

Consultation Questionnaire Exemption No. 4(f) of RoHS Annex III

Current wording of the exemption:

Mercury in other discharge lamps for special purposes not specifically mentioned in this Annex

Requested validity period: Maximum (5 years and 7 years (cat. 8 and 9) respectively)

ACRONYMS AND DEFINITIONS

UV	Ultra Violet
LED	Light-Emitting-Diode
Hg	Mercury
LEU	LightingEurope

1. INTRODUCTION

1.1. Background

Bio Innovation Service, UNITAR and Fraunhofer IZM have been appointed¹ by the European Commission through for the evaluation of applications for the review of requests for new exemptions and the renewal of exemptions currently listed in Annexes III and IV of the RoHS Directive 2011/65/EU.

VDMA and Lighting Europe submitted requests² for the renewal of the above-mentioned exemption. The request has been subject to a first completeness and plausibility check. The applicant has been re-quested to answer additional questions and to provide additional information, available on the request webpage of the stakeholder consultation³.

The stakeholder consultation is part of the review process for the request at hand. The objective of this consultation and the review process is to collect and to evaluate information and evidence according to the criteria listed in Art. 5(1)(a) of Directive 2011/65/EU.⁴

To contribute to this stakeholder consultation, please answer the below questions until the 27th of May 2021.

1.2. Summary of the Exemption Request

According to VDMA: *"The application for prolongation of the existing exemption refers to mercury-containing UV discharge lamps which are used for curing (e.g. of layers of inks and coatings, adhesives and sealants),*

¹ It is implemented through the specific contract 070201/2020/832829/ENV.B.3 under the Framework contract ENV.B.3/FRA/2019/0017

² Exemption request available at [RoHS Annex III exemption evaluation - Stakeholder consultation \(biois.eu\)](https://biois.eu/rohs-annex-iii-exemption-evaluation-stakeholder-consultation)

³ Clarification questionnaire available at [RoHS Annex III exemption evaluation - Stakeholder consultation \(biois.eu\)](https://biois.eu/rohs-annex-iii-exemption-evaluation-stakeholder-consultation)

⁴ Directive 2011/65/EU (RoHS) available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32011L0065:EN:NOT>

for disinfection (e.g. of water, surfaces and air) and for other industrial applications (surface modification, surface activation) The application includes the following lamp types:

- **UV medium-pressure discharge lamps (MPL) for curing, disinfection and other industrial applications** (internal operating pressure > 100 mbar). The UV medium-pressure lamps can be doped with iron, gallium or lead in addition to the mercury they contain.
- **UV low-pressure discharge lamps for special purposes** in the high power range. [...]

Typical applications to be covered by this application include curing, e.g. of inks and coatings, disinfection of water etc., and other industrial applications like surface activation and cleaning.

It is technically not possible to replace mercury in special UV lamps with other materials/chemicals in order to achieve the same widespread radiation distribution. LED-based technologies are increasingly being used, which in certain applications (e.g. curing) also offer many advantages over mercury-containing UV lamps. Nevertheless, LED technologies cannot be used as an equivalent replacement in many applications. ”

According to LightingEurope, “[...] The renewal application concerns lamps and UV light sources defined as:

- High Pressure Sodium (vapour) lamps (HPS) for horticulture lighting,
- Medium and high-pressure UV lamps for curing, disinfection of water and surfaces, day simulation for zoo animals, etc...
- Short-arc Hg lamps for projection, studio, stage lighting, microlithography for semiconductor production, etc...

Replacement of mercury and mercury containing lamps is impracticable:

- The lamps covered by exemption 4(f) must remain available on the EU market:
 - ✓ For new equipment for certain applications where no functionally suitable alternatives are available
 - ✓ As spare parts for in-use equipment as replacing end-of-life lamps avoids having equipment become electronic waste before due time”

We are a producer of polymer solutions employing over 20,000 people in more than 50 countries around the world with about 20 plants in Europe. The administrative headquarters of the REHAU Group is located in Switzerland. Our competencies are divided into five divisions, enabling closer alignment with specific markets and customer needs: Window Solutions, Building Solutions, Furniture Solutions, Industrial Solutions and Automotive.

We mainly use UV- lamps based on mercury for curing of varnish in furniture applications such as edgebands and extruded profiles. Additional, in our division “Building Solutions” the crosslinking of extruded polymers by Hg- UV- lamps is a key process.

It is more than 30 years ago, that we introduced Hg-UV-lamp curing for varnishes on extruded products as a standard. Market requirement for kitchen industries and furniture solutions is a high chemical- and scratch resistance of (decor) surfaces.

The main advantages of lacquer for Hg-UV-lamp curing are:

- No air pollution, dangers and no health hazards by solvent evaporation
- Energy saving by instant crosslinking with UV-curing
- UV-curing with mercury lamps is simple to operate and easy to maintain
- Unique wear resistant surfaces by UV ray crosslinking.
- Recycling of worn mercury UV- lamps with suppliers

Mercury UV lamps are necessary to cover our product portfolio for the following reasons: Only Hg-UV lamps deliver enough performance in UVA, UVB and UVC range, to cure our furniture profiles approved varnishes. LED and Excimer technology are not yet suitable for our standard applications. E-beam technology doesn't fit into our standard extrusion line concept and is very expensive.

Furthermore REHAU uses Hg vapour UV lamps for crosslinking of thick walled Polyethylene (PE) pipes. REHAU recently invested significant time and money into the development and industrialisation of UV cured PE-Xe pipes. Due to the high wall thickness of precursors for PE-Xe pipes up to 25mm, an extraordinary intensity of UV-C light is required. Otherwise the crosslinking factor of the PE pipe wall will not be sufficient. For the intended use of PE-Xe pipes for underfloor heating and cooling, a safe service lifetime over 50 years can only be achieved with a homogenous degree of crosslinking above 70% throughout the whole pipe wall. LED based UV-lamps do not provide enough intensity of UV-light to guarantee enough UV-light to come through to the inner surface of the pipe walls. Recently tests with LED based UV-light sources were carried out with negative results. Development of LED based UV lamps providing enough intensity is improbable for the next years to come.

2. QUESTIONS

1. VDMA and LightingEurope² requested the renewal of the above exemption for the maximum validity periods with the same scope and wording for all EEE of cat. 3 and 5 (VDMA) and cat. 1-10 (LEU).
 - a. Please let us know whether you support or disagree with the wording, scope and re-quested duration of the exemption. To support your views, please provide detailed technical argumentation / evidence in line with the criteria⁴ in Art. 5(1)(a).

The wording should be retained, and an extension should last until 2026 and beyond. The reasons are: To eliminate or substitute UV curing devices by changes of materials or curing technology is technically not available at the moment and in our opinion will also be in midterm prognosis still impracticable, because the necessary application range and reliability of substitutes are not ensured. E. g. UV LEDs are by far not yet comparable in terms of curing power and durability.

- b. If applicable, please suggest an alternative wording and duration and explain your proposal.

From our point of view, the further development of alternative solutions (e.g., based on UV LEDs) still takes a lot of time. Especially, the development for new applications in the UVC area is still facing major challenges. Also the total negative environmental, health and consumer safety impacts caused by substitution under pressure by a timelimit are likely to outweigh the total environmental, health and consumer safety benefits thereof.

2. Please provide information concerning possible substitutes or elimination possibilities at present or in the future so that the requested exemption could be restricted or revoked.
 - a. Please explain substitution and elimination possibilities and for which part of the applications in the scope of the requested exemption they are relevant.

Electron beam devices for UV lacquer curing may be possible substitutes but are bigger and much more expensive than mercury UV lamps, therefore the high investment costs will not pay back by our products within a reasonable time. Retrofit of existing lines is impossible because of missing length/space in existing buildings.

Electron beam devices are not suitable for crosslinking of thick walled pipe articles made from Polyethylene, as they show completely different product properties.

Development of UV LEDs is ongoing but their performance is still not comparable to mercury UV lamps.

Combinations of Excimer lamps and UV-LEDs are thinkable for high-quality matt lacquer applications in the future; the Excimer lamp produces low gloss surface in a treatment chamber, if operated with (pure) nitrogen. Since Excimer lamps can not cure lacquers through, an additional UV-LED lamp should provide the through-cure. However, the investment and running costs will be high and thus not affordable. But there is still no solution available for high gloss surfaces. *For comparison: Standard mercury UV-lamps produce all gloss levels between high gloss and deep matt.*

Thus, mercury-free types of discharge lamps (Excimer) and other light sources like UV-LEDs have severe limitations.

Our trials to replace Hg- UV devices by alternative curing processes have been ongoing for one decade and have failed up to now. Even if replacements would become possible in the future, exchanges in running processes are connected with high risks and costs as:

- Replacement of power supplies and peripheral electrical components
- Replacement or alteration of proved inks and varnishes
- Adjustments depending from substrates
- Necessity for (other) pre-treatment technology
- Necessity for additional nitrogen inert gas
- Change of UV measurement equipment (different spectral sensitivity)
- Change of process speeds (usually substantial speed and productivity decrease)
- Redesign of machine equipment

- b. Please provide information as to research to find alternatives that do not rely on the exemption under review (substitution or elimination), and which may cover part or all of the applications in the scope of the exemption request.

According to our experience, a substitution of curing technology is impossible without reformulation of lacquers and running expensive laboratory and field tests. This will be similar in case of crosslinking polymers by Hg- UV- lamps.

LED-lamps with high performance level typically emit at 365 or 395 nm. Lacquers which respond to the wavelength of LED lamps, respond to sunlight as well. Therefore, coating lines processing LED curable lacquers must be protected from direct sunlight and stray light very thoroughly. Operators would be forced to work without daylight conditions to prevent the LED-curable lacquer from pre-gelling on the coater. Furthermore, lacquers with photoinitiators, which respond to UV-A to wavelengths as 365 or 395 nm would become discolored. Discoloration is not acceptable for most of our products.

Thus, photo-initiators in our tailor made UV-curable lacquers for edgebands do not respond to these long wavelengths. Consequently, our UV-curable lacquers would stay tacky or even wet when only cured with LED lamps. UV-C LEDs for lacquer curing are still in basic development. Therefore a replacement of existing UV lamp system by alternatives can lead to quality issues, process downtime, productivity decrease, high investment costs and higher overall operational costs.

- c. Please provide a roadmap of such on-going substitution/elimination and research (phases that are to be carried out), detailing the current status as well as the estimated time needed for further stages.

We don't have a solution or roadmap for the complete substitution/elimination of mercury-based discharge lamps in our fields of application yet. In the future, there may be options when appropriate UV LED technology is available, which might justify investment into new machines and which might gain market share with respect to conventional UV applications over time. But for our numerous existing machines / processes / applications, there is no reasonable replacement available.

3. Do you know of other manufacturers producing devices of comparable features and performance like the ones in the scope of this exemption request that do not depend on RoHS-restricted substances, or use smaller amounts of these substances compared to the applications in the scope of this exemption?

We don't know manufacturers producing devices of comparable features and performance without use of Hg-UV bulbs. Alternative devices, when used with the alternative peripherals (other inks, varnishes, pre-treatment), can have comparable features and performance in some applications, but not in our standard applications which need the specific spectrum of mercury bulbs for their performance. LED- and Electron-beam curing for furniture applications are still exceptional or niche applications.

4. As part of the evaluation, socio-economic impacts shall also be compiled and evaluated. For this purpose, if you have information on socioeconomic aspects, please provide details in respect of the following:
- a. What are the volumes of EEE in the scope of the requested exemptions which are placed on the market per year?

We don't have figures to volumes of EEE in the scope of the requested exemptions. But for example even the rather unknown edgeband market is quite huge:

<https://www.marketsandresearch.biz/report/45792/global-thermoplastic-edgeband-market-2020-by-manufacturers-regions-type-and-application-forecast-to-2026>

Our annual consumption of Hg-UV-bulbs for edgeband production in our division Furniture Solutions is about 750 pieces per year. Also non neglectable is the consumption of Hg-UV-lamps for crosslinking polymers (PE-Xe).

- a. What are the volumes of additional waste to be generated should the requested exemption not be renewed or not be renewed for the requested duration?

Most machines running with mercury discharge lamps would have to be disposed of. In many of our applications, it will be economically and technologically not feasible to retrofit existing equipment with alternative light sources.

If UV Hg lamps would be no longer available, almost all of our edgeband extrusion lines would become no longer usable: According a rough estimation this would have the following effects for our company: Curing devices with a total value of EUR 3 Mio would be scrap, if service and spare parts would be no more available.

- b. What are estimated impacts on employment in total, in the EU and outside the EU, should the requested exemption not be renewed or be renewed for less than the re-quested time period? Please detail the main sectors in which possible impacts are expected – manufacturers of equipment in the scope of the exemption, suppliers, re-tail, users of MRI devices, etc.

Most of our plant workers working at edgeband and profile extrusion lines and people in management and development departments would be confronted with a vocational ban, leading to huge amount of unemployment and loss of products and productivity.

We don't have exact figures and can only state to the best of our knowledge, that thousands of companies and factories in the EU would stop existing; e.g. lamp manufacturers, power supply manufacturers, quartz glass suppliers, UV measuring device manufacturers, companies providing UV curing inks, UV-coats and UV-varnishes. Also uncountable customers -as we are- would be in severe trouble, because they relied on further availability of Hg-UV technology. Probably tens of thousands jobs would be lost in Europe and transferred to locations outside of the EU.

- c. Please estimate additional costs associated should the requested exemption not be renewed, and how this is divided between various sectors (e.g. private, public, industry: manufacturers, suppliers, retailers).

For production, where substitution is technically or economically not sensible, unemployment costs for thousands of personnel in plants of suppliers and customers in various sectors for example in the furniture industry.

In cases where substitution seems possible, heavy investment costs for companies into new machinery / equipment, at the same time costs for disposal of no longer usable machines and equipment must be calculated (for our company, we guess needed transformation costs up to a three-digit million amount as realistic).

Under conditions, that modified lacquers and alternative devices would be available, not only our suppliers and we but also our customers would have to perform high investments in new systems and machinery.

Loss of product diversity since no longer all products can be produced for technological and / or economic reasons.

5. Any additional information which you would like to provide?

We believe that a mercury UV lamp 4(f) ban would have a global impact on industries, products, markets and employment which are in no sensible proportion to the small amount of mercury that is brought into the market by mercury-containing discharge lamps. Used lamps can be recycled and the mercury can be reused for new lamps.

Please note that answers to these questions can be published in the stakeholder consultation, which is part of the evaluation of this request. If your answers contain confidential information, please provide a version that can be made public along with a confidential version, in which proprietary information is clearly marked.

Please do not forget to provide your contact details (Name, Organisation, e-mail and phone number) so that the project team can contact you in case there are questions concerning your contribution.

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