

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

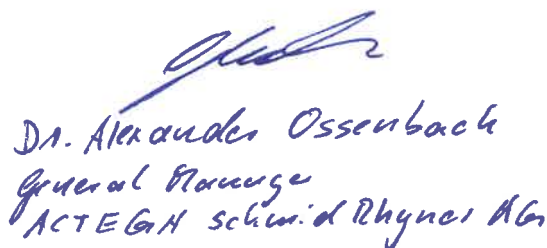
Requested validity period: Maximum (5 years and 7 years (cat. 8 and 9) respectively)

ACRONYMS AND DEFINITIONS

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



Dr. Wolfgang Josten
Managing Director
ACTEGA Terra GmbH



Dr. Alexander Ossebach
General Manager
ACTEGA Schmid Rhynel AG

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-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.

1.2. 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:
 - 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 re-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). **The wording, scope and requested duration of the exemption is fully supported. Currently there are no viable alternatives to curing UV coatings in the printing industry without mercury containing lamps. Medium pressure mercury lamps provide both shorter wavelength and longer wavelength UV light. Both are needed, the shorter wavelength for good surface cure and the longer wavelength for good through cure. LED technology is an alternative source of long wavelength UV light. These UVA LED light sources are available with good light intensity. In contrast, short wavelength UV LED is not available at a meaningful light intensity and lifetime. The short wavelength light is very important especially for the thin coating films used in the printing industry, meaning that the surface cure is extremely important. The power and lifetime of such alternative short wavelength UV sources is orders of magnitude away from mercury containing lamps. We therefore expect that it will take years until a decent replacement technology can be developed!**
 - b. If applicable, please suggest an alternative wording and duration and explain your proposal. **A shorter duration or alternative wording is in our opinion not feasible. The current status of**



alternative UV sources especially emitting at the UVC + UVB range, like LED for instance, is far away from mercury containing lamps in respect to power and lifetime that we expect years are needed until an alternative technology will be available.

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.

The most promising substitution technology are LED light sources. For the long wavelength UV range (365 – 395 nm) there are such lamps available with a high light intensity, a long lifetime and good energy efficiencies. To achieve high power intensities good cooling is essential, so there will be the need to adapt machines etc. However, these lamps have limited feasibility to cure clear coatings for example in the printing industry. The formulations need to be adapted to this wavelength. Most photoinitiators absorbing in this UVA range, like thioxanthenes, lead to a strong yellowing and therefore cannot be used. The non-yellowing ones like phosphine oxides do not absorb strong enough and therefore the coating surface does not cure properly.

The situation is completely different for shorter wavelengths. Here some LED diodes are available, for instance in the range of ~ 280 nm. However, the energy efficiency and intensity is so low, that these lamps cannot be used to feasibly cure UV coatings. Secondly the lifetime of currently available UVC diodes is very low.

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.

Both lifetime and intensity of UVC LEDs would have to be improved by one or two orders of magnitude before such a solution would be an alternative to a mercury containing discharge lamp. We have tested such a prototype once and could not cure our coatings in a decent time.

For UVA LED curing we did invest a lot of time in R&D to develop a coating suitable for the printing industry. We experienced following challenges of the LED technology with UVA LEDs:

- Strong yellowing
- Insufficient surface cure
- Low machines speeds to compensate for bad curing
- Migration of photoinitiator breakdown products (not suitable for food packaging)
- Limited reactivity
- Need for high reactive binders and monomers to compensate low reactivity
- Inertisation could help to compensate insufficient surface cure, but is technically extremely challenging or practically impossible in widely used sheetfed printing machines.
- Low availability of suitable photoinitiators absorbing UVA wavelength

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.

As a coating manufacturer we rely on possible alternatives proposed, like LED lamps, that we are testing but cannot influence or initiate any developments towards such solutions as we do not have the technical know-how in such lamps.

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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?

As stated above the only alternative we currently see are LED light sources. Due to the essential surface cure necessary in the printing industry (coatings are applied in very thin films) only a lamp emitting short wavelength UV light would be a viable option. The solutions currently offered are far away from what we would need to cure our products.

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 are a producer of coatings cured with such lamps. In our facilities we have 5 such lamps but all our customers of UV varnishes use at least one lamp to cure our products. Unfortunately we cannot provide a good estimate of such lamps in the market.*
- 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? *The equipment used for curing would be waste such as all curing units of our customers that are an essential part of a printing machine. In the worst case, many printing machines would have to be considered waste.*
- 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-requested 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 *We can answer this question in respect to our company. The business with UV coatings cured by mercury containing lamps accounts for the majority of the site in Switzerland, ACTEGA Schmid Rhyner and a significant part of the site in Germany, ACTEGA Terra. Roughly 100 employees are currently dealing with this business and would immediately be affected by a ban of mercury containing lamps. Since no viable alternative exists today we can only expect that production of goods, where curing with UV is essential, is moved to non-regulated regions outside of the EU.*
- 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). *The ration on how different sectors are affected is different to estimate for us. Without any doubt, the effect would be significant.*

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

For a replacement of mercury containing lamps in the future, it is essential in our opinion that the research & development of UVC LEDs is massively supported. A significant improvement of light output and lifetime is necessary to really replace mercury containing lamps in areas, such as curing of clear coatings or disinfection, where UVC is essential. Before such lamps are available an exemption for mercury containing lamps is unfortunately absolutely necessary.

Curing coatings by UV radiation itself is an environmentally friendly technology that furthermore delivers excellent coating surfaces. They are characterized by high mechanical and chemical resistance, protect and thus extend the lifetime of packaging and many other goods like furniture. This is due to the fact that these system crosslink efficiently and protect the coated surface over years. Usually the varnishes do not contain any solvent and the energy used to cure them is less compared to solvent based or even water based solutions.

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UV technology has been established throughout the industry for over thirty years. In the printing industry, UV varnishes are used for security printing applications, food, luxury food and pharmaceutical packaging.

This security, thus consumer protection through legally compliant, safe packaging, cannot currently be achieved or guaranteed with any alternative lamp technology to medium-pressure mercury 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.