



UV-C LED Technology

Ending the Mercury Exemption

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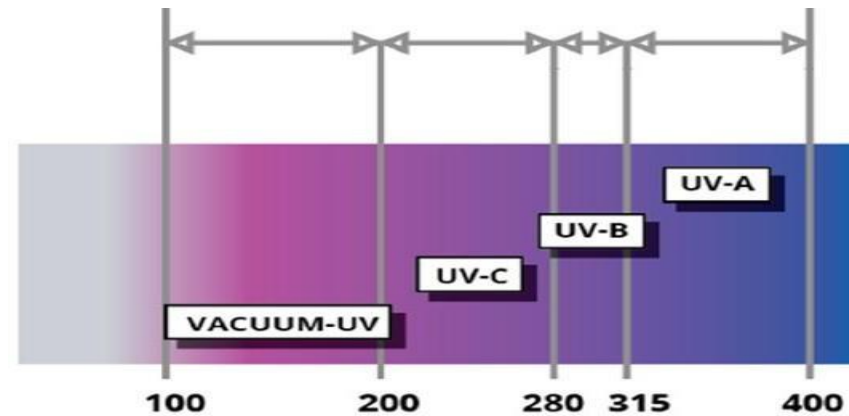
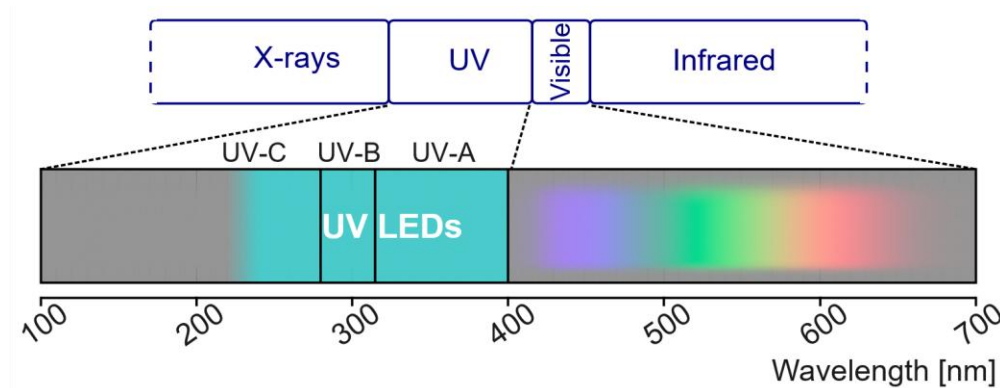
Agenda & Key Takeaway

1. What is UV-C Disinfection?
2. LED versus Mercury Comparison
3. Mercury Lamps – Toxicity & Restrictions
4. Application – Medical Device Disinfection
5. Applications – Water Purification
6. Conclusions and Key Takeaway

What is UV-C Disinfection

UV sits between visible light and x-rays on the electromagnetic spectrum

UV-C is in the 200-280nm range



UV-C photons penetrate organic cells and damage their DNA, rendering them incapable of reproduction (microbiologically inactive)



**Germicidal effects of UV-C
known for over 100 years**

**Niels Finsen – Nobel prize
1903 for UV-C treatment of
tuberculosis**

UV-C Emission Sources



Solid State LEDs

Longer lifespan, 25,000 to 30,000 hours

Capable of instant on/off cycling

Less prone to breakage

Compact and versatile

LOW TOXICITY

VS



Mercury Vapour Discharge Lamps

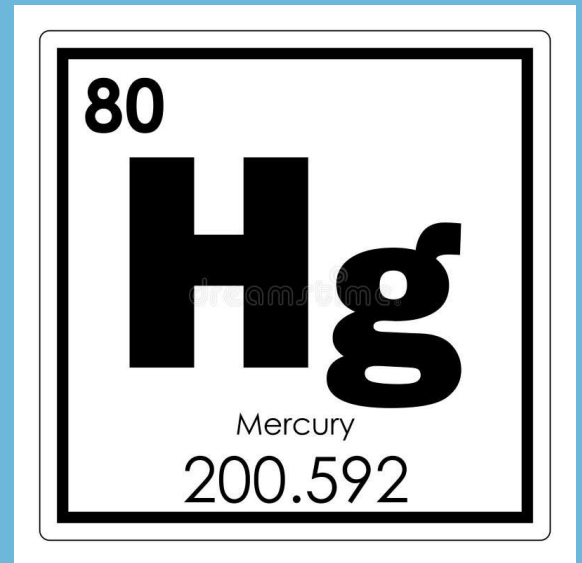
Shorter lifespan, 6,000 to 9,000 hours

Requires warm-up time to reach full intensity and can be negatively affected by frequent on/off cycling

More prone to breakage

Bulkier and less flexible

HIGHLY TOXIC (see panel)



Mercury is:

- a well-known neurotoxin, causing tremors, hearing impairment, paralysis and death
- One of the top 10 chemicals of major public health concern (World Health Organization)
- a priority pollutant under UN Minamata Convention
- Banned under Hazardous Substance Regulations (but exempted at present for germicidal UV)
- Mining restrictions from 2032

Mercury: Regulatory & Legal Landscape

Global consensus to eliminate Mercury products



Core Mechanisms

Restrict product sales

Restrict Raw Material Supply

Europe (RoHS)

- Allowed by exemption until 2027
- 2027 extension?
- **Stakeholder Consultation started in May 2026**

TODAY

2023

COP-5 --- held in Geneva, Switzerland.

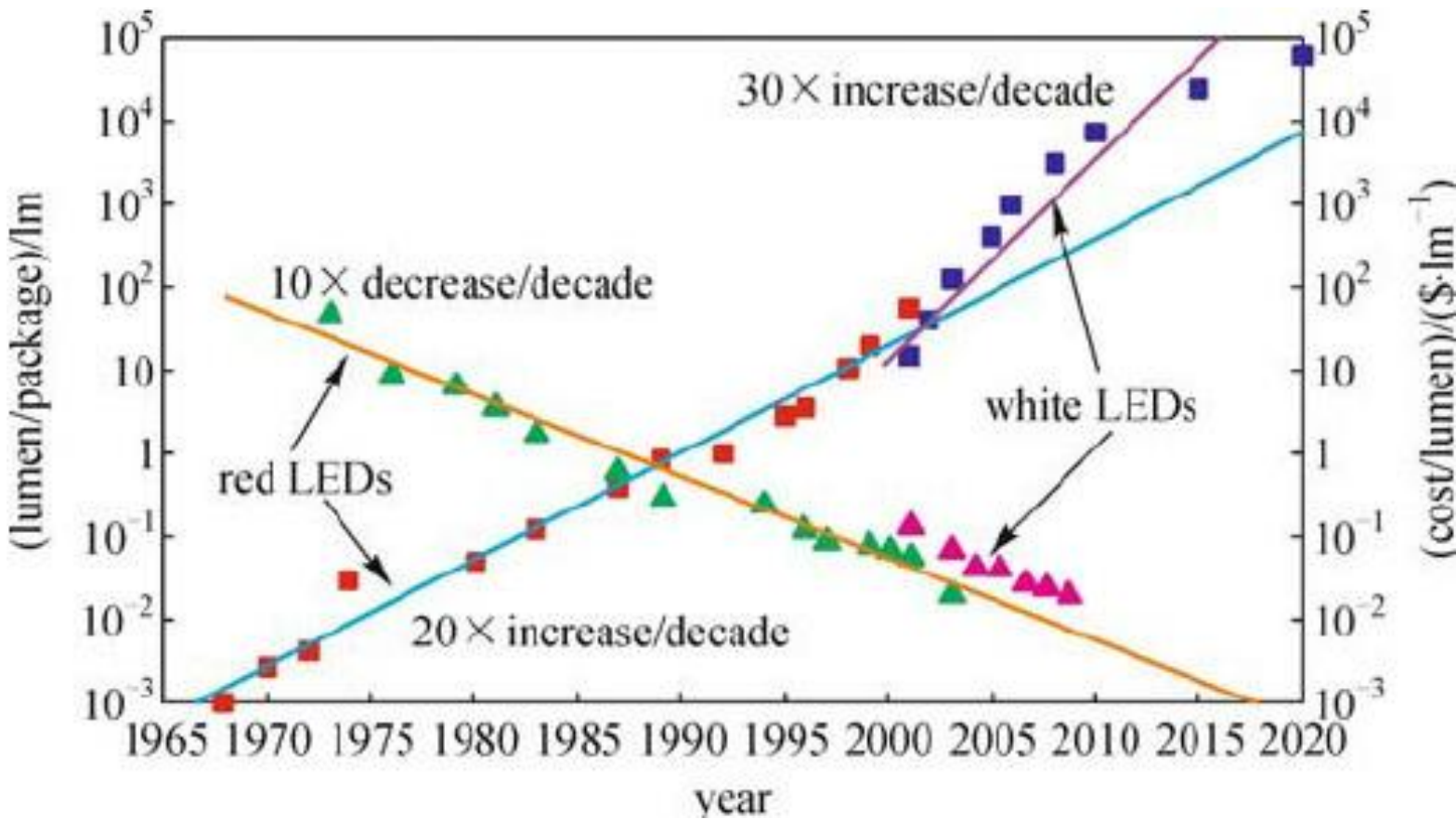
2032

Deadline for ending **primary mercury mining** in known producing parties.

<https://minamataconvention.org/en/about/timeline>

LED Technology

What happened in lighting?



Different applications ready at different times



Emergency – 2007
(100 lumens)



Halogen – 2009
(300 lumens)



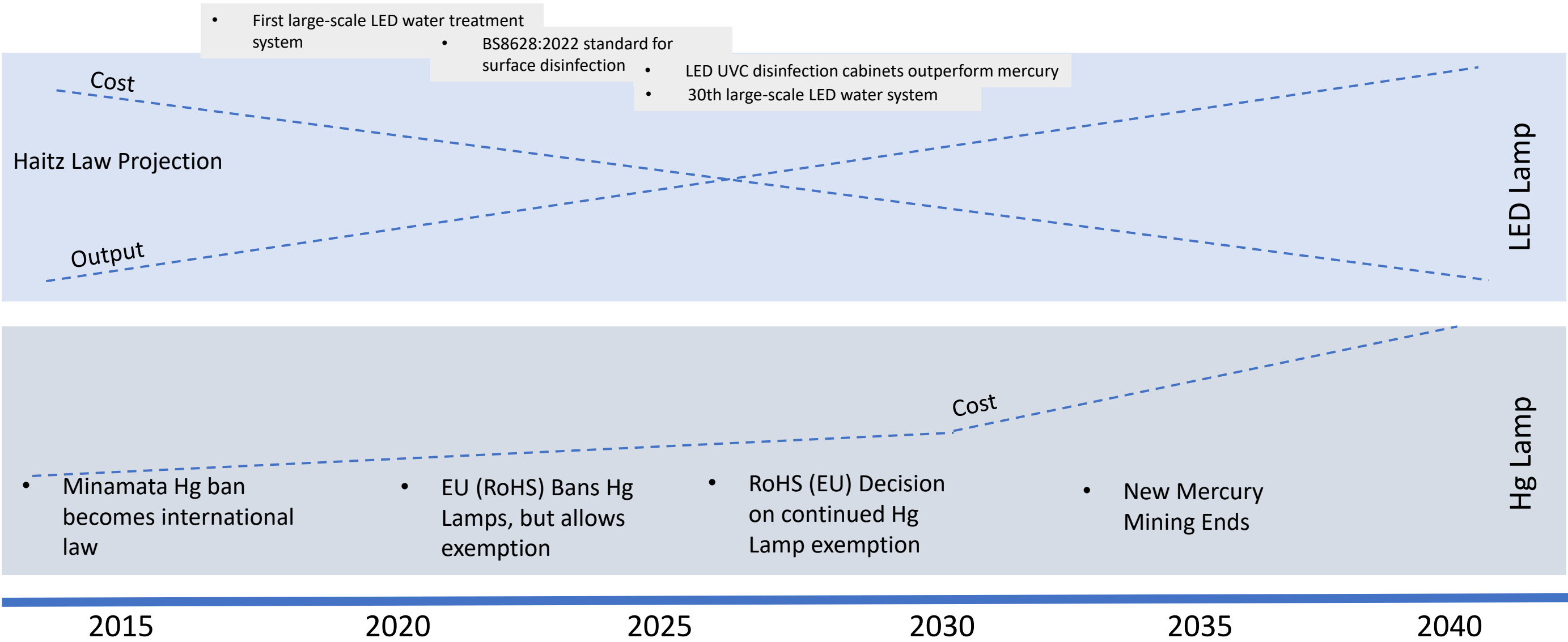
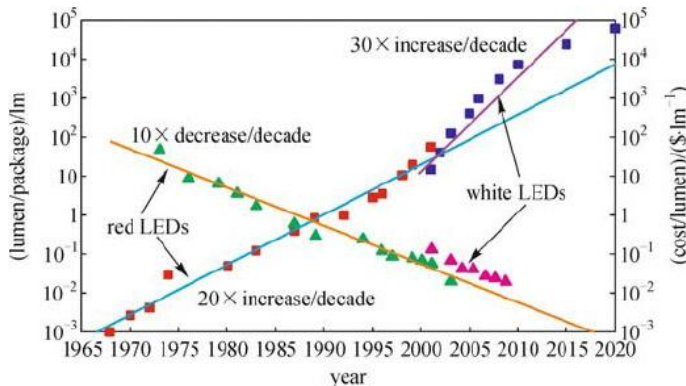
HID Spot – 2012
(2000 lumens)



Fluorescent – 2014
(3500 lumens)

LED Technology

What happened in lighting is repeating in UV-C





Enclosed Chamber Medical Device Disinfection Example

NOT YET high power room disinfection (but that will come, remember lighting)

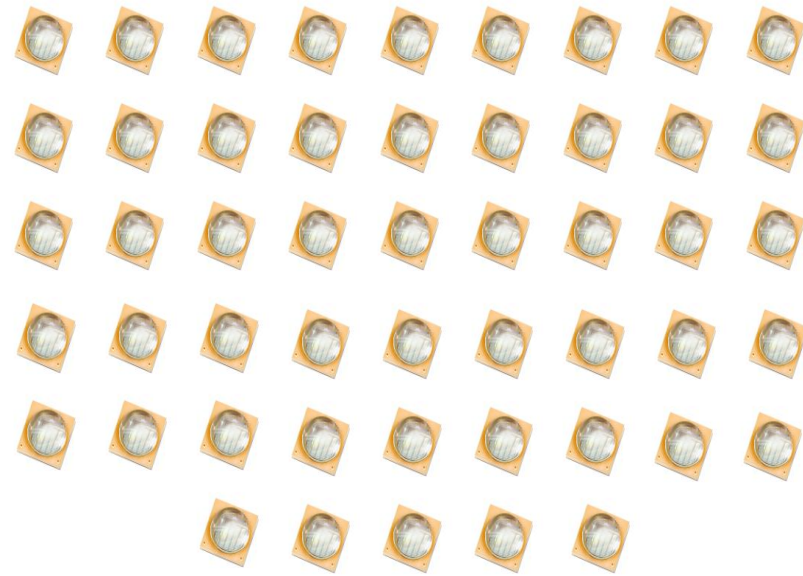
In scope



Out of scope



Its about the system...



50 LED chips
Distributed around box inner walls
UVC from all directions

MINIBOX-HD2



Reflectors that are 90% reflective
at the UVC wavelength
>50% of the UVC landing on the device
comes from a reflector, not direct from an LED
This addresses the old shadowing concern

Outcome

BS8628:2022 high level disinfection
in 5 minutes

6.8 log reduction on video
laryngoscopes

6.1 log reduction on laryngoscope
handles

5.3 log reduction on anaesthetic
masks

With more case studies emerging

Minibox HD2 achieves this in 5
minute cycles at just 115W power
(*<1 minute of Henry Hoover*)

0.01kWh of energy

0.2 pence per cycle

LED vs Mercury lamp application comparison

ENT Scope example

Technology	No. of sources	Dose (mJ/cm2)	Cycle time (mins)	Dose per minute	Wattage	Wavelength (nm)	BS8628	Size	MDR Class	Cost indication	Maintenance
LED 	108 More sources avoid shadowing	900	5 (to achieve BS8628)	180	600	265 Optimised for DNA/RNA absorption	Yes	1300 x 600 x 450	Ila	Lower	Included in price package
Hg lamps 	4	200	1.5 (but does not achieve BS8628)	133	650	254	No	2033 x 473 x 861	Ila	Higher	



TALLBOX-HD2

BS8628:2022

A standardized method for testing the efficacy of UV-C disinfection devices to achieve a high level of disinfection

minimum tests for full standard claim

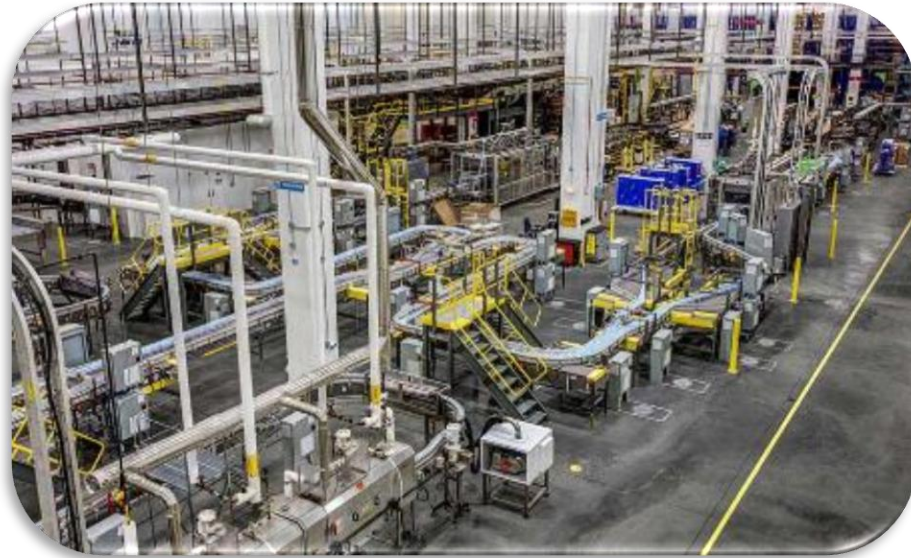
Category	Organism	Relevance	Log Reduction Target
Bactericidal	<i>Ent. Hirae</i>	VRE	>5
	<i>Staph. Aureus</i>	MRSA	>5
	<i>E. Coli</i>	<i>E. Coli</i>	>5
	<i>Act. Baumanii</i>	MDR	>5
Yeasticidal/ Fungicidal	<i>Candida Albicans</i>	<i>Candida Auris</i>	>4

Not just about the data – also about the test methodology and organism selection

Key facts:

- The first standard that covers the requirements and methodology for testing the efficacy of UV devices
- Disinfection using ultraviolet radiation – Methods for quantitative testing of automated ultraviolet disinfection activities by direct illumination
- Determination of bactericidal, mycobactericidal, sporicidal, yeasticidal, fungicidal, virucidal and phagocidal activities

Applications in Water Purification



Pharmaceutical



Drinking Water



Data Centres



Wastewater

Key Reasons for Hg to LED Switch:

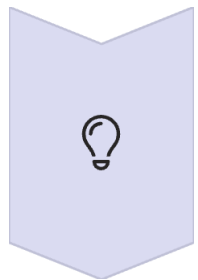
- High switching frequency
- 2032 Mercury mining ban impact on future lamp price & availability
- Impact on 20-year OpEx calculation
- Corporate ESG Goals
- Reduced Maintenance Costs
- Increased process yield
- Small footprint

Images courtesy of

AquiSense 



Key Takeaway



**For UV-C Device Disinfection applications,
continued exemption for mercury lamps is
no longer justifiable**

because

**Evidence now shows that UV-C LED
systems can outperform mercury lamp
alternatives**



Thank You

Questions?

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Safety by choice, not by chance