

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 requested 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 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>

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), 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:*
 - o *For new equipment for certain applications where no functionally suitable alternatives are available*
 - o *As spare parts for in-use equipment as replacing end-of-life lamps avoids having equipment become electronic waste before due time”*

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 requested duration of the exemption. To support your views, please provide detailed technical argumentation / evidence in line with the criteria⁴ in Art. 5(1)(a).

Answer Lott-Lacke: We absolutely support the wording, scope and requested duration of the exemption. Because the best potential alternative for medium pressure mercury lamps the UV LEDs are still by far not comparable in terms of curing power, durability, and the cost performance ratio.

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

Answer Lott-Lacke: The shortening of the duration must be refused from the industry's point of view. The development of competitive UV LEDs is still going on but will for sure need many more years to be actually comparable with mercury UV lamps.

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.

Answer Lott-Lacke: Until now there are only few alternatives for mercury UV lamps:

1. **Electron beam equipment – from a technical point of view a good alternative but these machines are still much more expensive than mercury UV lamps. More than 90% of the companies which are now using mercury UV lamps would struggle, as the high investment cost will hardly pay back within a reasonable time.**

2. **UV LEDs – as mentioned above are in technical terms still not comparable to mercury UV lamps.**

3. **Combinations of Excimer lamps with LED lamps – this could be an interesting future perspective for high-quality applications => the Excimer lamp produces low gloss levels and at the same time a good surface cure in a nitrogen chamber, while the LED lamp provides the right power and wavelength for the proper through-cure. However, the investment cost are high and thus not affordable in all industries. And the production cost are high as this type of equipment must be operated with a constant nitrogen supply. In plus, standard mercury UV-lamps can produce all kinds of gloss levels between high gloss and deep matt. The variety of gloss levels is limited, however, when curing technologies like EB, LED, Excimer are used.**

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.

Answer Lott-Lacke: LED-lamps typically emit at 365 / 395 nm. Most photo-initiators used in ordinary UV-curable lacquers do not respond to these long wavelengths, however. Consequently, ordinary UV-curable lacquers stay tacky or even wet when cured with LED lamps. In order to respond to LED lamps, these lacquers need to be equipped with special LED photo-initiators. Nevertheless, the biggest technical disadvantage of UV LEDs is still the insufficient surface curing properties of these lamps.

Some users combine LED lamps with ordinary UV-lamps having the LED pre-cure lacquers and inks and having the ordinary UV- lamps cure the surface properly at the end of a coating line. Or they use LED-lamps in nitrogen-rinsed chambers to have a better surface cure. Under oxygen atmosphere, however, the total curing and the matting of a radiation curable lacquer is much easier with a mercury UV lamp than with UV LEDs. Still, it will hardly be possible to keep up the high-quality level required in a lot of applications in the coating industry like foil coating for the furniture market or coatings for floor coverings.

Lacquers which respond to the wavelength of LED lamps, respond to sunlight as well and as quickly. Therefore, coating lines processing LED curable lacquers must be protected from direct sunlight and stray light very thoroughly. Operators are forced to work in a dark environment to prevent the LED-curable lacquer from pre-gelling on the coater.

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.

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?

Answer Lott-Lacke: There are several suppliers in the market which offer UV LEDs or EBeam equipment like PHOSEON-TECHNOLOGIE, EASYTEC GmbH, IST Metz GmbH, IOT GmbH, RADSYS and some more. But any company which is now using mercury UV lamps for curing their UV lacquers cannot change the curing equipment to UV LEDs or EBeam from one day to another. The whole process and coating line must be changed, the coating will be different and has to be adapted to the new type of curing - that all results in a totally different final product. So, for a company this is a huge transformation with lot of uncertainty and of course a big financial challenge without any technical benefit for the company and the end customer.

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?
 - b. 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?

Answer Lott-Lacke: Not only the whole UV curing equipment with mercury lamps would be waste, also a huge amount of UV curable raw materials like UV oligomers / monomers and photo initiators would be unusable if mercury UV lamps are prohibited.

For, a lot of these materials cannot be used with UV LEDs, since due to their low functionality (for example: monofunctional monomers and mono-/ di-functional urethan acrylates or the whole range of methacrylates) they would not crosslink easily under UVA and visible light only.

- c. 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.

Answer Lott-Lacke: Because of an absence of real alternative to mercury UV lamps it would be an irreparable damage to several industrial sectors. In the coating industry the innovative, modern and ecological sector for radiation curing lacquers (radiation curing lacquers are mainly without any VOCs) would be wrecked. Also, in terms of sustainability mercury UV lamps will still be needed in future because the raw materials for radiation curing lacquers which are made of renewable resins or which have a high renewable content (RNC) have all in common, that they are low functional and therefore not very reactive to UV light. So, for these future “eco or bio based – coatings a powerful mercury UV lamp with light ranging from UVC through to UVA is needed. If soon only UV LEDs can be used, the developers of radiation curing lacquers must use in most of the cases mineral oil based raw materials again. And this cannot be the right solution for the future of the coating industry!

- d. 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).

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

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