Consultation Questionnaire Exemption Annex III, Ex. 2(b)(4)-II

Exemption for "2(b): Mercury in other fluorescent lamps not exceeding (per lamp): […] 2(b)(4)-II: Lamps emitting mainly light in the ultraviolet spectrum: 15 mg"

Abbreviations and Definitions

RoHS	Directive 2011/65/EU on the Restriction of Hazardous Substances in Electrical and Electronic Equipment
ECP	Extracorporeal Photopheresis
EEE	Electrical and Electronic Equipment
Hg	Mercury
HVAC	HVAC: Heating, Ventilation, and Air Conditioning
LED	Light-Emitting Diode
LEU	LightingEurope
PCO	Photocatalytic oxidation
UV	Ultraviolet light emitted in the spectral bandwidth of NASA Science (2010): UV-C: 100-280 nm UV-B: 280-315 nm UV-A: 315-400 nm
WPE	Wall Plug Efficiency

Background

The Oeko-Institut and Fraunhofer IZM have been appointed by the European Commission, within a framework contract[1], for the evaluation of applications for exemption from Directive 2011/65/EU (RoHS), to be listed in Annexes III and IV of the Directive.

LightingEurope (from here abbreviated as LEU) has submitted a request for an exemption renewal, which has been subject to an initial evaluation. A summary of the main argumentation for justifying the request is provided below as a first basis to be used in the stakeholder consultation planned as part of this assessment. Additional information supporting this request can be found on the request

[1] The contract is implemented through Framework Contract No. ENV.B.3/FRA/2023/0012, led by Ramboll Deutschland GmbH.

webpage of the stakeholder consultation (https://rohs.exemptions.oeko.info/exemption-consultations/2026-consultation-1).

Please read the summary of the argumentation provided to ensure that your line of argumentation has been understood correctly and provide answers to the questions that follow that address aspects requiring additional information and/or clarification.

1 Summary of argumentation of applicant on the justification of the exemption

1.1 Background

Ex. 2(b)(4)-II appears in Annex III of the Directive with the following wording and is valid until 24 February 2027:

> *'2(b): Mercury in other fluorescent lamps not exceeding (per lamp):*
>
> *[…]*
>
> *2(b)(4)- II: Lamps emitting mainly light in the ultraviolet spectrum: 15 mg'*[2]

LEU (2025)[3] requests the exemption to be renewed with its existing wording for the maximum possible duration but specifies the following wording which is slightly different:

2(b)(4)-II: Mercury in other fluorescent lamps not exceeding (per lamp) for lamps designated to emit mainly light in the ultraviolet spectrum: 15mg

LEU (2025) explains that the lamps covered by Ex. 2(b)4-II are mainly niche products with low market shares compared to other fluorescent lamps. According to LEU (2025), though an increasing number of mercury-free solutions have entered the market for fluorescent applications, for lamps covered by this exemption, only some luminaires, equipped with integrated LED light sources are available and a very limited range of retrofit lamps i.e., for use as replacement lamps in existing equipment and luminaires. Where available, in cases where a luminaire or an EEE containing a light source needs to be replaced, LEU explains that LED-based equipment is increasingly used. However, LEU further states that they are not aware of LED retrofit solutions, i.e., in the form of replacement lamps. For most special-purpose applications covered by this exemption, LEDs do not currently provide a viable alternative for replacing single-capped fluorescent lamps.

History of the exemption

When Directive 2011/65/EU was published, an exemption for special purpose lamps was specified in Annex III Ex. 2(b) as follows:

> *'Mercury in other fluorescent lamps not exceeding (per lamp):*
>
> *2(b)(4) Lamps for other general lighting and special purposes (e.g. induction lamps)'*

[2] RoHS Directive consolidated version: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02011L0065-20250101#anx_III, last viewed 20.4.2026

[3] LEU (2025), Request to renew Exemption 2(b)(4)-II under Annex III of the RoHS Directive 2011/65/EU - 2(b)(4)-II Mercury in other fluorescent lamps not exceeding (per lamp) for lamps designated to emit mainly light in the ultraviolet spectrum: 15mg, available under this link, last viewed 29.5.2026

The exemption was last reviewed in 2015-2016[4]. At the time, the applicant explained that substitution on the substance level was not practical, and it was also shown that further reducing the amount of Hg per burner shall no longer result in significant environmental benefits. In other words, already in 2015, it was apparent that all research efforts towards development of further substitutes were focused on LED technologies. Though the applicant detailed various application areas at the time, detail was not provided about the availability of substitutes or the specific difficulties of developing substitutes for most application areas. There were only two cases where the consultants could follow the argumentation: emergency lighting lamps, for which replacement lamps were specified in safety regulation and standards, and UV lamps for which technical information was available to support why LED alternatives could not provide comparable performance. For each of these a specific item was added with a 5-year duration, while for remaining application areas only a short-term exemption was recommended.

Volume of Mercury to be placed on the EU market through the exemption

Though the current exemption provides an allowance of up to 15 mg Hg per lamp, LEU (2025) states that between < 2 mg and up to 15 mg mercury are dosed in the lamps falling under exemption 2(b)4-II on average. “Taking the mean of all different lamps and lamp types sold on the EU market by LightingEurope members” they estimate “the average amount of mercury per lamp is around 8 mg. The total number of lamps put on the EU market per year is ca. 12.5 million pieces, containing 100 kg of mercury”.

1.2 Technical description

LEU (2025) gives some technical details of the lamps covered by this exemption, generally explaining the mode of function of Hg in such applications. This has been detailed in earlier assessments[4] and is not detailed here again but can be viewed in the application.

LEU (2025) explains lamps covered under this exemption to be low-pressure discharge lamps containing a phosphor coating and emitting mainly in the UV-A/UV-B spectrum. Low-pressure lamps without a phosphor coating (e.g., UVC lamps) or medium and high-pressure UV lamps are covered by other exemptions. Examples of lamp configurations (non-exhaustive) given as being covered by this exemption are: T2, T5, T8, T9, T12. All of these are understood by the consultant to be double capped fluorescent lamps.

In a later communication, LEU (2026)[5] confirms that lamps covered by this exemption do not emit intentionally in the UV-C spectral range, despite the application document mentioning UV-C a few times. For lamps under this exemption the majority of the output is in the range above 280nm. “The targeted use of phosphors and glass specific to the application prevents UV-C radiation from being

[4] Baron, Y., Blepp, M., Gensch. C. and Deubzer, O. (2019), Study to assess socio-economic impact of substitution of certain mercury-based lamps currently benefitting of RoHS 2 exemptions in Annex III - Under the Framework Contract: Assistance to the Commission on technical, socio-economic and cost-benefit assessments related to the implementation and further development of EU waste legislation - Final Version, available under: https://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_Pack_9/RoHS-Pack_9_Part_LAMPS_06-2016.pdf last viewed 20.4.2026

[5] LEU (2026) RoHS Pack 29 clarifications for Oeko Institut - Ex. 2(b)(4)- II “Lamps emitting mainly light in the ultraviolet spectrum: 15 mg Hg, available under link, last viewed 29.5.2026

emitted. The glass used causes a cutoff of the UV-C range due to its specific transmission properties".

LEU (2025) gives the following list of applications where lamps covered by this exemption are needed, specifying it to be non-exhaustive:

- Phototherapy
- Extracorporeal Photopheresis (ECP) - Photopheresis is a procedure that changes blood cells called lymphocytes to help them fight cancer or calm the patient's immune response. During photopheresis, a machine removes lymphocytes from the blood and treats them with UV-A light before they are returned to the patient's blood. Photopheresis treats some forms of cancer, graft versus host disease and organ transplant rejection.
- Sun tanning
- Black light (e.g. for diazo printing, reprography, lithography, insect traps, photochemical and curing processes)
- Black light blue (e.g. for entertainment, forensics, dermatology, banknote validation)
- Flexography and letterpress (e.g. exposure and light finishing of photopolymer printing plates): Flexography is a form of printing process which uses a flexible relief plate. It is a modern version of letterpress, evolved with high-speed rotary printing press functionality, and can be used for printing on almost any type of substrate, like plastic, metallic films, cellophane, and paper. It is widely used for printing of packaging. The printable relief elements on the photopolymer printing plate are extremely fine, in the micrometre range, and require very precise reproduction, making this processing step using UV-A lamps essential in creating precise printing elements.
- Purification
- Lamps for curing of inks in printing systems, hardening of adhesives and silicones
- Lamps for the Photocatalytic Oxidation Process: Photocatalytic oxidation (PCO) is the process of converting malignant contaminants into water, carbon dioxide and detritus. The photocatalytic method is applied for water treatment and air purification and works by breaking down the pollutants to improve the quality of air and water. It is used in smoking rooms, cars, refrigerators, HVAC systems, etc.
- Lamps for breeding small animals: Applications like animal breeding, terrariums, and zoos.

1.3 Applicant's justification for the requested exemption

1.3.1 Availability of alternatives

It can be understood from the past evaluation of Ex. 2(b)4-II that substitution of Hg or reduction of Hg amounts in existing fluorescent lamps is not viable and that this direction of research is no longer being pursued.

Nowadays, all efforts towards substitution are understood to focus on the development of LED lamps. In this respect LEU (2025) explains that 'a growing market approach is the use of integrated LED luminaires for certain emerging professional applications, but this requires full luminaire replacement' as well as high investments.

In their argumentation, LEU (2025) refers to the following aspects to explain which problems need to be considered to assess the compatibility of substitutes on the market – see application for further detail:

- Electrical compatibility with the luminaire in which the lamp is to be used - An LED tube has to operate on the installed control gear without problems. In this respect some progress was made in the last years in developing limited retrofit solutions (such as certain T8) on the market, however still leaving different lengths & diameters of linear lamps and other lamp envelope forms (e.g., circular) uncovered).
- Energy Use and Wall Plug Efficiency (WPE) - LED UV-B/C sources have a limited efficiency of about 7% while the corresponding conventional Hg-based lamps have a much higher efficiency of respectively 20 % for UV-B and 30% or higher for UV-C lamps;
- Applicable legal and compliance requirements – this means on the one side the revalidation of e.g., CE declarations, lamp labelling, and on the other side ensuring that related requirements are still complied with when a technical professional replaces the lamp in an existing device with a replacement lamp different from the intended one (e.g., LED lamp instead of a discharge lamp);
- Extensive validation in clinical studies – this is based on the lacking spectral compatibility of LED substitutes to the fluorescent spectrum tested in previous clinical trials, with the possible impact being a loss of EEE device certification and inability to treat patients in some cases.
- Different/required light distributions – different optical characteristics of LED mean that substitutes may provide a diverging light distribution from that provided by conventional Hg-based lamps.

LEU (2025) further explains that where LED luminaires or devices using an LED light source are available that they shall be applied. However, LED lamps for replacing mercury-based lamps in existing luminaires and devices are explained not to be available. “In case LED-based alternative luminaires or equipment are available, the sales of new luminaires with mercury-containing fluorescent lamps falling in 2(b)(4)-II are declining, for example, in lighting aquaria, but not in medical equipment or tanning, for instance. This will decrease the request for replacement lamps in the longer term”. In this respect they further state that LEDs cannot replicate the broad UV spectra of mercury lamps, for instance, in the UV-B narrowband range. While applications with UV-LED, for UV-A applications, are increasing in availability of newly designed equipment, for UV-B/C applications, the energy efficiency is much lower than for conventional UVB/C fluorescent lamps, affecting substitute availability.

For specific application areas mentioned, additional detail given by LEU is specified in the following table.

Table 1-1: Additional detail given for specific application areas

Application area	Sub-category	Additional detail
Purification		Purification can be done in different ways, for example, photocatalytic oxidation, which can be done using UV-A/UV-B lamps (more information can be found in the application).
Curing		UV curing of flexographic printing inks, depend on mercury lamps for uniform radiation to ensure complete adhesive hardening and ink polymerisation.
UV curing lamps for flexographic and		Lamps that emit long-wave (UV-A) ultraviolet light and limited visible light. Lamps normally contain an internal

letterpress plate making		reflector. Sold in different envelopes, mainly (but not limited to) T8 & T12. Critical for the flexographic and letterpress plate making process, for the exposure and light finishing of photopolymer printing plates.
Medical and skin treatment	Phototherapy	UV-B lamps (311 nm) are indispensable for treating conditions such as psoriasis and vitiligo, for which clinical efficacy hinges on validated spectral accuracy. Special Spectra for Phototherapy (skin care) applications. UV-A and UV-B; T8, T12, PL.
	Extracorporeal Photopheresis (ECP)	Photopheresis uses UV-A lamps.
Sun tanning lamps		Lamps that emit UV-B and UV-A ultraviolet light and limited visible light are part of a tanning bed, booth or other tanning device which produces ultraviolet light used for indoor tanning. There are hundreds of different kinds of tanning lamps, most of which can be classified into two basic groups: low-pressure and high-pressure. Lamps covered by this exemption are low-pressure. Sold in different envelopes, including (but not limited to) T5, T8, T9, T10, T12, PL.
Blacklight Blue Fluorescent lamps		Lamps that emit long-wave (UV-A) ultraviolet light and very limited visible light. Sold in different envelopes, including (but not limited to) T5, T8, T12, PL. Used for detection and analysis in the textile and chemical industries, banking and forensic science, Special effects in nightclubs, discos and theatres, and sign lighting.
Blacklight Fluorescent lamps for insect trap applications		Lamps that emit long-wave (UV-A) ultraviolet light and limited visible light. Sold in different envelopes, including (but not limited to) T5, T8, T9, T10, T12, TL-E(Circular). Used in pest management to attract flies to decide fixtures containing glue boards or grid-based fixtures. Used in restaurants, professional kitchens, convenience stores, etc.
Lamps for the Photocatalytic Oxidation Process		Lamps that emit UV-C, UV-B or UV-A ultraviolet light and limited visible light and are being used in the process of photocatalytic oxidation. Lamps in different envelopes, including (but not limited to) T5, T8, T9, T10, T12, PL.
Lamps for breeding small animals		Lamps with colour spectrum optimised for the breeding of small animals, e.g. turtles, reptiles. Applications require a minor but essential range of the lamp-spectral output to be in the ultraviolet spectrum to maintain the health and fertility of these animals (related to the vitamin D production). Such an application requirement can be met in practice by using either separate lamps for visible and UV lighting (covered by this exemption) or, otherwise, a specific visible and UV spectrum, combined in lamp designs which are covered by Exemption 2b4-I.

Source: Own compilation based on LEU application

To demonstrate why they believe that existing LED substitutes are not suitable as replacements for Ex. 1(f)-I discharge lamps, LEU (2025) gives examples of lamps used for medical skin therapy. LEU (2026) states that similar lamps are covered by Ex. 2(b)(4)-II, having a double-ended tubular lamp shape like a TL 100W/01 type. The example is explained in more detail (LEU, 2026), clarifying a comparison between a PLS 9W/01 compact fluorescence lamp covered by the exemption with a

spectral output focused in the range of 308-313nm and an LED potential substitute with its peak spectral output at 309 nm.

Table 1-2: Spectral output comparison of PLS 9W/01 compact fluorescence lamp with potential LED alternative

	Energy (in ranges)			
UV source	200 - 308 nm	308 – 313 nm	313 – 400 nm	**Total** (200-400nm)
LED (pk 309nm)	36%	35%	29%	100%
PLS 9W/01	6%	61%	33%	100%

Source: reproduced from LEU (2025) and LEU (2026)

LEU (2026) explains that the PLS 9W/01 lamp is used for phototherapy for treating skin conditions such as psoriasis. It has its peak spectrum at 311 nm "to maximise output within the therapeutic range, while minimising emissions below 308 nm, where the risk of erythema and skin cancer is significantly higher". LEU further explains that the LED alternative specified in the table has a significantly higher spectral output below the 208 nm range, increasing the risk of causing erythema and thus increasing the likelihood of skin cancer. The PLS 9W/01 lamp has both a lower risk for erythema and skin cancer as also a higher dose in the output range relevant for the treatment, thus explained (LEU, 2026) to provide a more effective treatment than LED-sources. It is further stated that though a large body of clinical studies has been carried out on the narrow band width of the PLS 9W/01 lamp, there is a "a lack of clinical studies involving human subjects that assess the long-term effects of exposure to the broader UVB spectrum emitted by these LED solutions". In this respect, an annex is shared which has been posted in the exemption consultation page[6].

LEU (2025) gives the following example of LED luminaire development in the field of exposure of photopolymer flexographic printing plates:

"Despite the significant material cost difference between available UV-A LED light sources and the commonly used mercury-containing UV-A tubes, first LED-based UV-A exposure units are available on the market. These units feature a scanning movement of the exposure head, resulting in completely different designs for plate processing equipment. However, they are not a one-to-one replacement for commonly used UV-A tube exposure units: costs remain mostly prohibitive, and the much higher UV-A output intensity is intended to achieve different effects (e.g., different dot shapes on the plate, anchoring of surface screening), requiring customers to adapt their workflow process". (LEU 2025)

Two further examples are given for applications where LED based devices or luminaires have become available, however as some of the data in the application refers also to lamps of Ex. 1(f)-I, their relevance is not yet clear to Ex. 2(b)(4)-II (LEU, 2025):

- For the treatment of baby jaundice, equipment using blue LED is quite common, though the cost of single-capped fluorescent lamps are still used as the cost of lamp replacement is much lower

[6] Access through this link.

than the cost of replacing the complete equipment. In this case, lamps for treatment of baby jaundice are not mentioned elsewhere in the application and it is not clear if they are covered by this exemption.

- For black lights and aquarium lamps, LED alternatives may exist, but they do not provide the same (visual) effects of fluorescent lamps and are not really comparable.

In a later communication, LEU (2026) refers to UV-LEDs with a spectral output near 285 nm which have been evaluated as potential substitutes for NDUV-SO_2 measurement. However, LEU states that these LEDs currently have insufficient optical output and lifetime. They have a broader spectral bandwidth and significant temperature-dependent variations in optical intensity and peak wavelength which can lead to a loss in SO_2 measurement accuracy.

1.3.2 Environmental and health arguments

In the context of development of LED alternatives, LEU (2025) contends that in lack of suitable LED replacements, the scenario of the exemption not being renewed could result in negative environmental impacts due to a premature end-of-life of luminaries and devices already on the market that use conventional lamps (e.g., Hg based). In this context they estimate an average weight of 5-10 kg WEEE scrap being generated per luminaire or device where replacements are not available. This does not include the weight of the solarium beds that would become obsolete as well for some of the lamps covered by the exemption.

LEU (2025) states that LED-based luminaires so far do not reveal a clear general environmental benefit over fluorescent solutions, e.g. due to higher energy consumption during the use phase. Looking at other information in the application, the consultant understands this to particularly be the case for UV-B lamps but less relevant for UV-A.

1.3.3 Socioeconomic impacts

In relation to the possible need to replace existing luminaries and devices with LED compatible ones (so far available), LEU (2025) gives a conservative estimate of €400–100,000 per luminaire or equipment including installation but also explains that the amount could increase dramatically in cases of high hardware and/or installation efforts. LEU (2025) states that “replacing a luminaire in an explosion-proof area can lead to high additional costs for safety, facility certification and construction measures during installation”.

LEU (2025) specifies some socio-economic impacts that are expected should the exemption not be renewed:

- Loss of jobs – see detail in document,
- Increased creation of premature waste (see above),
- Implementing alternative technologies could require additional investments for new equipment (see above).

Additional detail about the possibility of substitution is compiled in the following table.

Table 1-3: LEU information regarding availability of substitutes for Ex. 2(b)(4)-II lamps

Application area	LEU feedback (LEU, 2026)
Phototherapy lamps	There are some devices in the market using UV LEDs in the phototherapy market. These lack clinical studies assessing the long-term effects of exposure of humans to the broader UV-B spectrum emitted by these LED solutions. Consequentially, such LED based devices are not used by leading OEMs in the Phototherapy industry.
Tanning lamps	Most newly sold devices still use low-pressure discharge lamps, despite some new solutions being available using LED lamps. Existing installations using low-pressure discharge lamps, have no retrofit LED lamps that can be used as replacements and that are considered regulatory safe, allowing a conversion.
UV curing lamps for flexographic and letterpress plate making	LED replacement lamps cannot currently serve as a true "drop-in" or "plug-and-play" solutions for existing gas-discharge based luminaires due to mismatched driving electronics, differing spectral distributions, prohibitive costs, and severe environmental vulnerabilities to volatile compounds unless fully encapsulated. There are currently no suitable LED alternatives on the market for letterpress photopolymer printing exposure, and while UV-A LED exposure units are emerging for flexography, they emit at higher intensities, altering exposure results. Because these units are not one-to-one replacements, downstream users require an extension of the RoHS exemptions to provide the necessary time to safely re-engineer equipment, adapt workflows, and complete extensive validation processes for printing plates without disrupting the supply chain.
Curing lamps	UV-A LED substitutes exist in some curing applications where they are built into new curing equipment for which light output uniformity is not critical. As LEDs are point sources, where curing applications often require an even spread of light, the use of alternatives is explained to result in spottiness and quality issues in the curing. Viable LED solutions are explained to also be available for new installations used for nail hardening and dental curing; however, these cannot be applied as replacement lamps in existing devices using Ex. 2(b)(4)-II lamps.
Lamps for breeding small animals	Existing fluorescent UV lamps provide combined UV-A, UV-B, and visible light characteristics that are specifically designed for basking and thermoregulation behaviour. Some LED-based systems may support partial application functions but often require additional heating equipment and supplementary UV sources to achieve equivalent biological performance. Compatibility with existing terrarium installations and established husbandry practices may therefore be limited. Replacement LED lamps suitable for replacement of lamps in existing luminaires are not broadly available across the full application range. UV-A LED substitutes are becoming available for selected terrarium and decorative lighting applications where the primary function is visible illumination or behavioural stimulation. However, where combined in one lamp, UV-A and biologically effective UV-B radiation, together with radiant heat generation and stable full-spectrum emission characteristics, remain dependent on fluorescent UV technology for many reptile husbandry applications.

Source: LEU (2026)

2 Questions to stakeholders

Before you start, please fill in your contact details:

Name:

Company:

E-Mail and phone number:

1. Do you agree with the arguments put forward by the applicants? Are there any additional reasons that support the requested extension of the exemption? Please detail in your answer if you agree with the exemption wording proposed by LEU and to the duration for which the exemption has been applied for. In each case, please explain your views.

2. In your opinion, what reasons oppose the requested extension of the exemption?

3. Please provide details of possible LED lamp and/or LED-based equipment substitutes for emergency lamps. Please explain which replacement lamps for existing emergency installations are available on the market, and how these can be used as an alternative to conventional discharge lamps or equipment designed for conventional lamps.

4. How do you assess the potential negative effects of substitution on occupational health and consumer safety, in particular with regard to possible accidents due to insufficient reliability of substitutes?

5. How do you assess the overall benefits of substitutes for the environment, health and consumer safety?

6. Are there any other aspects that you believe should be taken into account when assessing this application? Please provide relevant documents and evidence.

Please send your answers to the project email: rohs.exemptions@oeko.de at the latest by 24 July 2026.

Your answers shall be posted on the RoHS Evaluations website as part of the online consultation. In case parts of your answers are confidential, please provide your answers in two versions (public /confidential). Please also note, however, that requested exemptions cannot be granted based on confidential information!

3 Bibliography

Baron, Y., Blepp, M., Gensch. C. and Deubzer, O. (2019), Study to assess socio-economic impact of substitution of certain mercury-based lamps currently benefitting of RoHS 2 exemptions in Annex III - Under the Framework Contract: Assistance to the Commission on technical, socio-economic and cost-benefit assessments related to the implementation and further development of EU waste legislation - Final Version, available under: https://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_Pack_9/RoHS-Pack_9_Part_LAMPS_06-2016.pdf last viewed 20.4.2026

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LEU (2025), Request to renew Exemption 2(b)(4)-II under Annex III of the RoHS Directive 2011/65/EU - 2(b)(4)-II Mercury in other fluorescent lamps not exceeding (per lamp) for lamps designated to emit mainly light in the ultraviolet spectrum: 15mg, available under this link, last viewed 29.5.2026

LEU (2026), RoHS Pack 29 clarifications for Oeko Institut - Ex. 2(b)(4)- II “Lamps emitting mainly light in the ultraviolet spectrum: 15 mg Hg, available under link, last viewed 29.5.2026