

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"*

General Statement

Optimarin AS is a producer of Ballast Water Systems based in Norway and employ 40 people around the world, and additionally a world-wide network of agents, service partners for support & maintenance and ship's crew training centre's in Norway, Manilla and Mumbai which includes 16 service companies with a total of 50 service engineers working for Optimarin and 19 agency companies in direct contact with Optimarin.

The Optimarin Ballast System (OBS) is a system for treatment (cleaning) of a ship's ballast water. The system is based on filtration and UV treatment, and no environmentally dangerous substances are used in the cleaning process. There are also no dangerous substances made as a product of the process. For this

application Optimarin is dependent on UV lamps to fulfil the obligation to neutralize alien species according to the Type Approvals (TA) issued by IMO and US Coast Guard. Please see the following link for further information from IMO: <https://www.imo.org/en/MediaCentre/HotTopics/Pages/BWM-default.aspx>

All Optimarin` s systems are delivered with a range of UV Chambers from 1 to 18 UV chambers which includes 1 UV lamp per UV chamber with a capacity of 167m²/h. So, the range of the capacity of one system goes from 167 to 3000m³/hour.

During the cleaning process, the water flows through a fine masked filter before it is being radiated with UV light in our UV chambers from a 35kW lamps.

The percentage of UV-based products of the total production is 100%.

Our annual consumption of lamps is 750 (2020) Total delivered number of lamps are 7005 UV lamps from 2009 until present. This number will vary with the amount of applications installed onboard the ships around the globe.

For the time being there are 678 systems with mercury-based UV technology in operation on vessels worldwide (March 2021). This number is currently increasing.

Optimarin's experience with alternative lamps is that such lamps will not work, and there is no technology on the horizon which is a candidate to replace the lamps used in the products. The treatment of ballast water requires a broad spectrum UV light in order to neutralize the life in the ballast water. The light from alternative technologies is too "narrow" and does not have sufficient power to be used in the treatment process.

The UV lamps will be required for the OBS to do the job according to the type approvals in IMO and USCG. Optimarin has chosen to use filter and UV light in the system due to the environmental impact and the efficiency of the technology. Alternatives like electro chlorination or use of other substances like different kinds of chemicals are not an option for Optimarin and have a negative environmental footprint. Optimarin has not invested in developing such products but invested in improving and ensuring that the product has type approvals required by relevant authorities.

Use of other kinds of technologies have also proven inadequate under some conditions like very cold water or in freshwater and partly in brackish water, hence suboptimal for the removal of the invasive species.

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).

The wording should be retained, and an extension should be requested at least until 2026 and beyond. The reasons are:

One of the largest threats to oceanic life on the planet is defined by United Nations to the threat of invasive species. Click [HERE](#) for further details on the International Convention for the Control and Management of Ship's Ballast Water and Sediments. As a solution to this threat is the use of environmentally friendly technology like the use of filter and UV-based cleaning system for ballast water. Each year approx. 10 billion tons of ballast water is transported around the globe. For Optimarin and its competitors using filter and UV the only efficient way of treating this water is by using mercury lamps.

The use of filter and UV systems to clean the water has no ecological impact on the environment. The alternative is as mentioned, to use electro chlorination or chemical substances. The chemicals have to be neutralized before discharge, but nevertheless, the chemicals are produced and used, and the neutralizer is self has a negative impact in the oceans as well as onboard the vessel.

The need for UV lamps in our industry is regulated through the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention). The goal is to have equipped all relevant vessels with a BWTS within September 2024. The use of filter and UV technology will be installed on all the relevant vessels, and further increase will follow the increase or decrease of the world fleet form 2024 onwards. The number of relevant vessels is estimated to be around 30 thousand globally in 2024.

The mentioned regulative is guiding the market through Type Approvals given by IMO (International Maritime Organization) and the US Coast Guard. They have appointed class survey companies to issue the certificates based on tests performed on the system. In all UV/filter systems you will find lamps using Mercury.

Optimarin (**and other companies**) has described how to collect and return used lamps to approved receiving points around the world in our operation manual. This will reduce the amount of mercury polluting the earth to an absolute minimum.

One should also keep in mind that the amount of mercury used in our lamps is approx. one gram per lamp. Meaning that our 7000 lamps has a potential to release 7 kilos of mercury world-wide. Since the majority of the lamps are recycled the amount released to the nature is close to zero.

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

From an industrial point of view, the shortening of the period of validity does not make sense, because the development of alternative solutions (e.g., based on UV LEDs) takes a long time, and the technology is most likely not viable unless a major technology breakthrough is achieved. The development for new applications in the UVC area is therefore still facing major challenges.

Furthermore, it can also be assumed that not all specific UV applications are well-known to VDMA and LightingEurope and have therefore been neglected to be investigated and considered in detail. The previous wording of the exception: "Mercury in other discharge lamps for special purposes not specifically mentioned in this Annex" should therefore be retained unchanged.

With regard to the following current and future developments/processes/products, the availability of UV lamps containing mercury is indispensable for our company. Currently there are no other ways than using mercury for the ballast water treatment industry.

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 periodic system of the elements offers no alternative to mercury in discharge lamps (i.e., an "alternative filling") that would be a direct 100% compatible replacement. The physical properties of mercury make this material quite unique and ideally suited for discharge lamps (high vapor pressure, low boiling point, specific spectral lines in areas that are ideal for disinfection and photochemical reactions). Scientific and industrial approaches to compatibly replace mercury with an alternative substance while maintaining the specific beneficial properties of mercury discharge lamps have been ongoing for decades and have all failed.

There are other mercury-free types of discharge lamps and other light sources like UV-LEDs available with very severe limitations:

- Direct replacement (exchanging only the lamp) is in most cases technologically not possible
- Replacement of existing machines/processes with alternative light sources (if available) usually requires additional steps, which may include:

- replacement of power supplies and peripheral electrical components
- use of other substrates
- necessity for (other) pre-treatment technology
- necessity for inert production environments (expensive use of nitrogen or carbon dioxide)
- change of UV measurement equipment (different spectral sensitivity)
- change of process speeds (usually substantial speed and productivity decrease)
- heavy redesign of the treatment system
- complications like cross-sensitivity to daylight and/or artificial lighting

- With respect to UV disinfection (water/air/surfaces), there currently is no real replacement available with a similar efficiency or with less impact on the environment. The affected markets include, vessel ballast water treatment, and many more.

- 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, replacement of existing UV lamp system with alternatives leads to a manifold of problems including quality issues, process downtime, productivity decrease, high investment costs, higher overall operational costs, but most importantly a non-functional product, which in its own right contributes to improve the environment significantly and on a much larger scale than the detriment of using mercury in the lamps.

There are currently no alternatives in the market as a substitute for the existing UV technology with all its benefits compared to other ballast water technologies. Taking into consideration that our customers vessels are running globally, they might experience cold water, fresh, marine, and brackish water and turbid water on one single journey, loading and offloading in different harbours on one voyage. The system has to cope with all these different circumstances and mercury lamps are the only doable way fulfilling the demands of the system set by legislation and TA.

- 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 see the existence of a roadmap for the complete substitution/elimination of mercury-based discharge lamps in ballast water treatment applications.

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?

Competing technologies are used to treat ballast water. However, they will have to use chlorine made from an electrolysis process in the system. Before de-ballasting they must add neutralizing agents to make sure that the water is pH-neutral. The long-term effects on the use of these agents are not 100% clear. In addition, a misreading might lead to that chlorinated water is discharged by accident. Yet other systems use active substances which are neutralized over time in the ballast tanks. The acid levels are read over time and the ballast water might be discharged when the readings are OK. All these systems are potentially more harmful against the nature than the use of some grams of mercury in the lamps.

A return system, as mentioned above is in place and is making sure that most of the mercury used in lamps is returned and re-used.

Accidental spills are very rare and occurs only if the system is wrongly treated/operated.

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?

The market is huge. i.e. are most of all the container ships in the world equipped with UV / Filter systems. Half of the world's fleet is a potential for using UV / filter. This amounts to approx. 30 000 vessels. Approx. 3000 of these are potential Optimarin systems. This led to an installed base in the future of approx. 15 000 lamps running, being exchanged approx. every 2,5 years. (6000 lamps exchanged every 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?

Most existing machines on the market running with mercury discharge lamps would have to be considered as additional waste and would have to be disposed of. In many cases, it is economically and/or technologically not feasible to retrofit existing equipment with alternative light sources.

If UV lamps are no longer available, the following processes and entire machines are no longer usable: The whole system has to be re-engineered and all existing equipment used to run the lamps would be obsolete. We are talking about hundreds of tons of electronic components.

The effect for our company would be devastating. Everything around our technology need to be re-engineered and all TA's would have to be renewed, with significant costs. The same would be valid for the whole market of ballast water treatment system using filter / UV technology.

All vessels will have to replace their systems with environmentally less friendly system for a cost of billions of dollars.

- 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 requested time period? Please detail the main sectors in which possible impacts are expected – manufacturers of equipment in the scope of the exemption, suppliers, retail, users of MRI devices, etc.

For Optimarin and its sub-suppliers the consequence would be to place the operation outside Europe. For European customer the consequence would be that they could only obtain new lamps outside Europe and therefore have to stop running, or install chemical-based system to operate within Europe.

- 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).

Optimarin will close and the cost of exchanging the world's fleet will amount to 100s of billions of dollars.

Unemployment costs for thousands of personnel.

Heavy investment costs for companies into new machinery/equipment, at the same time costs for disposal of no longer usable machines and equipment

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

We/our customers would have to perform investments in systems and machinery to a total value of billions of €

Our business would cease to exist.

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

We believe that the responsible authors of the pending mercury ban dramatically underestimate the global impact of a mercury ban on industries, products, markets, and lastly employment opportunities and end consumers.

The dramatic socio-economic outcome of a mercury-ban bears no meaningful relation to the very small amount of mercury that is really brought into the market by mercury-containing discharge lamps both in absolute amounts and compared to other industries using mercury. Used lamps can be recycled and the mercury content can be reused for new lamps. If all participants in the market actively use the recycling opportunities, the mercury content for discharge lamps can be confined to closed-loop processes without damage or impact to the environment and personal health.

We would like to strongly encourage policy makers to invest their effort into a well-organised recycling system including increasing the public awareness on the necessity of actively participating in the recycling loop. This is a win-win situation for all involved parties to the best outcome of having the best technologies available for the specific needs and without banning certain products, machines, technologies, or markets for “the worse”.

It is also important for us to emphasise the volumes of mercury used in lamps which might be spilled into the nature and compare this with the spills coming from mining and other heavy industries. This not for the sake of blaming others, but in order to get the best result and still affect the socio economics as low as possible.

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.

The following information is to be treated confidentially and may not be published. We are sharing it with Bio Innovation Service for the sole purpose of better understanding and supporting the arguments against a mercury ban. The numbering refers to the aforementioned questions and points.