

Mercury and RoHS: The link between environmental regulations and efficiency

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Scholand)

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Michael Scholand, CLASP Europe
Peter Bennich, Swedish Energy Agency



Efficient Appliances for People & the Planet

Introduction – 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



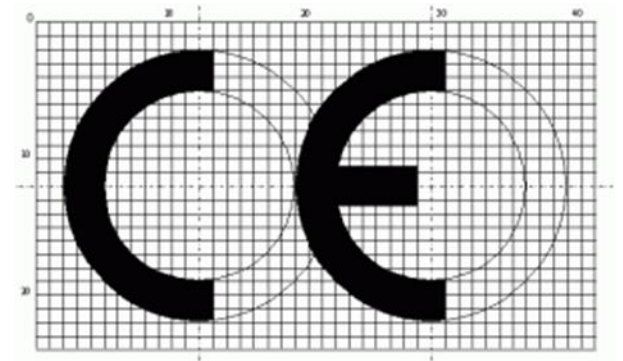
Background on RoHS Directive

- 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



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

Timeline of Events, 2016 to today....

Date	RoHS Directive	Ecodesign Directive
Jun 2016	Öko-Institut identifies mercury-free LED alternatives and recommends phase-out of common fluorescent lamps by 2018	Review study completed and preparation of regulation (EU) 2019/2020; launch of impact assessment
Oct 2016	DG ENV announces launch of new Socioeconomic Impact Assessment (SEIA)	
Dec 2017		DG ENER publishes first draft of regulation (EU) 2019/2020, proposing phase-out of fluorescent lamps in September 2020.
Jul 2018		DG ENER publishes revised draft, proposing a linear fluorescent lamp phase-out one year later, September 2021.
Dec 2018		Regulatory Committee votes on lighting regulation, and delays the phase-out of T8 fluorescent to September 2023; T5 fluorescent remain on the market.
Sep 2019	Draft of the SEIA circulated; data on mercury-free LED alternatives is from 2013-15 and does not reflect current product offering	
Dec 2019	Sweden-CLASP publish first Report (SEA-CLASP, 2019)	
Feb 2020	DG ENV convenes a small technical meeting of LightingEurope and European Environmental Bureau to discuss fluorescent exemptions	
Mar 2020	Sweden-CLASP publish second Report, (SEA-CLASP, 2020a)	
Jul 2020	DG ENV publishes the final update to the SEIA (Öko-Institut, 2020); Sweden-CLASP publish third Report (SEA-CLASP, 2020b)	
May 2021	DG ENV has not yet published their draft position on the Commission's "Have Your Say" webpage.	

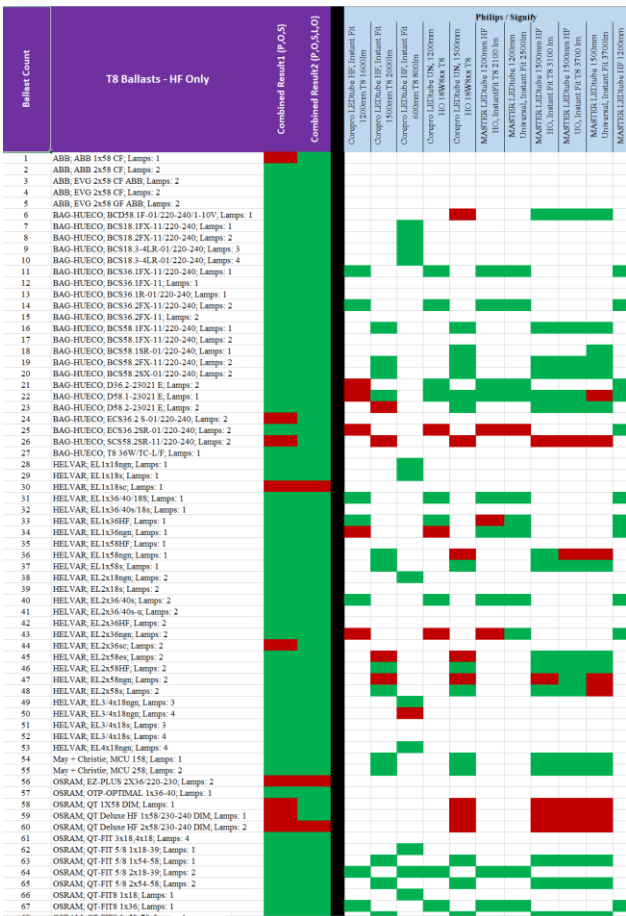
RoHS could accelerate market transformation for lighting



“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.”

Are there Mercury free alternatives?

- **Yes**, literally tens of thousands of mercury-free LED retrofit lamps
- Different diameters, lengths, ballast types (magnetic and electronic), colour temperatures, and light output
- Products sold today do not need to rewire the old fluorescent fixture:
 - **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”
 - **Tungsrham** says in addition to “the 2.5-3x longer life (compared to T8 fluorescent)....LED T8 tubes provide lower system loss while existing fixtures remain intact.”
- Sweden-CLASP **database** (pictured) shows 91-93% of existing fluorescent fixtures can accept drop-in retrofit LED lamps



Ballast Count	T8 Ballasts - HF Only	Combined Results (P.O.S)	Philips/Signify
1	ABB, ABB 1x58 CF, Lamps: 1		
2	ABB, ABB 2x58 CF, Lamps: 2		
3	ABB, EVO 2x58 CF, ABB, Lamps: 2		
4	ABB, EVO 2x58 CF, Lamps: 2		
5	ABB, EVO 2x58 GF, ABB, Lamps: 2		
6	BAG-HUECO, BCD58 1F-01 220-240 1:10V, Lamps: 1		
7	BAG-HUECO, BCD58 1FX-11 220-240, Lamps: 1		
8	BAG-HUECO, BCD58 2FX-11 220-240, Lamps: 2		
9	BAG-HUECO, BCD58 3-4LR-01 220-240, Lamps: 3		
10	BAG-HUECO, BCD58 3-4LR-01 220-240, Lamps: 4		
11	BAG-HUECO, BCD58 1FX-11 220-240, Lamps: 1		
12	BAG-HUECO, BCD58 1FX-11, Lamps: 1		
13	BAG-HUECO, BCD58 1R-01 220-240, Lamps: 1		
14	BAG-HUECO, BCD58 2FX-11 220-240, Lamps: 2		
15	BAG-HUECO, BCD58 2FX-11, Lamps: 2		
16	BAG-HUECO, BCD58 1FX-11 220-240, Lamps: 1		
17	BAG-HUECO, BCD58 1FX-11 220-240, Lamps: 2		
18	BAG-HUECO, BCD58 1R-01 220-240, Lamps: 1		
19	BAG-HUECO, BCD58 2FX-11 220-240, Lamps: 2		
20	BAG-HUECO, BCD58 2FX-01 220-240, Lamps: 2		
21	BAG-HUECO, D58 2-23021 E, Lamps: 2		
22	BAG-HUECO, D58 2-23021 E, Lamps: 1		
23	BAG-HUECO, D58 2-23021 E, Lamps: 2		
24	BAG-HUECO, ECD58 2 5-01 220-240, Lamps: 2		
25	BAG-HUECO, ECD58 2R-01 220-240, Lamps: 2		
26	BAG-HUECO, ECD58 2R-11 220-240, Lamps: 2		
27	BAG-HUECO, T8 36W/TC-LF, Lamps: 1		
28	HELVAR, EL1x18g, Lamps: 1		
29	HELVAR, EL1x18g, Lamps: 1		
30	HELVAR, EL1x18g, Lamps: 1		
31	HELVAR, EL1x36 40-18, Lamps: 1		
32	HELVAR, EL1x36 40-18, Lamps: 1		
33	HELVAR, EL1x36HF, Lamps: 1		
34	HELVAR, EL1x36g, Lamps: 1		
35	HELVAR, EL1x36HF, Lamps: 1		
36	HELVAR, EL1x36g, Lamps: 1		
37	HELVAR, EL1x58g, Lamps: 1		
38	HELVAR, EL2x18g, Lamps: 2		
39	HELVAR, EL2x18g, Lamps: 2		
40	HELVAR, EL2x36 40-18, Lamps: 2		
41	HELVAR, EL2x36 40-18, Lamps: 2		
42	HELVAR, EL2x36HF, Lamps: 2		
43	HELVAR, EL2x36g, Lamps: 2		
44	HELVAR, EL2x36g, Lamps: 2		
45	HELVAR, EL2x58g, Lamps: 2		
46	HELVAR, EL2x58HF, Lamps: 2		
47	HELVAR, EL2x58g, Lamps: 2		
48	HELVAR, EL2x58g, Lamps: 2		
49	HELVAR, EL3-4x18g, Lamps: 3		
50	HELVAR, EL3-4x18g, Lamps: 4		
51	HELVAR, EL3-4x18g, Lamps: 3		
52	HELVAR, EL3-4x18g, Lamps: 4		
53	HELVAR, EL4x18g, Lamps: 4		
54	May - Christie, MCU 158, Lamps: 1		
55	May - Christie, MCU 158, Lamps: 2		
56	OSRAM, E2, PLUS 2x36 220-230, Lamps: 2		
57	OSRAM, OPT-OPTIMAL 1x36-40, Lamps: 1		
58	OSRAM, QT 158 DM, Lamps: 1		
59	OSRAM, QT Deluxe HF 1x58 220-240 DM, Lamps: 1		
60	OSRAM, QT Deluxe HF 2x58 220-240 DM, Lamps: 2		
61	OSRAM, QT FIT 2x18 4x18, Lamps: 4		
62	OSRAM, QT FIT 5 8 1x18-39, Lamps: 1		
63	OSRAM, QT FIT 5 8 1x54-58, Lamps: 1		
64	OSRAM, QT FIT 5 8 2x18-39, Lamps: 2		
65	OSRAM, QT FIT 5 8 2x54-58, Lamps: 2		
66	OSRAM, QT FIT 1x18, Lamps: 1		
67	OSRAM, QT FIT 1x36, Lamps: 1		

What are the Benefits?

- Although not a criterion for RoHS, payback periods are very short:
 - T8 LED retrofit lamp: 4-10 month payback, lasts 2-3 times longer
 - T5 LED: 1.1 – 1.4 year payback, lasts 16 years
 - CFLni LED: 1.2 – 2.7 year payback and lasts 2-3 times longer

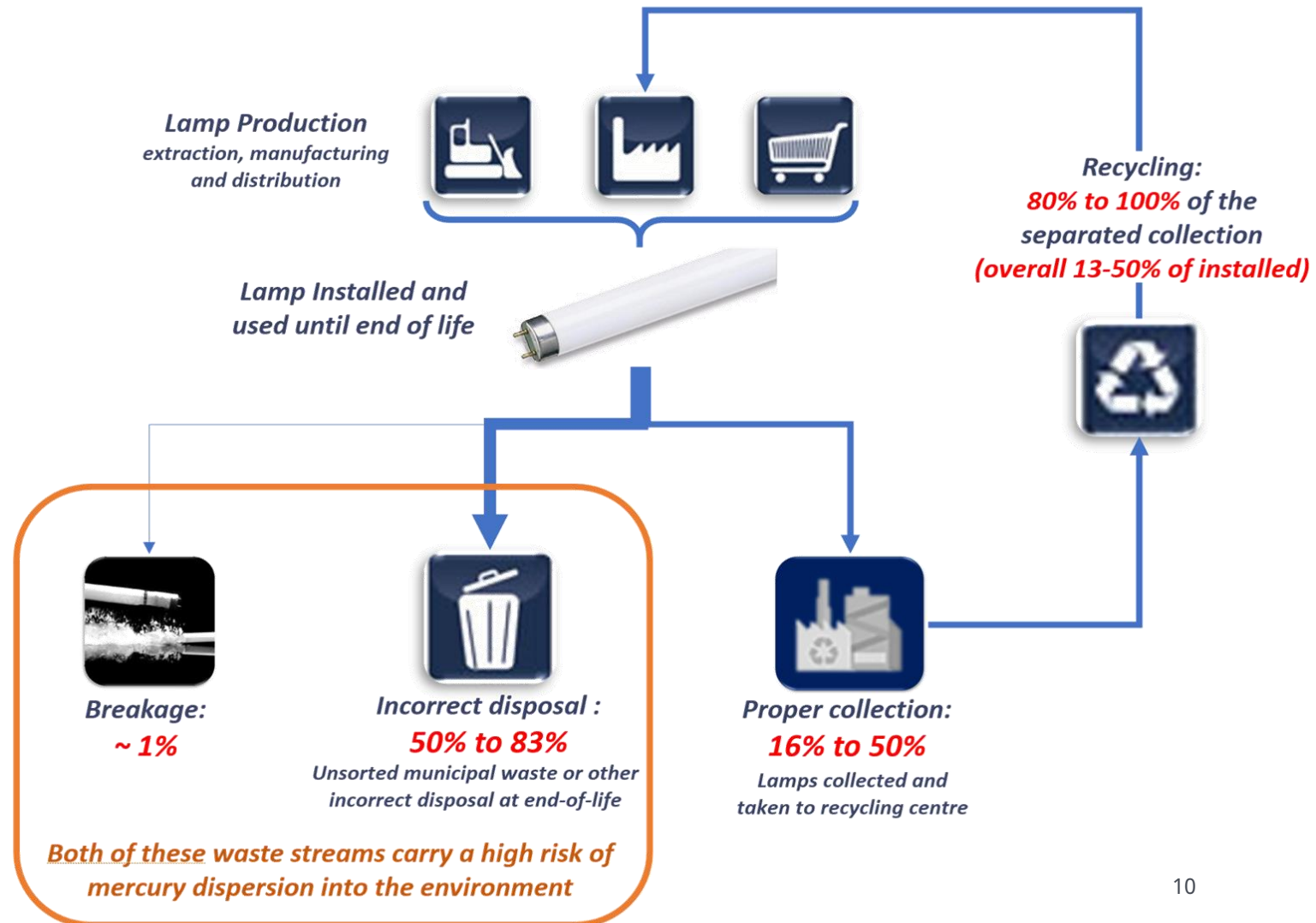


Oko-Institute and VHK study* calculated benefit for T5, T8 and CFLni phase-out	Savings (cumulative to 2035)
Hg Savings: from lamps (2.9 metric tonnes) and power stations due to electricity savings (2.5 metric tonnes).	5.4 metric tonnes Hg
Financial Savings: Billions of Euros saved by businesses and consumers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

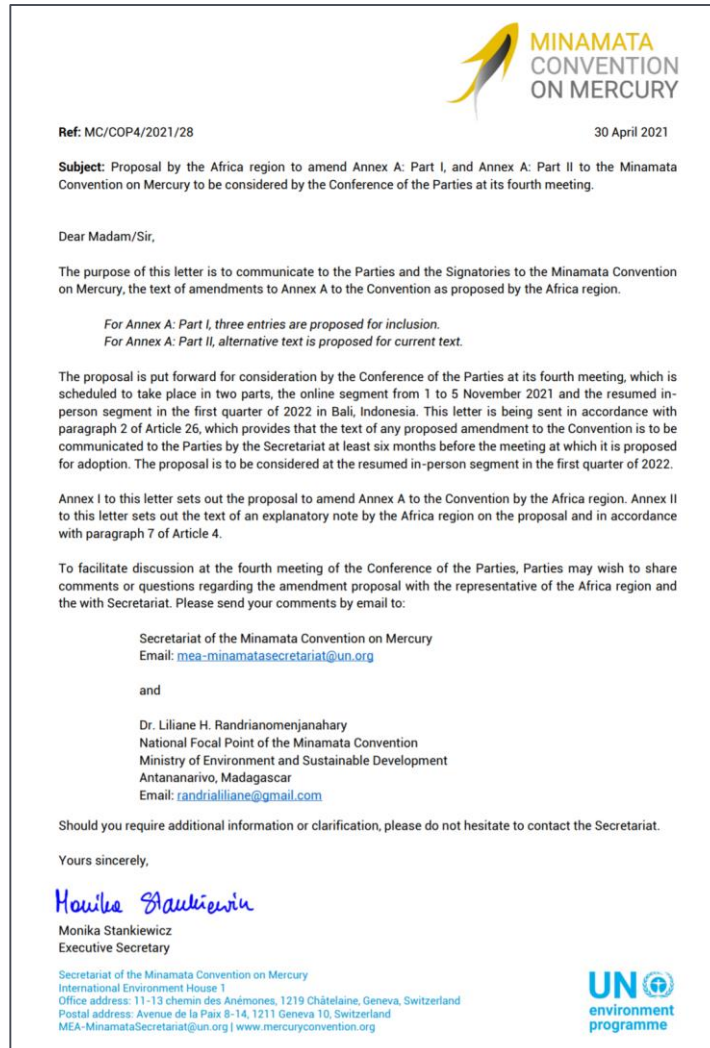
- Literature review across multiple Member States
- Claims for 100% recovery are misleading, the definition in the WEEE Directive divides by percentage collected and delivered to a recycling centre
- Bottom line: more than half of the mercury in the lamps is not disposed of properly – “incorrect disposal”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





- Launched in 2013 with the goal to “**Make Mercury History**”, currently has 131 Parties to the Convention
- Seeks to eliminate mercury in products and processes worldwide, but **includes exemptions for 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 by 2025 will accelerate a transition to LED lighting
- Conference of Parties (COP4) is launched in November 2021 with in-person negotiations in Q1/Q2 of 2022

African Amendment Proposed to COP4



- 30 April 2021 – the African Amendment on Lighting was circulated to all 131 countries
- Submitted by the African region – 36 countries, all Parties to the Convention
- Proposes to Amend the fluorescent lamp exemptions to phase-out the following:
 - Integrally ballasted CFLs by the end of 2024
 - Linear fluorescent lamps by the end of 2025
 - CCFL and EEFL by the end of 2024

Link:

http://www.mercuryconvention.org/Portals/11/documents/News/ES_Africa_Amendment_Proposal_April_2021.pdf

Global Benefits of Minamata Phase-Out of Fluorescent

- 3.3 billion fluorescent lamps sold in 2020; 5-10 mg/lamp => 16.5 to 33 tonnes Hg/year placed in the global market
- If *fluorescent* (LFL and CFL) is phased out in 2025 (cumulative, 2025-2050):
 - **232 metric tonnes of Hg** can be saved
 - **3.5 gigatonnes of CO₂** are avoided
- The Clean Lighting Coalition (CLiC) is a coalition of industry, public health authorities, mercury experts and NGO partners who are working together to eliminate toxic mercury in lighting through the Minamata Convention on Mercury.
- Visit website to learn more:
www.cleanlightingcoalition.org



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 of electricity (7 large coal powerplants over 15 yrs – [link](#));
 - 2.9 tonnes of mercury (plus 2.5 tonnes from avoided coal powerplant emissions)
- The RoHS fluorescent exemption amendment revision is delayed, and these delays are eroding the benefits
- 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.**

Thank you!
Any questions?



■ **Michael Scholand**

Senior Advisor | mscholand@clasp.ngo



■ **Peter Bennich**

Senior Policy Advisor, Swedish Energy Agency

peter.bennich@energimyndigheten.se

clasp.ngo



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Back-up Slide: Payback Period, T8 Linear Lamp

Table 2. Economic Analysis of T8 fluorescent vs. LED lamps in Europe²

Economic indicator description	T8 LFL	T8 LED-1	T8 LED-2	Units
Price for one lamp:	€3.68	€6.77	€12.74	<i>Euros/lamp</i>
Rated lamp wattage:	36	18	12.5	<i>Watts</i>
Rated lamp lifetime:	20,000	30,000	50,000	<i>Hours</i>
Annual electricity consumption (10 hr/day):	131	66	46	<i>kWh/yr</i>
Annual cost of electricity:	€16.48	€8.24	€5.72	<i>Euros/year</i>
Payback period in years:		0.38	0.84	<i>years</i>
Payback period in months:		4.5	10.1	<i>months</i>
Life-Cycle Cost, 13 years, net present value:	€223.40	€118.82	€87.12	<i>Euros (NPV, 2021)</i>
Life-Cycle Cost savings (net present value):		€104.58	€136.28	<i>Euros (NPV, 2021)</i>

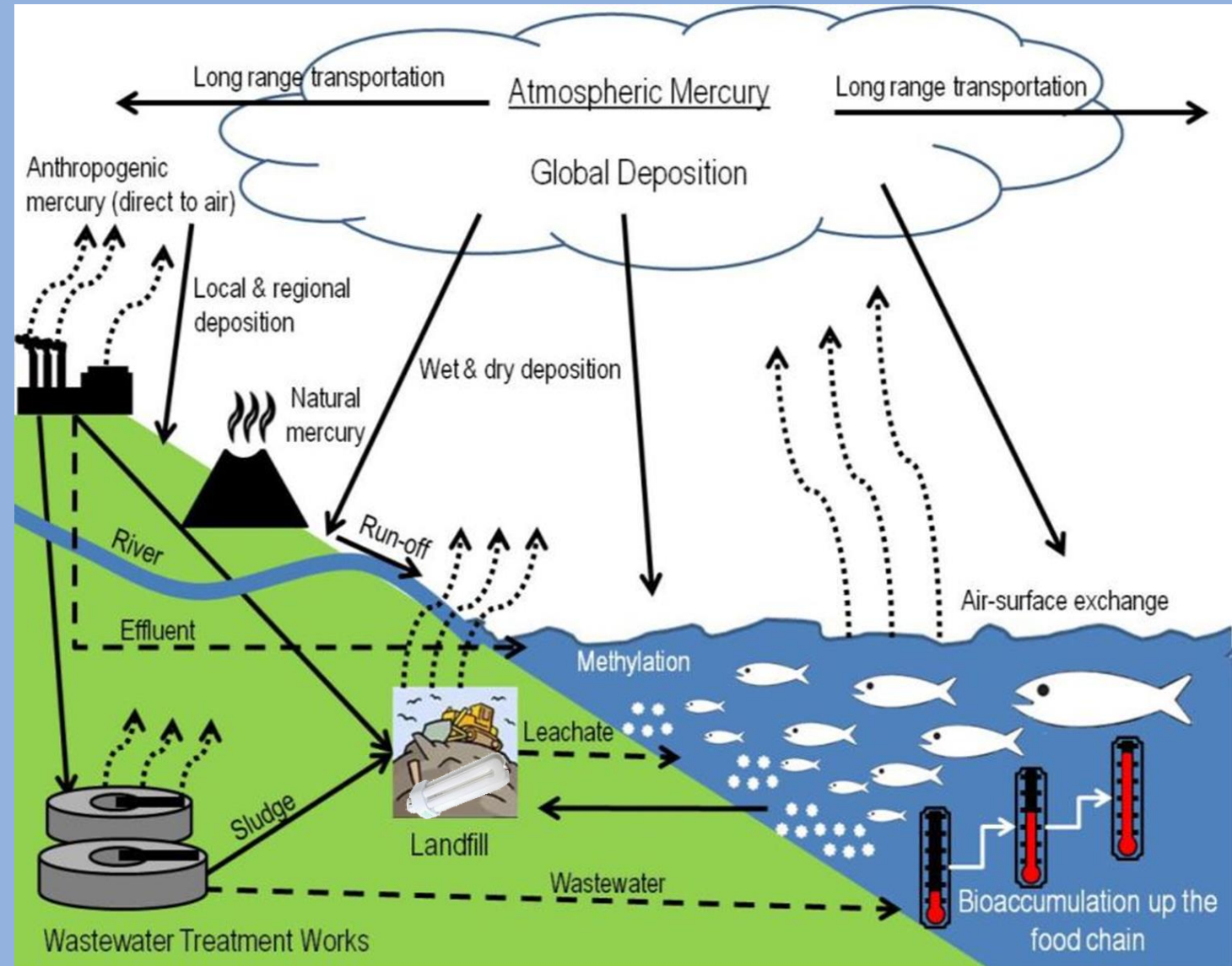
Minamata Annex A – Mercury Content Limits for Lighting

Part I: Products subject to Article 4, Paragraph 1

Mercury Added Products	Year
Compact fluorescent lamps (CFLs) for general lighting purposes that are ≤ 30 watts with a mercury content exceeding 5 mg per lamp burner	2020
Linear fluorescent lamps (LFLs) for general lighting purposes: (a) Triband phosphor < 60 watts with a mercury content exceeding 5 mg per lamp; (b) Halophosphate phosphor ≤ 40 watts with a mercury content exceeding 10 mg per lamp	2020
High pressure mercury vapour lamps (HPMV) for general lighting purposes	2020
Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for electronic displays: (a) short length (≤ 500 mm) with mercury content exceeding 3.5 mg per lamp (b) medium length (> 500 mm and $\leq 1\,500$ mm) with mercury content exceeding 5 mg per lamp (c) long length ($> 1\,500$ mm) with mercury content exceeding 13 mg per lamp	2020

MERCURY (Hg)

- Heavy metal, elemental Hg persistent, global pollutant
- Toxic to human health and the environment, especially to the developing nervous system
- Most toxic: Methylmercury, it bioaccumulates, biomagnifies, and passes placental & blood-brain barrier
- Possible carcinogen, tremors, insomnia, memory loss, neuromuscular changes, headaches, dementia
- In Europe, roughly one-third of all births (1.8 million babies) are born with methylmercury levels above the safe limit



Higher Impact in Developing and Emerging Economies

- Minamata can ensure all countries receive mercury-free LED retrofit lamps
- Avoid developing countries from becoming the dumping ground for hazardous linear fluorescent lamps
- Recycling – very low collection and recycling rates for linear fluorescent lamps (<10%); even best rates, such as Europe is only 12-50%
- Higher energy bills caused by inefficient fluorescent lighting harms low-income consumers
- Electrical grid supply – fluorescent requires double the energy per unit light compared to LED retrofit lamps

