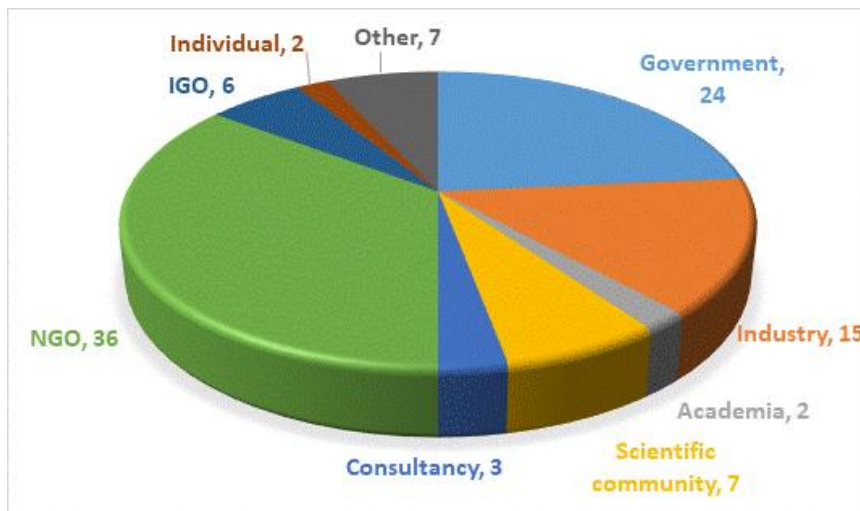
Activities by the Waste Management area of the UNEP-Global Mercury Partnership

Overview of the Waste Management area (WMA)

- Established in 2008 with over 100 partners (as of December 2021)
- Objective (revised):**

“To promote the environmentally sound management of mercury wastes by developing and disseminating relevant materials, enhancing capacities and awareness and providing specific solutions at the global, regional, national and local levels.”
- Lead:** Misuzu Asari (Associate Professor, Kyoto University)
Ministry of the Environment, Japan (MOEJ)

- Partners**



Future activities (2021-2023)

- Established three working groups under the WMA to implement followings:

Resource development

- **List of facilities** on mercury wastes treatment
- **Factsheet** on the management of certain types of mercury wastes
- Review **Resource Person List** with expertise on mercury wastes management
- **Training** materials

Capacity-building and awareness raising

- **Webinar** in cooperation with other Partnership areas
- Compilation of **good practices** on mercury wastes management
- **Workshop** for specific sectors and stakeholders

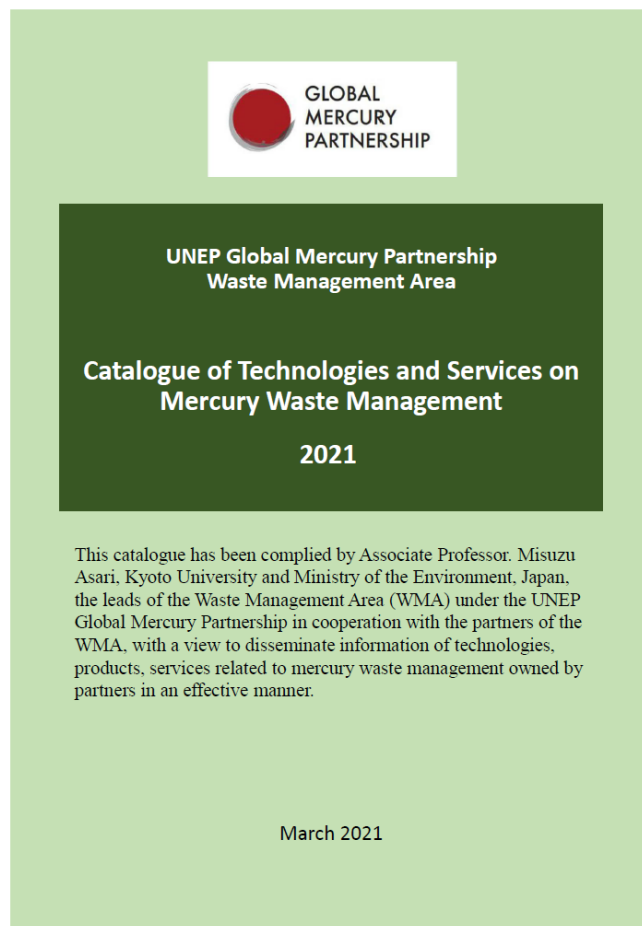
Solution exchange

- Platform for **matchmaking** between stakeholders in needs and solution-providers

Catalogue of Technologies and Services on Mercury Waste Management

- This Catalogue contains mercury waste treatment technologies and services owned by 12 Partners of the WMA, including the technologies to treat mercury-containing lamps in an effective manner.
 - ✓ Profiles
 - ✓ Overview of technology / product / services
 - ✓ Strengthening / Advantage
 - ✓ Applicability

- The Catalogues has been updated annually and is available at the website of the UNEP-Global Mercury Partnership.



Available at:
<https://www.unep.org/globalmercurypartnership/resources/tool/catalogue-technologies-and-services-mercury-waste-management-2021-version>

Factsheets on the ESM of mercury wastes

- Aim to provide countries (particularly developing countries) with practical and comprehensive information for safe management of various mercury waste streams, taking into account different economic and technological circumstance of countries.

- Attempt to complement issues covered by the technical guidelines on ESM of mercury wastes under the Basel Convention in which technical aspects are well highlighted.

- Development will be led by International Solid Waste Association (ISWA) in cooperation with the WMA as one of the activities for the Working Group on resource development.
 - ✓ The Working Group will develop a list of priority mercury waste streams.
 - ✓ Mercury-containing lamps are expected to be highly prioritized.

Factsheets on the ESM of mercury wastes

- Template for factsheets may include
 - ✓ Introduction (Description/Occurrence/figures)
 - ✓ Classification
 - ✓ Collection (best practices)
 - ✓ Packaging, labelling & transport
 - ✓ Storage (best practices)
 - ✓ Environmentally sound treatment (from pre-treatment to final treatment)

To be further decided...

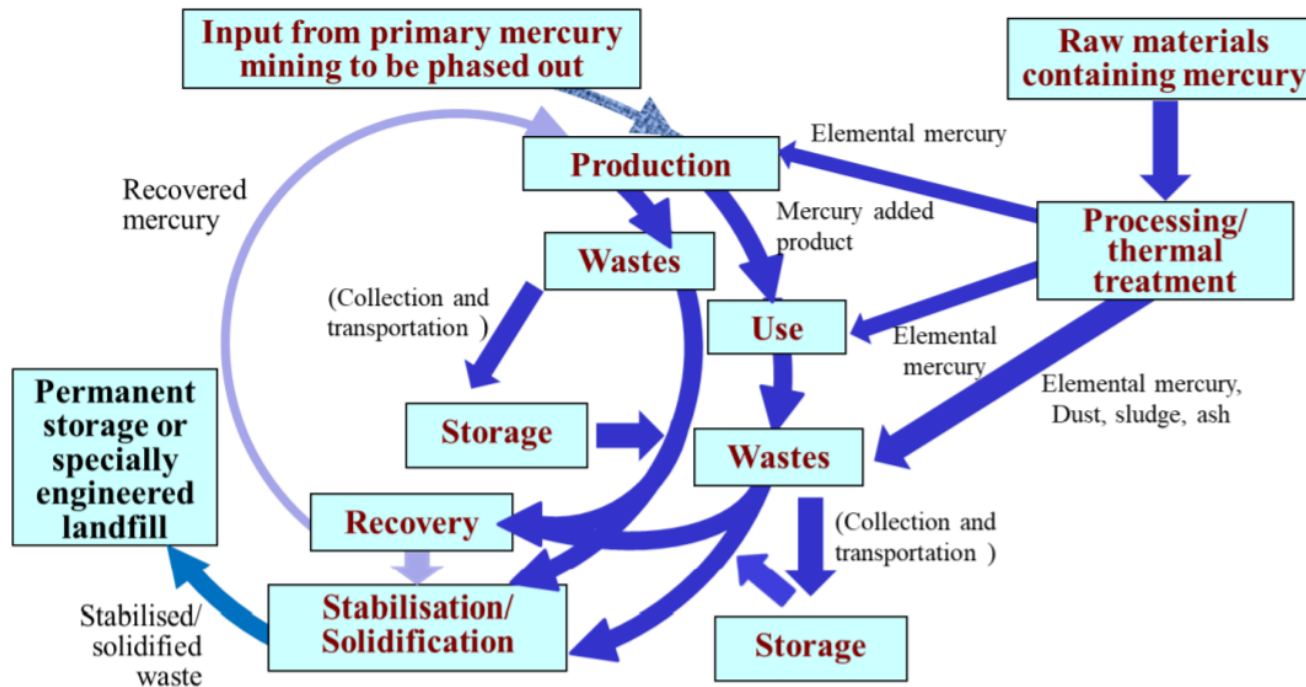
- Factsheets will be developed and available in the order of priority list. All factsheets are expected to be completed by the end of 2023.

The slide features a decorative header with a light blue vertical bar on the left and a teal horizontal bar on the right. The text is centered within the teal bar.

Technical guidelines on the ESM of mercury wastes under the Basel Convention

Technical guidelines on the ESM of mercury wastes

- Basel Convention COP14 (2019) decided to update the technical guidelines on ESM of mercury wastes, considering the invitation by the Minamata COP2.
- COP14 established a small intersessional working group (SIWG) to assist the update (lead country: Japan). The SIWG developed a draft updated version of the technical guidelines* for its consideration by the OEWG12 and COP15.



*UNEP/CHW.15/6/Add.6, <http://www.basel.int/TheConvention/ConferenceoftheParties/Meetings/COP15/tabid/8392/Default.aspx>

Technical guidelines on the ESM of mercury wastes

- The draft updated guidelines address both mercury wastes categorized as hazardous wastes or other wastes as defined under the Basel Convention and mercury wastes as defined under the Minamata Convention.

- Guidance on ESM includes but not limited to
 - ✓ Legislative and regulatory framework
 - ✓ Identification and inventory
 - ✓ Sampling, analysis and monitoring
 - ✓ Waste prevention and minimization
 - ✓ Handling, separation, collection packaging, labelling, transportation and storage
 - ✓ Environmentally sound disposal
 - ✓ Reduction of mercury releases from thermal treatment and landfilling of waste
 - ✓ Management of contaminated sites

Technical guidelines on the ESM of mercury wastes

- Elements in the guidelines relevant to wastes of mercury-added products including lamps

Section	Content
Waste prevention and minimization	<ul style="list-style-type: none">▪ Introduction of <u>mercury-free alternatives</u> and <u>banning products</u> containing mercury.▪ <u>Setting maximum limits of mercury content</u> where alternatives are not available.▪ <u>EPR schemes can be effective</u> to encourage the production of mercury-free or low-mercury products.
Handling, separation, collection, packaging, labelling, transportation and storage	<ul style="list-style-type: none">▪ Mercury wastes<ul style="list-style-type: none">✓ should be <u>placed in a gas- and liquid-tight containers with a mark</u> indicating that they contain “toxic” mercury.✓ should be <u>separated from other wastes</u> for appropriate treatment. Wastes from households and industries should be collected separately.✓ should be <u>transported to avoid spills</u>. Should also <u>be tracked</u> during transport until final destination.▪ Storage facilities of mercury wastes<ul style="list-style-type: none">✓ should <u>not be built in sensitive locations</u> (e.g., earthquake zones)✓ should be <u>constructed of non-combustible materials</u>.

Technical guidelines on the ESM of mercury wastes

- Example of pre-treatment operation for fluorescent lamps

Operation	Content
Mechanical crushing	<ul style="list-style-type: none">▪ Waste lamps should be processed in a machine that <u>crushes and separates the lamps into glass, end-caps and mercury-phosphor powder mixtures</u>.<ul style="list-style-type: none">✓ End-caps and glass should be sent for reuse in manufacturing. Metal pins of end-caps should be removed and treated separately.✓ Mercury-phosphor powder may be disposed of or further processed to separate mercury from the phosphor.✓ Lamp glass should be treated to remove mercury before sending the glass for recovery or disposal.
Air separation	<ul style="list-style-type: none">▪ The aluminium <u>end-caps of fluorescent lamps are cut by hydrogen burners</u>. <u>Air is then blown into the cut lamps from the bottom of the lamps to remove mercury-phosphor powder adsorbed on lamp</u>.▪ Mercury-phosphor powder is collected in a precipitator, and glass parts are crushed and washed with acid, mercury-phosphor powder adsorbed on the glass is completely removed.▪ The end-caps are crushed, and aluminium, iron and plastics are magnetically separated for recycling



Thank you for the attention.

Past, Present and Future of Lamp Recycling

www.almr.org

Past

- Mercury Lamp Recycling began when world governments declared these materials to be hazardous waste
- Approx. 1990 in US; similar in Sweden, Germany
- Basel Convention 1989 and the EU WEEE directive first in 2003, later in 2012; Canada, rest of EU, others followed
- For over 20 years States and Countries made their own policies, some more stringent, some not so much.
- Most stringent is California where all mercury lamps must be recycled

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About
500,000,000
lamps per year
have been
recycled in
North America,
no data for
global efforts

- There are many **exemptions**, so recycling rates low
- Trans-boundary mercury trade banned or restricted
- Recycling industry developed to extract Hg, attempt to recycle all components, mainly in developed nations
- Initial opposition to recycling from lamp manufacturers during mid-1990s, and even after recycling mandates were in place
- EPR schemes popular, although EPR implies market control which does not work for hazardous waste because of compliance and liability issues
- There are still no real incentives for consumers to turn in lamps for recycling

Tenacious efforts to Encourage Lamp Recycling!

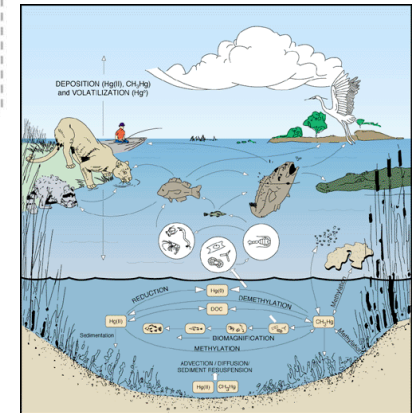
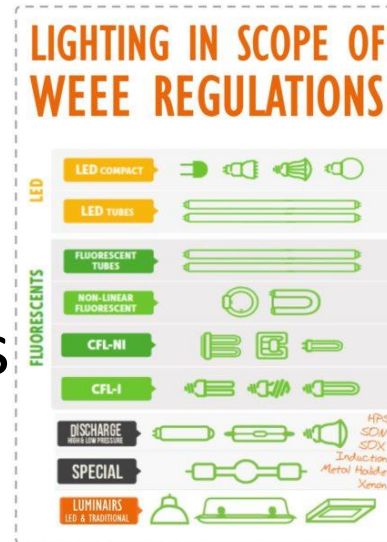
Legislation

Regulation

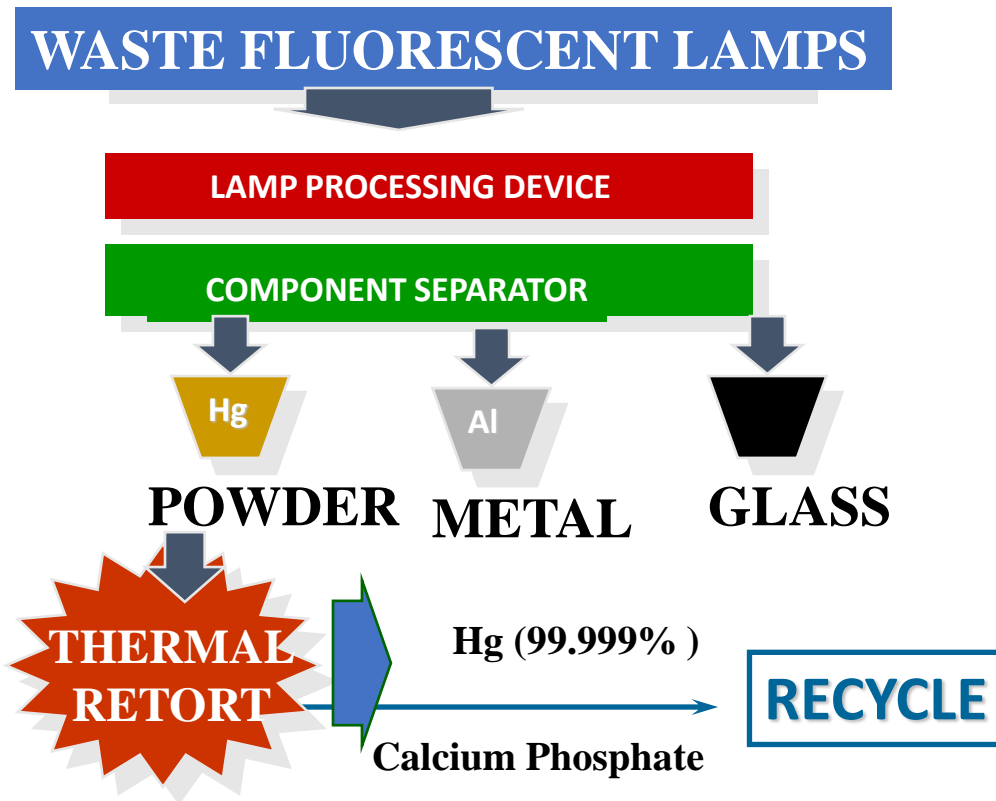
Best management practices

Pro-environment attitude

Protect-people attitude



Lamp Recycling Process



Present

ALMR members and other recyclers operate from about 70 locations in North America

Globally, a common practice is pretreatment (usually lamp crushing) followed by shipping to an integrated recycler in other locations

Some examples of recycling in other countries include the UK, Japan, Australia, Philippines, Singapore, not all of which are fully operating

Global distribution of recycling systems, from the US, Canada, Australia, Indonesia, South Africa, Uruguay, Dubai, Abu Dhabi, Greece, Portugal, Slovakia & Bulgaria



Integrated mercury lamp system

Automating mercury lamp and LED recycling now



Operates in Asia, North America and Europe

Info

CAPACITY

The capacity depends on all the waste to be processed and the efficiency of the operating process. In general, the following capacity can be expected according to the waste:

100 kg flat screens per hour	+	100 kg lamp waste per hour	=	30000 lamps and flat screens per year
------------------------------	---	----------------------------	---	---------------------------------------

Operating personnel required:

- 1 operator for logistics and control
- 1 operator processing lamps
- 1 operator processing LEDs

SPECIFICATIONS

Weight: 10000 kg
 Dimensions (without platform): 42 m (length) x 13.70 m (W) x 4.40 m (H) (H) (m)
 Average consumption: 40-70 kWh at 400V
 Air flow throughput: 200 m³/h up to 2000 m³/h

SAFETY

Even in stand-by mode, the BLU BOX is permanently monitored under "negative pressure" in order to ensure a fully clean environment and to protect the operating staff.

Several easily accessible emergency stop facilities ensure an emergency halt. Even in such a case, the ventilation system continues to run.

The sophisticated, measuring, measuring instrument allows the user to check the ambient air requirements according to the facility standards.

SALES

SALES contact person: SARPI - VEOLIA
 Tel: +39 051 361 1111 | info@veolia.com

blu box
 PLUG & RECYCLE



- Not fully recyclable flat screen recycling plant
- Flat screen recycling for energy for closed loop recycling
- Conversion of fluorescent lamps into high quality glass powder
- No mercury emission - the gas has negligible presence
- The harmful gas of recycling parts are contained
- High recuperation - 85% of the energy
- Flat screen recycling - up to 100 kg/h
- Low maintenance costs - proven technology



THE FIRST INTEGRATED PLANT FOR MIXED LAMP AND FLAT SCREEN RECYCLING

BLU BOX Recycling AG developed and manufactured with the BLU BOX the world's first technology capable of recycling fluorescent lamps and flat screen recycling. With the BLU BOX, the recycling of the lamp waste is now possible in a fully integrated way. The idea of recycling of the equipment is a reinforced 40 ft high cube container automation.

BLU BOX Recycling AG
 Schwanenweg 200, 4100 Birmensdorf, Switzerland
 Tel: +41 78 555 1111 | info@blu-box.ch



LAMPS RECYCLING
SOVAG Switzerland

SOVAG/SARPI, lamps recycling activities



Business model, framework and volumes:

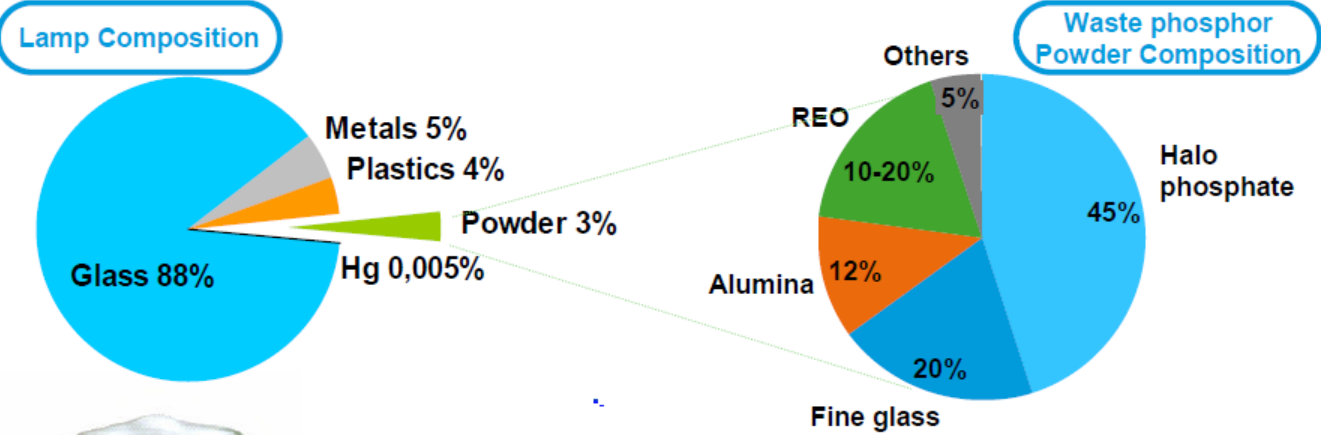
The business model is based on contract of waste management with Swiss Eco-organism in charge of lamps recycling (and household WEEE) - SENS. The contract is negotiated every 3 years and:

- (i) it provides the guaranteed prices for treatment, collection and transport activities, with the possibility for price's evolution if there would be any important and proven significant circumstances;
- (ii) does not give any guarantee on tonnage/volume.

Annual quantities by types of lamps - the SOVAG sites treat around 700k per year:

- 500 t of linear tubes,
- 200 t of lamps (non linear / bulbs, all shapes and sizes)
- LED represent only 3-4% of the volume

Several years ago we also began to recover Rare Earth Elements from lamp phosphors



Driven by critical supply shortages needed for defense, aerospace, wind turbines, and more



Future

Now, in developed countries we see distribution of LED lighting replacing mercury. This shift is coming fairly quickly for many applications.

Mercury lamps will be with us for many more years, especially in developing countries where funding and priorities cannot support rapid technology changes



LED recycling



Aluminum



Plastic

- LEDs are recyclable and are specifically included in WEEE Directive, parts of US, Canada- rules are rapidly changing to manage them as e-waste
- High value aluminum
- Plastics- most valuable when free from contamination and can be easily re-used by smelting.

High Value Fractions for Maximum Returns

Ferrous

This stream contains **steel**, **brass**, high-quality **copper**, transformers and **circuit boards, more**.

Non Ferrous/Ferrous Mix

Mixed fractions sent to downstream process for best value and use.

Screened Fines

Valuable if sent to specialist to isolate **small wire, aluminum shards, copper fines**, etc.

Plastics

Plastics are mixed with various grades, difficult to recycle. May contain POPs. Short-term will likely route this to energy production to ensure that any undeclared POPs are removed from the recycled waste stream.



Mercury Abatement Project- our global mission

- Goal- create infrastructure through partnerships to provide collection and recycling of mercury lighting and related materials for SIDS and any country or region where:
- 1) eco-tourism is a principle component of the local economy
- 2) energy-efficient lighting is being encouraged
- 3) there is a desire to protect the environment, yet no infrastructure to collect and divert mercury lamps from local unlined landfills near ocean waters
- 4) a mercury-free local environment will be a benefit to the local economy

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Philippines, Western Caribbean examples



- MANILA 2/3/2016 photo by EcoWaste Coalition

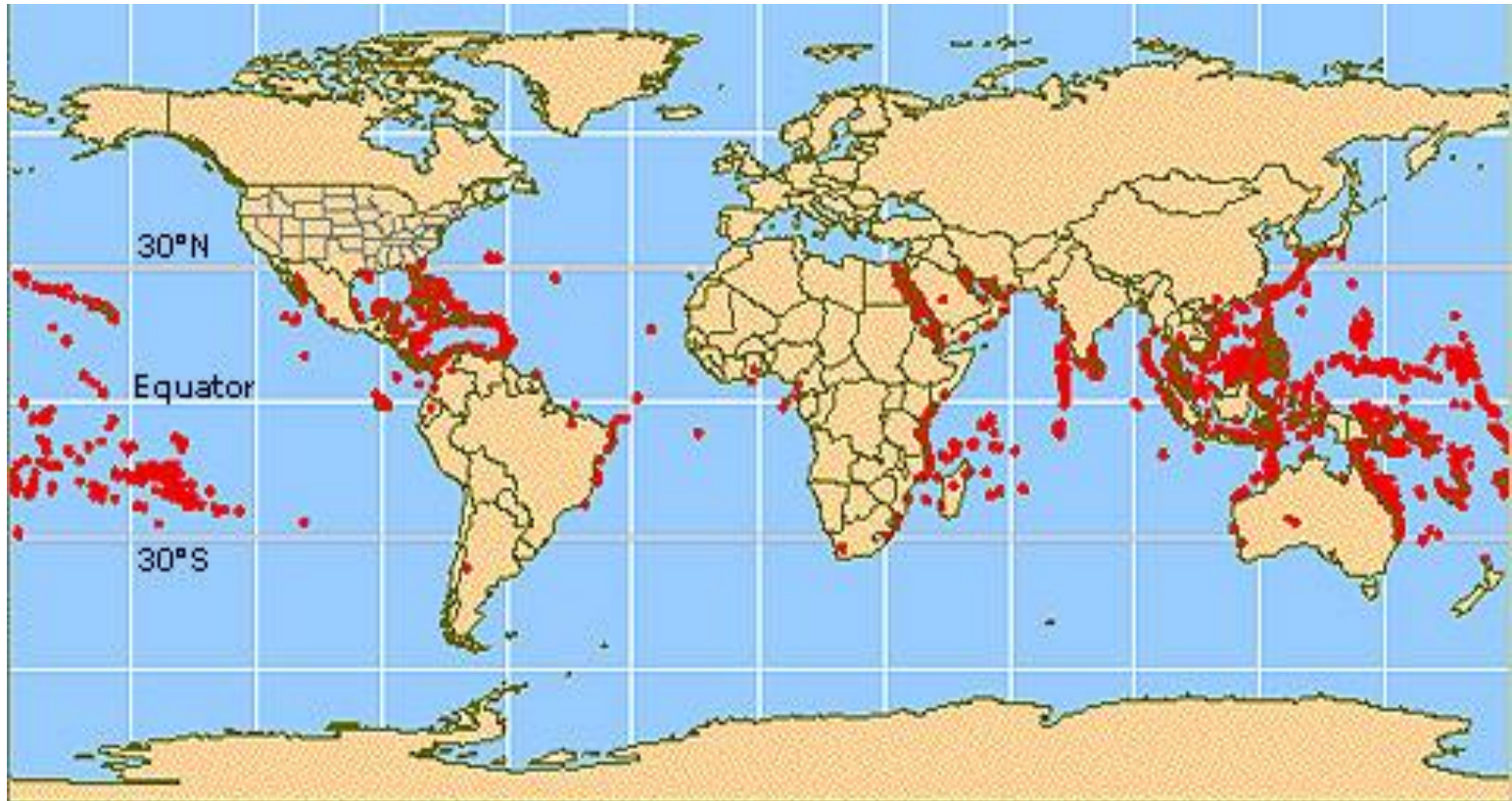


Locals have told us they see lamps every day!



Blackwater (leachate)
containing mercury
adjacent to
mangroves
in Roatan Honduras

Reefs of the World and SIDs



Mercury Abatement Project

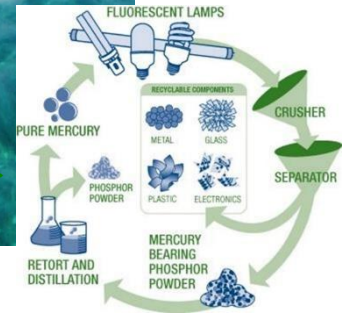
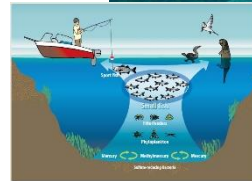
- We assist with setting up infrastructure, training, outreach, POS, equipment, and
- Local people provide collection and pre-processing, consolidation and shipping to recovery/recycling facilities for mercury removal. Recovery- not landfilling.
- Local resorts and merchants who benefit from tourism can pay their fair share of the cost of recycling, and in turn, can use their participation in the project as a way to market their businesses as clean, green, energy-efficient and socially responsible. Economy improves, Tourism can increase and Locals manage sustainable project.
- Free for consumers



Mercury Abatement Project



Funding needed to assist developing areas





UNEP Global Mercury Partnership Webinar on Lamps 7 December 2021

Example of technologies and international cooperation for ensuring the environmentally sound management of mercury-containing lamps in Asia

Nomura Kohsan Co., Ltd.
Hiroki Iwase

7 December 2021

Contents

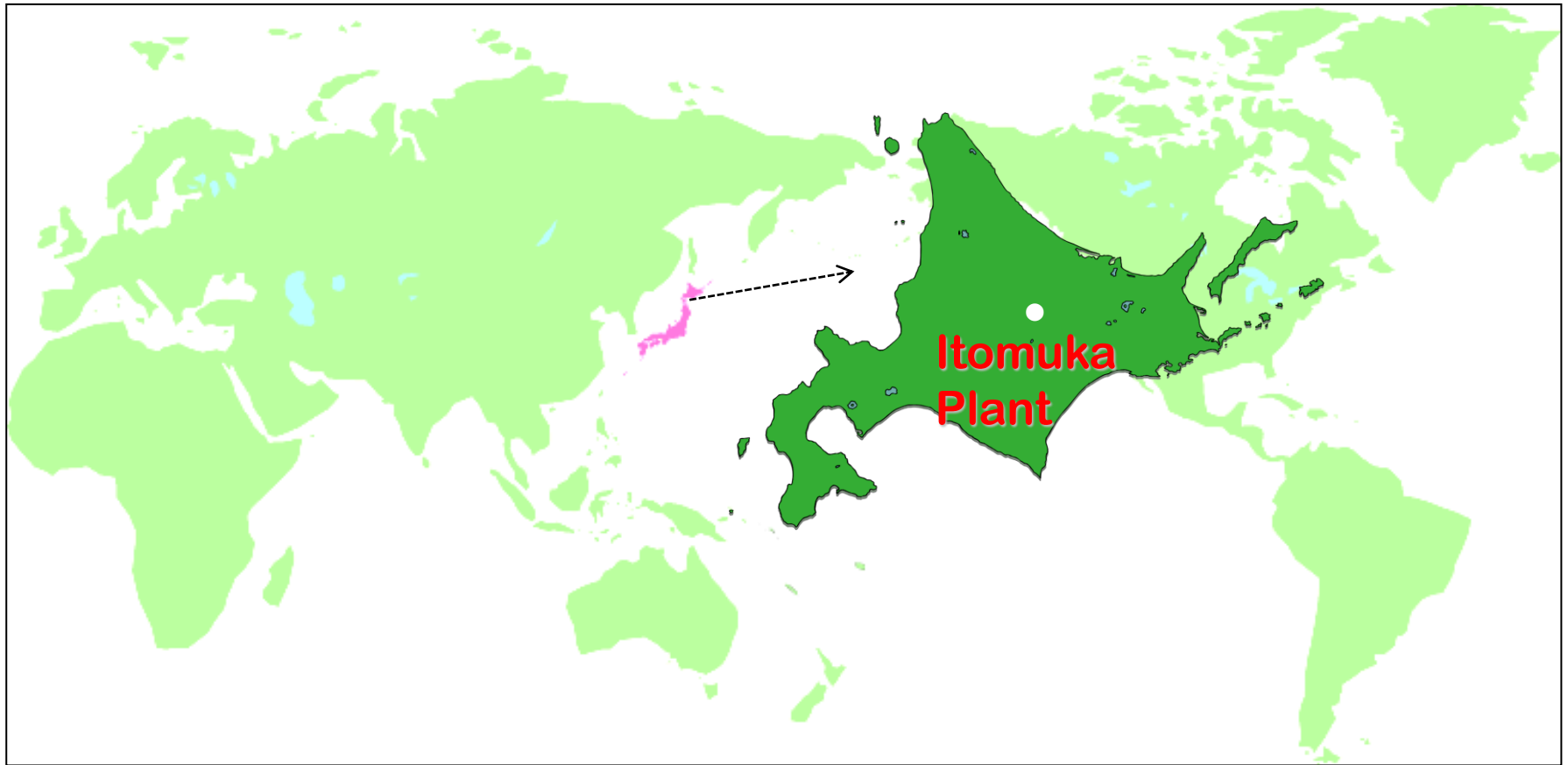
1. Overview of Nomura Kohsan
2. Treatment Process
3. Collection System
4. International activities



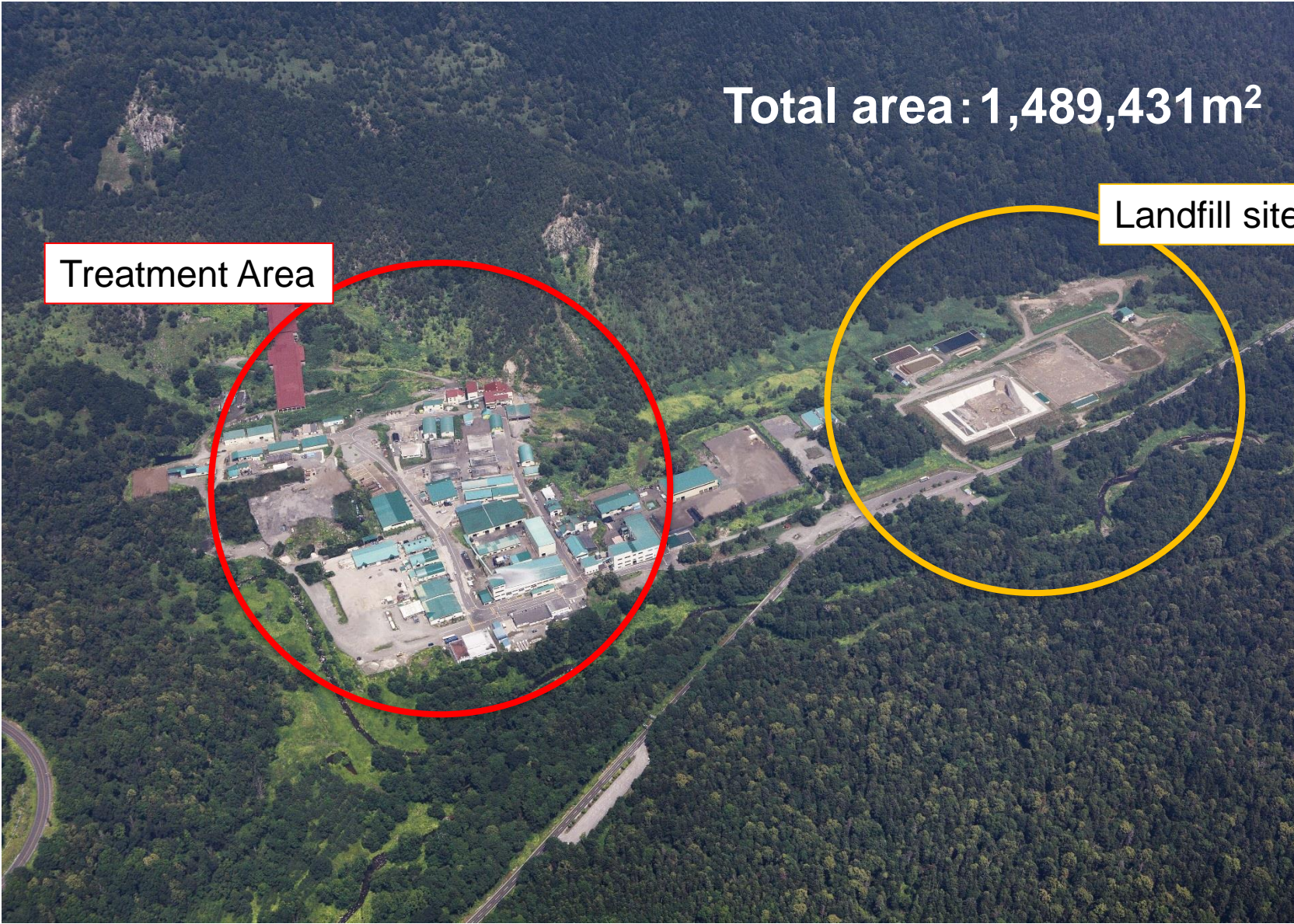
1. Overview of Nomura Kohsan



Overview of Nomura Kohsan



Overview of Nomura Kohsan



Treatment Area

Landfill site

Total area: 1,489,431 m²



History

- 1936 Itomuka mine was discovered
- Apr. 1939 Nomura Mining Co., Ltd. began operations
- Dec. 1973 Nomura Kohsan Co., Ltd. established
- Apr. 1974 Itomuka Mine was closed
- Jul. 1974 Nomura Kohsan took over all of Nomura Mining's plants and technology. Started management business of industrial wastes and municipal wastes
- Jul. 1985 Demonstration plant for recycling mercury containing wastes constructed (mainly used dry cell batteries)
- Aug. 1993 Waste fluorescent lamps recycling plant constructed
- Mar. 2004 Kansai Plant completed
- Feb. 2014 Nomura Kohsan joined two areas of UNEP GMP
- Apr. 2014 Nomura Kohsan signed a MoU with UNIDO
- Apr. 2018 Nomura Kohsan and UNIDO renew the MOU



Treatment Process



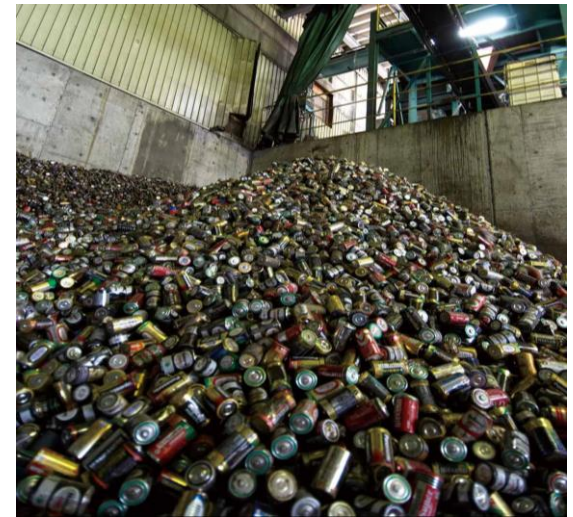
Overview of Nomura Kohsan

We treat a total of **33,400** tons
of mercury waste in 2020

-**16,700** tons of dry-cell batteries

-**9,000** tons of fluorescent lamps

-**7,700** tons of other types of waste



Used Fluorescent Lamp Recycling System

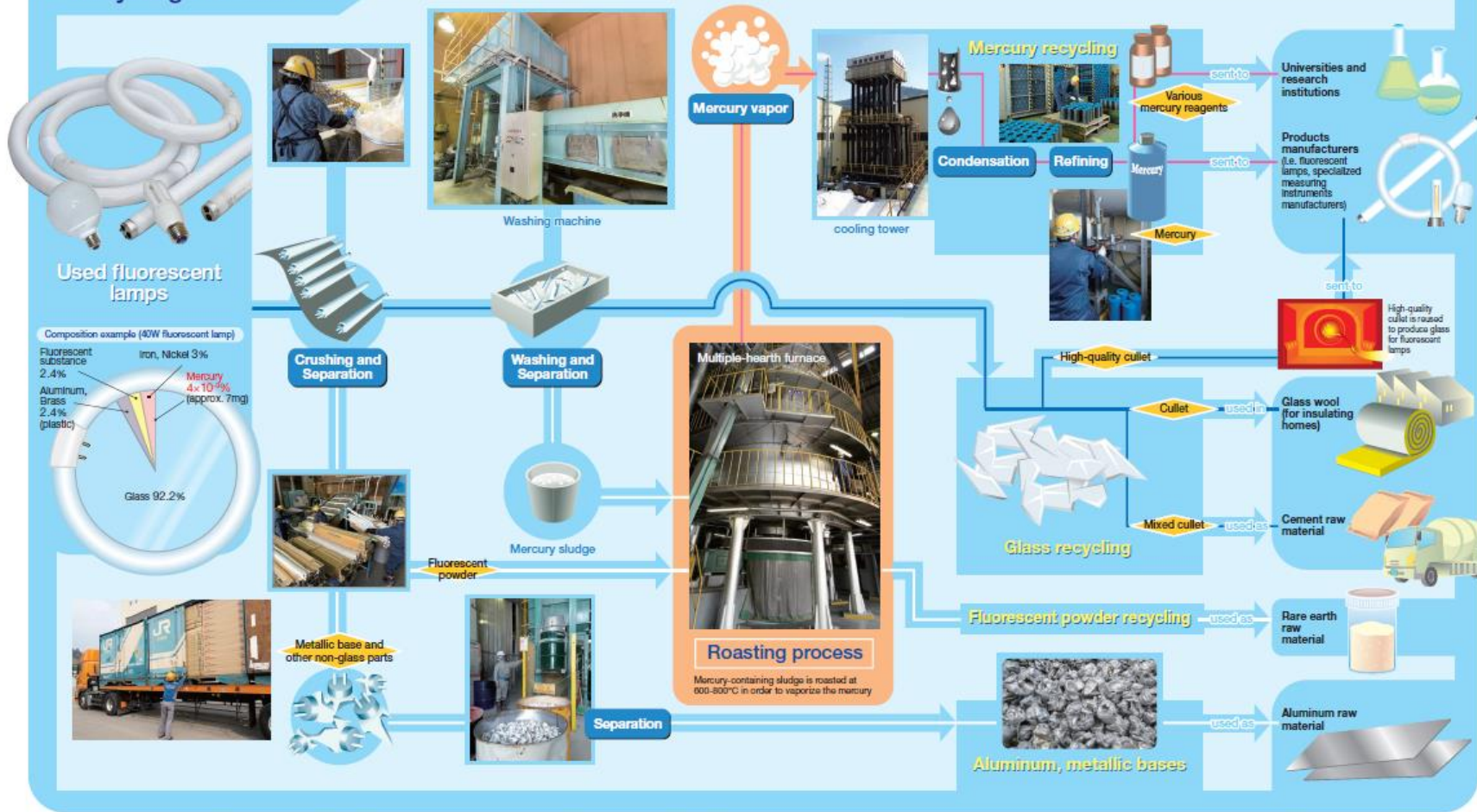


Used Fluorescent Lamp Recycling System



At Nomura Kohsan, used fluorescent lamp parts are crushed, separated, washed and made ready for distribution. Recycled glass can be transformed into glass wool insulation for homes and raw glass materials for fluorescent lamps. Recovered aluminum and metallic bases are converted into aluminum raw material. Mercury is recovered from wastewater and can be reused in new fluorescent lamps.

Recycling Process Flow



*For more information regarding plant visitations and where we deliver our recycled products, please contact our sales representative at info@nkl.jp

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Roasting process

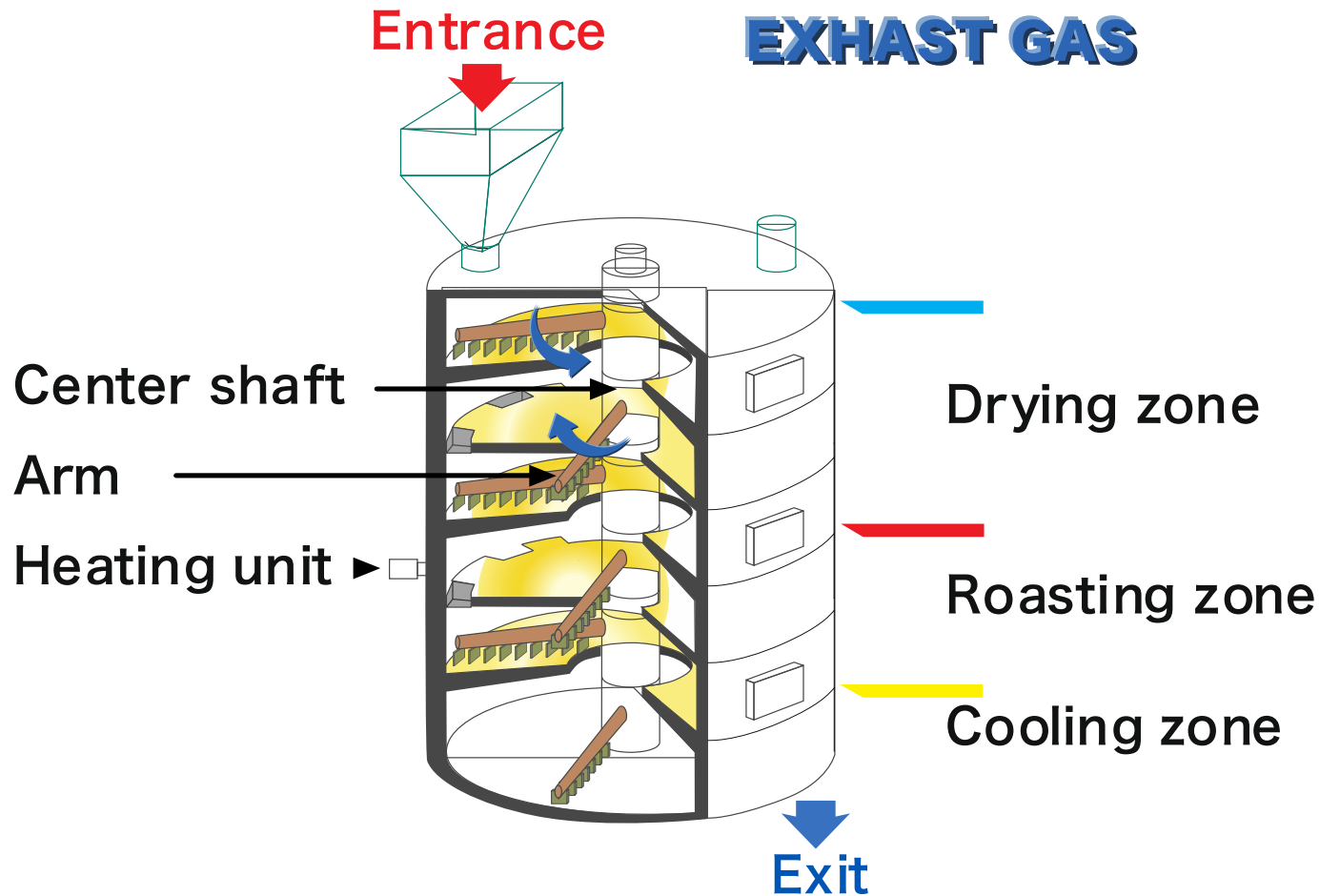
- Waste is heated at a temperature between 600°C to 800°C
- The mercury evaporates, which is then collected through a cooling process.



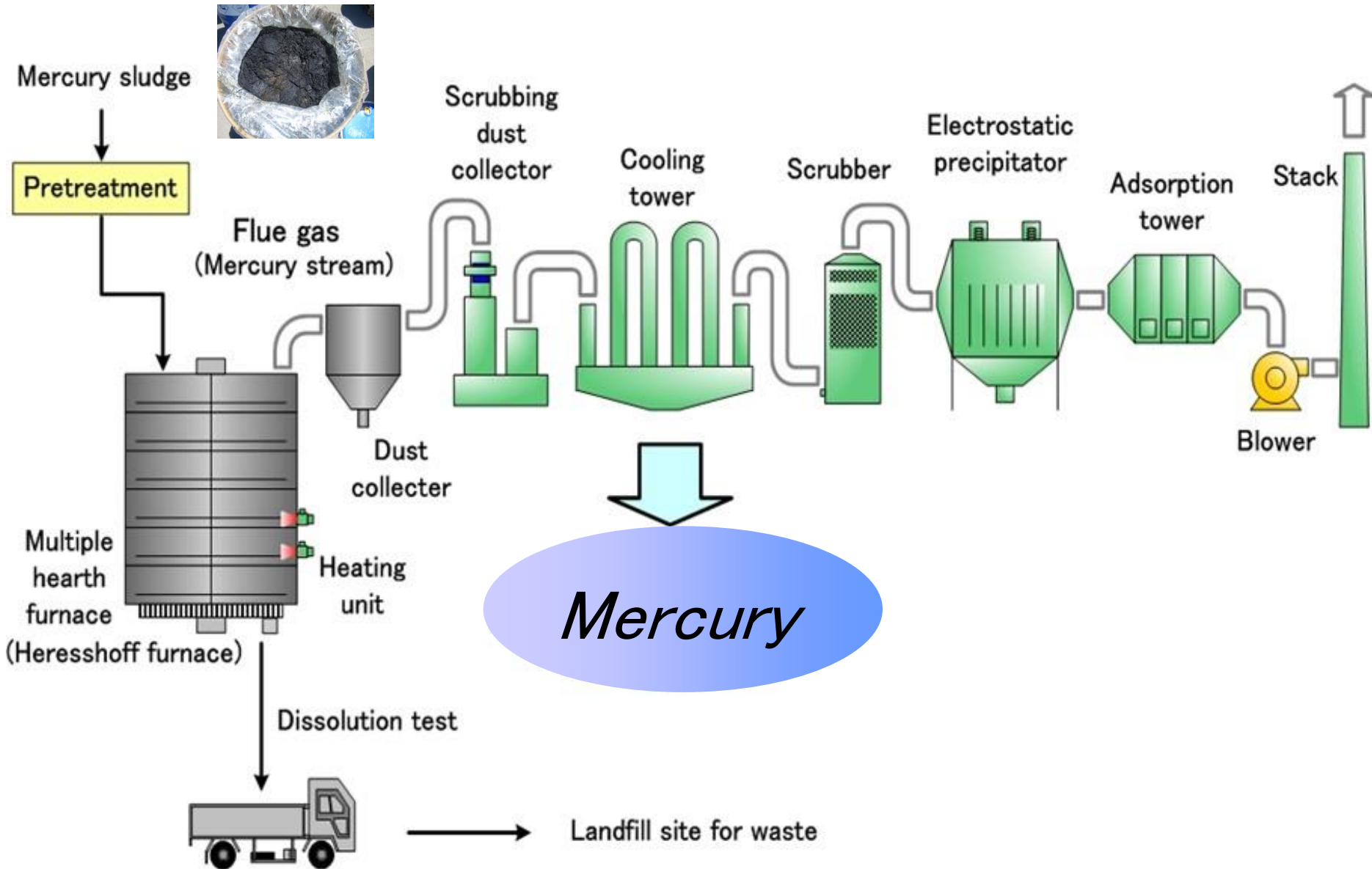
Roasting process



Herreshoff furnace



Mercury recovery system



Leachate-controlled Landfill Site



- Double water-sealing structure
- Reinforced concrete on the premises
- Only residues below the acceptance standard
(Under the Japanese Leaching Test $\leq 0.005\text{mg/L}$)
- Discharged water and groundwater regularly analyzed

Collection System

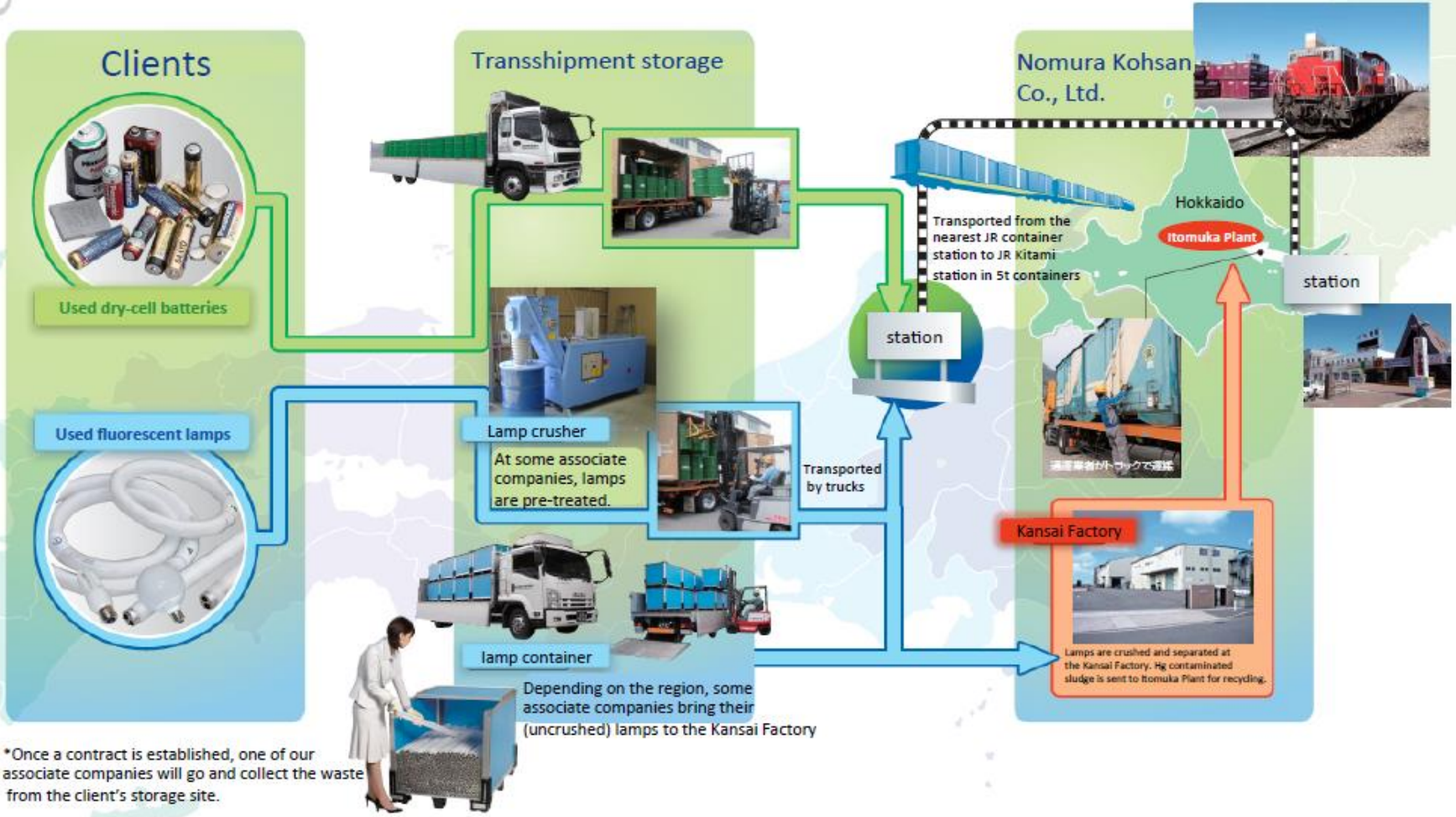


Nomura Kohsan distribution system

Nomura Kohsan Recycling Network

Used dry-cell batteries and fluorescent lamps are sent from associate companies to Nomura Kohsan

*The following chart is an example of our collection and transportation method



International activities



The Philippines

Conducted activities for the Philippines From 2014 to 2016

- 1) **Field surveys** (Manila, Cebu)
- 2) In-country **workshops** (Manila, Cebu)
- 3) **Training** in Japan
- 4) **Installation** of a **lamp crusher** for two local companies.



Imported crushed lamps to Itomuka plant

2017 30t

2019 13t

Macau

A local E-waste treater in Macau has a lamp crusher.

They collect and crush fluorescent lamps.

The treated lamps will be packed into drums and then exported to Itomuka plant in Japan under the Basel Convention.





Thank you!

For more information,
please contact: info@nkcl.jp
Or visit our website at: www.nkcl.jp



Nomura Kohsan Co., Ltd.

Sustainable financing for environmentally sound processing, recycling & disposal of mercury-added lamps

UNEP Global Mercury Partnership Webinar on Lamps

7 December 2021

Michael Bender, Executive Director

Mercury Policy Project

**Mercury
Policy Project**

Sustainable financing systems: ARFs & EPR

- An advanced recycling fee (ARF) is a separate charge paid by the consumer to cover end-of-life management cost.
- Cost Internalization, or EPR, involves having manufacturers and importers internalize end-of-life management costs into the product purchase price.
- OECD defines extended producer responsibility (EPR) as “an environmental policy approach in which a producer’s responsibility for a product is extended to the post-consumer stage of a product’s life cycle.”
- EPR therefore promotes a market in which prices reflect the environmental costs of products (OECD 2001a).

Advanced Disposal Fee (ADF) Programs

- Canadian provinces require sellers of mercury lamps must provide no-charge recycling system at end-of-life.
- In South Korea ADFs are imposed on producers of products that are more costly, difficult and hazardous.
- In Taiwan, manufacturers must provide ADFs to recycle.

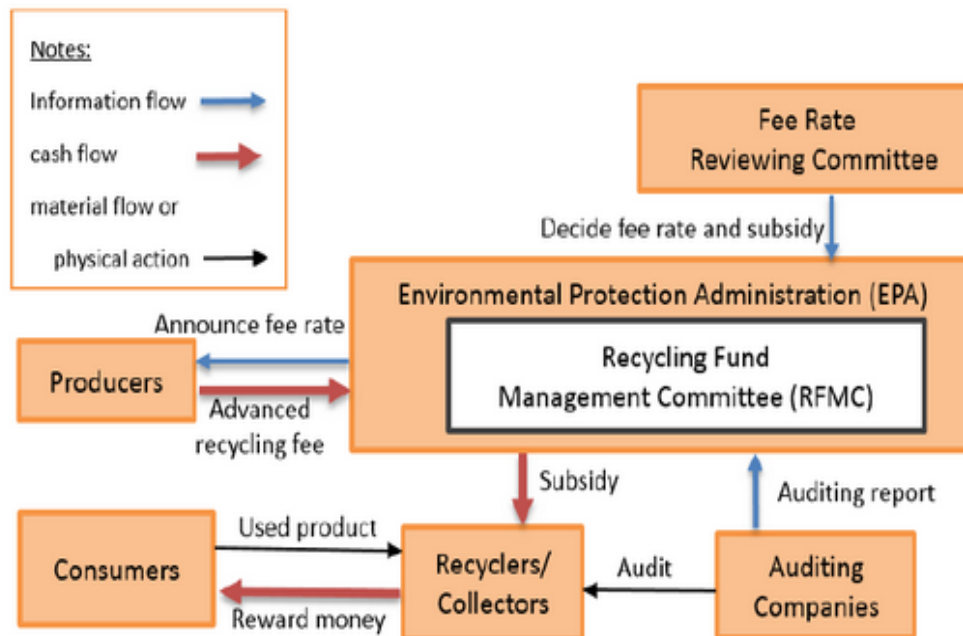


Figure 2. Extended producer responsibility (EPR) system in Taiwan [18].

EPR can achieve several objectives:

- 1) Relieve governments of financial/operational burden of waste disposal;
- 2) Design products for recycling and reduce quantity and hazards of material;
- 3) Increase collection rates for unwanted product discards;
- 4) Set performance standards
- 5) Increase recycling and innovations in recycling

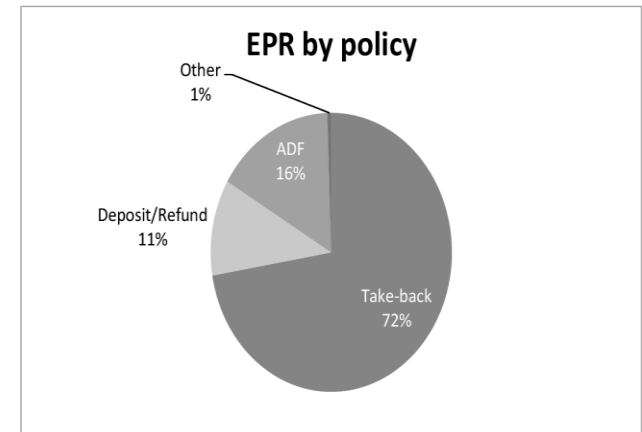
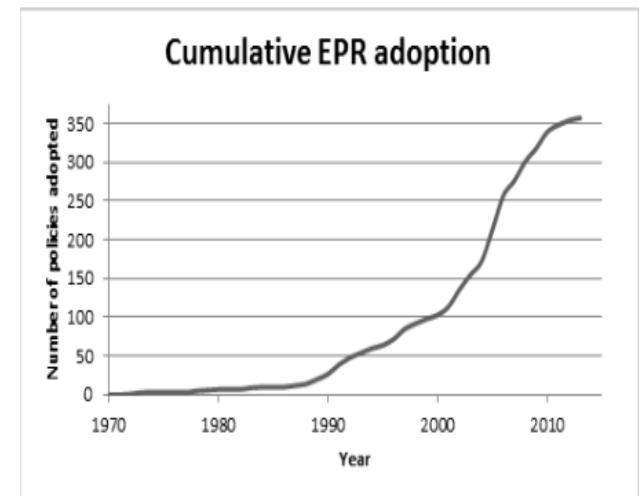


Figure 1. Cumulative EPR policy adoption over time.



Waste Electrical and Electronic Equipment Directive

- In the EU, WEEE Directive is implemented through EPR cost internalization
- Fosters competition among several stewardship organizations in one country.
- For example, establishment stewardship organizations in Austria reduced take back cost significantly within a 6-month period

“Philips supports the principle of Individual Producer Responsibility (IPR) as introduced in ...the WEEE Directive. We therefore actively cooperate with our industry partners, the recycling community and other stakeholders to further develop these systems and their supporting financial mechanisms to create the boundary conditions to make IPR work.”

-Philips statement on its website

Lamp makers support EPR in some countries but not others

- Lamp makers support recycling under EU 'Waste of Electrical and Electronic Equipment' (WEEE)
- However, some companies refused to accept responsibility for the management of lamps mandated under India's 2016 E-waste Rules.
- Instead they challenged government's notification by moving a petition in the Delhi High Court.
- A 2008 dialogue with lamp manufacturers in the USA did not reach consensus on who should pay for a sustainable collection and recycling system

Lamp recycling worldwide

- Most mercury-added lamps are haphazardly disposed of in trash or otherwise disposed of
- Small proportion recycled in certain countries:
 - 23% in the US
 - 6% in Brazil
 - 16%-50% EU wide
- Several countries report higher recycling rates
 - 80% in Austria and
 - 95% in Switzerland

(de Farias et al. [2020](#); Silveira and Chang [2011](#), (USEPA 2021e) https://www.researchgate.net/publication/280775669_Extended_producer_responsibility_for_lamps_in_Nordic_countries_best_practices_and_challenges_in_closing_material_loops)



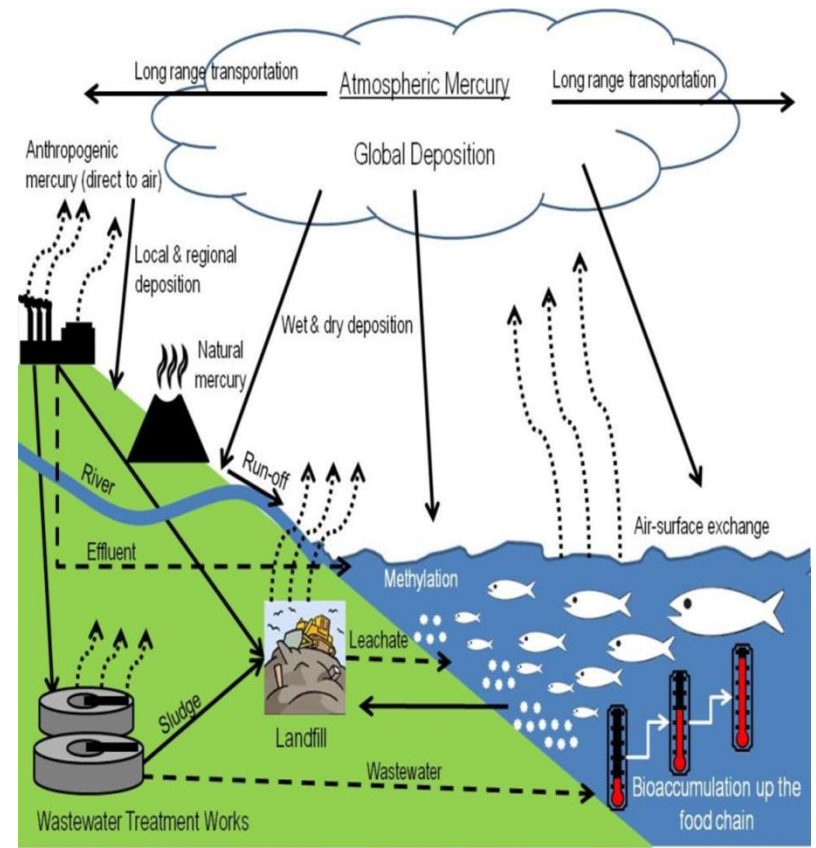
Drum top crushers consolidate lamps



- Drum-top crushers (DTCs) fit on the top of a 55 gallon drum and crush fluorescent lamps
- DTCs are used to reduce the volume of waste lamps, consolidate storage and reduce shipping costs
- Mercury releases occur when emptying drums
- End product is often designated as a hazardous waste
- Several US states prohibit the use of drum-top crushers
- Especially in warm climates, better to operate DTCs outside to reduce worker exposure

Mercury lamp management challenges

- Many mercury vapor lamp breakage release pathways
- Lamps are fragile to handle and can pose a risk for workers, and the disadvantaged
- Compared to the value of the product, relatively high cost for lamp recycling
- Low or negative value of recovered material from lamp waste, often hazardous, are more often costly to manage



Continent	Est. price per CFL recycled	Est. price per tube recycled	Recycling/disposal method
Central America	1.00 USD	1.25 USD	In country ES disposal
Australia	1.76 USD per kilo	Charge by kilo	Recycled into new product
North America	0.90 USD; usually priced by pound or kilo	0.52 USD; different price for crushed lamps	Recycled into new product; In country ES disposal; Stored
Africa	1.5 USD	2.00 USD	Exported for ES disposal
Europe	2.00/3.00 USD (2007 data)	1.90/2.60 USD (2007 data)	Recycled into new product

Cost of recycling fluorescent lamps

Summary

- Many countries lack hazardous waste infrastructure for ESM, Hg disposal
- This makes managing lamps and other discards more challenging & expensive
- Countries are looking for sustainable financing, including ADFs or EPR, to cover end-of-life management.
- Minamata Convention recommends “interim storage,” but not time limited
- Longer interim storage occurs, more likely mercury is mismanaged, goes out “the back door” (ie ASGM) and/or results in future contaminated sites, potentially undermining Convention effectiveness





For more information, email:

mercurypolicy@gmail.com

Thank you!

**Mercury
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Questions and Answers



Closing remarks

Teeraporn Wiriwutikorn, Ministry of Natural Resources and Environment, Thailand and Co-chair of the Partnership Advisory Group
