BALDWIN®

Unlocking Your Potential

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

Dear Sir, Madam,

Baldwin are a global manufacturer of ultraviolet light sources, process automation equipment, consumables and service solutions. The organization was established in 1918 and employs over 500 personnel worldwide. Baldwin manufacture the Primarc and Western Quartz UV lamps and AMS Spectral UV curing systems which are utilized in a wide range of industries:

Disinfection/Sterilization

- Water treatment (waste water, drinking water and fish farms)
- Surface disinfection
- Air disinfection

Accelerated Drying – UV Curing of inks and coatings

- Offset printing
- Web (narrow/wide)
- Security printing
- Label printing
- Metal decorating
- Composites, automotive coatings
- Food packaging
- Pharmaceutical and cosmetics packaging
- Wood finishing

Industrial Applications

- Electronics – PCB board manufacture, Surface modification for semiconductor fabrication
- Photochemical / photobiological processes
- Surface treatment of marble and ceramics
- Adhesives and silicones
- Flat screens
- Medical

Please find below our comments / feedback with regard to the Consultation Questionnaire.

Question 1a

The wording should be maintained, and the extension requested at least until 2026 and beyond. Reasons as follows:

With reference to RoHS Art. 5(1)(a): Exemptions for materials and components may be considered, if:

"their elimination or substitution via design changes or materials and components which do not require any of the materials or substances listed in Annex II is scientifically or technically impracticable."

This is the current situation.

There are no alternative chemical elements that could be deployed to replace the mercury within the lamp to reproduce the UV wavelength spectrum. There are also no viable UVC light sources that are vital for many applications.

Whilst there has been ongoing development of alternative technology such as UV LED, for certain applications adoption is limited due to significant differences in the emitted UV spectrum (polychromatic mercury lamps vs monochromatic LED), lack of availability of viable shortwave LEDs (UVC, UVB) and the need to develop new chemistries to work with the LED light sources. For the limited number of applications where alternative technology, is possible, this is achieved with completely new / re-designed equipment as retrofit/upgrade solutions to the existing UV system / equipment are not possible.

Shortwave UV is very important for applications requiring a hard wearing or scratch resistant surface. For example, Car headlights, mobile phone screens, currency, security, coatings for glass. UVC is also vital for disinfection/sterilization, surface modification and inspection applications. There is no viable substitute technology for most of these applications.

It should also be considered that UV lamps are a consumable component and there is no viable alternative technology for spare parts - existing equipment on the market cannot be easily fitted with an LED light source without significant re-investment to replace the current controls and infrastructure to support the LED technology.

"the reliability of substitutes is not ensured"

This is the current situation.

The deployment of alternative substitutes to UV lamps also requires the development of new chemistries for the UV curable inks and coatings. This is particularly an issue for applications currently requiring shortwave UVC where there is no alternative substitute technology. UV disinfection/sterilization is also an example requiring wavelengths in the UVC region.

For the limited applications where an alternative technology could be used this often requires much higher cost UV curable material. For certain applications for a change in formulation to be accepted certification may be required particularly for medical and disinfection/sterilization processes.

"the total negative environmental, health and consumer safety impacts caused by substitution are likely to outweigh the total environmental, health and consumer safety benefits thereof"

If the application of mercury in lamps is prohibited, there will be huge negative socioeconomic impacts: The EEE using these lamps as spare parts will become unnecessary waste. Potential health hazards with not being able to disinfect/sterilize drinking water, processing of wastewater, surface / air disinfection and UV disinfection of food packaging. The application to produce scratch resistant coatings would have to revert to solvent based inks which are more hazardous to health and the environment. UV curable processes are more efficient than traditional solvent based drying methods with a significantly lower CO2 footprint.

Question 2a

There is no alternative to the application of mercury in UV lamps. Mercury is unique in that it has properties that are ideal for the use as a filling in arc discharge lamps:

a) Low boiling temperature and ability to form a high vapor pressure
b) As a vapor in a discharge lamp, it will produce radiant emission across the full UV wavelengths spectrum (UVC, UVB, UVA & UVV) making the lamps suitable for a wide range of applications ranging from disinfection/sterilization to various photochemical processes
c) By using a combination of different elements, the spectral wavelengths emission can be modified and controlled

There is ongoing development of alternative technology such as UV LED, however, adoption is limited due to:

a) Differences in the emitted UV spectrum (monochromatic LED source vs polychromatic mercury lamp source)
b) Limited viable wavelengths – UVA and UVV only
c) Existing Ink / coating chemistries have to be completely redeveloped to work with the LED light source
d) Alternative technology is not retrofittable to replace the existing mercury lamp.
e) No viable alternative for applications requiring high levels of shortwave UVC radiation (required for scratch resistant coatings, disinfection/sterilization, surface cleaning, surface modification applications

Question 2b

As mentioned above, there is ongoing work to develop UV LED technology, but adoption is slow due to the reasons stated above and in some cases may require reintroducing hazardous solvent based technologies that are damaging to the environment:

a) Increased energy consumption to achieve similar process speeds
b) Release of harmful chemicals to the environment

For many applications especially those requiring high levels of shortwave UV radiation, there are no alternatives to mercury lamps. Development of efficient UVC LED light sources are at least 15-20 years away from possibly becoming viable.

Question 2c

The roadmap is indicating 15-20 years until UV LED could substitute existing UV mercury lamp technology over the complete wavelength range.

a) Viable LED wavelengths are limited to the range 365 – 420nm.
b) Development of UV LEDs emitting over the range <365 – 265nm is ongoing and best case is 5-10 years for viable performance. For example, our testing of UVC LEDs suggest we require 250mW output from a single die. Today the typical output is around 40mW with acceptable lifetime
c) Below 265nm performance falls away even further. Ultimately, there are fundamental limitations with the physics of the of the current LEDs (Al GaN) which limits them to 210nm. Wavelengths below 210nm are used by a number of existing applications – particularly semiconductor / electronics.

Question 3

There are no alternative devices with comparable performance that can be retrofitted into equipment designed to operate a mercury lamp.

As stated above, there are technologies for example LED that can be used in certain applications requiring UVA/UVV but can only be deployed by replacing the EEE designed to operate the mercury light source and requiring new ink / coating chemistries. There is no viable alternative technology for processes requiring wavelengths in the UVC & UVB regions.

Question 4a

The total worldwide mercury lamp UV Curing systems market value was 2,409.4MUSD in 2019 (Data from Markets and Markets).

This figure does not include applications of mercury outside of UV Curing.

Question 4b

There are no substitute technologies that can be retrofitted into equipment/processes designed for mercury lamps. As detailed above for certain applications UV LED may be an alternative but can only be deployed by replacing the EEE designed to operate the mercury light source.

Therefore, should the exemption not be renewed, or, not be renewed for the requested duration, the supply of these lamps as consumable parts would not be allowed to be placed on the market. This would impact the manufacturers of these special purpose lamps resulting in economic impact and users will no longer have access to lamps to service existing equipment and production needs. The lack of lamps for existing equipment will result in the installed equipment becoming obsolete, and creating unnecessary EEE waste.

Question 4c

There will be a significant impact to all business particularly the food industry and medical applications currently using mercury based UV technology should the exemption not be renewed.

Users of mercury based UV equipment would no longer be able to utilize their equipment and significant business for the manufacture of products requiring the use of this technology would move outside of Europe.

The lack of availability of viable light sources for disinfection/sterilization applications would have a direct impact on public health.

Question 4d

The range of products and services requiring mercury based UV lamps is vast and very difficult to quantify.

a) Companies using mercury UV lamps to manufacture their products would have to re-invest in new non mercury based technology (where possible). This will result in high costs to replace the existing equipment, generate unnecessary EEE waste, and the prospect of loss of business to companies outside of Europe.
b) Manufacturers of mercury UV lamps would face closure
c) Disinfection/sterilization (eg, water/waste water, surface disinfection). Again, significant investment would be required to move to alternative technologies where possible and certain processes would no longer be practical thus impacting public health.

Question 5 – Additional Information

The application of mercury in special purpose UV Curing lamps is largely self-sustaining in that support infrastructure for the recycling of used lamps has been in place for a considerable time allowing the mercury to be reclaimed and utilized for future lamp production. Conversely, alternative EEE technology cannot so easily be repurposed at the end of life.

Yours faithfully

Jonathan Drayton
Research & Development Manager