Exemption Request Form

Date of submission: _____

1. Name and contact details

1) Name and contact details of applicant:

Company:	VDMA e.V.	Tel.:	+49 (0) 69 6603-1454
Name:	Roger Starke	E-Mail:	roger.starke@vdma.org
Function:	Printing and Paper Technology	Address:	Lyoner Straße 18, 60528 Frankfurt/Main

2) Name and contact details of responsible person for this application (if different from above):

Company:	_____	Tel.:	_____
Name:	_____	E-Mail:	_____
Function:	_____	Address:	_____

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2. Reason for application:

Please indicate where relevant:

☐ Request for new exemption in:

☐ Request for amendment of existing exemption in

☒ Request for extension of existing exemption in

☐ Request for deletion of existing exemption in:

☐ Provision of information referring to an existing specific exemption in:

☒ Annex III ☐ Annex IV

No. of exemption in Annex III or IV where applicable: 4f

Proposed or existing wording: Mercury in other discharge lamps for special purposes not specifically mentioned in this Annex

Duration where applicable: 21.07.2016

☐ Other: _____

3. Summary of the exemption request / revocation request

The application for extension of the existing exemption refers to mercury discharge lamps which are used for curing / polymerisation (e.g. of layers of ink and coating,

adhesives and sealants) and for disinfection (e.g. of water, in the medical field, beverage bottles).

The German engineering federation Verband Deutscher Maschinen- und Anlagenbau (VDMA) is the organisation of both the manufacturers of such UV lamps (so-called medium-pressure mercury lamps) including UV systems in which they are used as a basis and machine manufacturers who integrate this UV technology into their products. The VDMA is the largest European association of the capital goods industry with approx. 3100 mainly medium-sized German and European member companies.

In the printing industry, a large number of products are printed with UV inks and/or finished with UV coating. They include, inter alia, folding boxes, flexible packaging products, labels, books, advertising matter, package inserts for pharmaceutical industry, forms, banknotes, credit cards and identity documents.

It is estimated that approx. 35% of the sheetfed offset printing machines and approx. 85% of the narrow-web flexo label printing machines in Europe are equipped with or prepared for conventional UV technology. According to the market research company Smithers Pira (UK), total sales of products printed with UV curing amount to approx. 7.5 billion euros in West Europe; a new study ("The Future of Radiation Curing for Graphic Arts 2014-2019") expects an increase to approx. 10 billion euros by 2019. This is equivalent to approx. 10% of the total sales of the European printing industry (88 billion € in 2010; www.intergraf.eu). Estimates of the machinery manufacturers assume that UV printing accounts for 20% of sales. Due to its advantages, among others, immediate availability for print finishing, gloss, no need for powder application and production of resistive surfaces, UV curing cannot be substituted adequately by other drying technologies in the printing industry. Medium-pressure UV mercury lamps provide a radiation dose in the short-wave UV range (UVB and UVC) which is required for the current press speed and application thicknesses in order to guarantee reliable through-curing of inks and coatings.

Short-wave UV light can destroy DNA and, therefore, it is used for chemical-free and hence environmentally friendly disinfection. For the disinfection of water, low-pressure and/or medium-pressure UV lamps are used, depending on the flow rate. In the urban water supply systems, UV radiation is a cleaning step before the water is fed into the urban water distribution pipes. Another example of applications is, for instance, the disinfection of ballast water on ships before it is discharged again into the sea.

LEDs are seen as first choice to replace mercury discharge lamps. In contrast to mercury lamps, LEDs create only narrow banded light and are mainly available in the UVA and visible light range. Mercury discharge lamps supply UV light ranging from UVC through to UVA of which especially the short-wave ranges with high radiation doses are used for polymerisation and disinfection. In this respect, LED-UV lamps can, at present, only be used in selected applications due to the low performance and limited emission ranges. Medium-pressure UV lamps are much more efficient (in

terms of cost, energy, speed) and cannot be replaced in specific applications (disinfection, surface hardening, low-migration printing).

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4. Technical description of the exemption request / revocation request

(A) Description of the concerned application:

1. To which EEE is the exemption request/information relevant?

Name of applications or products: UV equipment for polymerisation and disinfection

a. List of relevant categories: (mark more than one where applicable)

☐ 1	☐ 7
☐ 2	☐ 8
☒ 3	☐ 9
☐ 4	☐ 10
☒ 5	☐ 11
☐ 6	

b. Please specify if application is in use in other categories to which the exemption request does not refer: No

c. Please specify for equipment of category 8 and 9:

The requested exemption will be applied in

☐ monitoring and control instruments in industry

☐ in-vitro diagnostics

☐ other medical devices or other monitoring and control instruments than those in industry

2. Which of the six substances is in use in the application/product?

(Indicate more than one where applicable)

☐ Pb ☐ Cd ☒ Hg ☐ Cr-VI ☐ PBB ☐ PBDE

3. Function of the substance: Mercury is responsible for the creation of typical spectral lines and, therefore, the UV spectrum, which cannot be achieved by other technologies.

4. Content of substance in homogeneous material (%weight): Pure mercury (=100%) in sealed lamps

5. Amount of substance entering the EU market annually through application for which the exemption is requested: According to Yole Report 2012[1)] the estimated market of mercury-based lamps for UV curing applications is 440,000 pieces worldwide. Under the assumption of an average mercury content of 0.5 grams per lamp, the worldwide usage for UV curing is approx. 220 kg. RadTech (http://www.radtech-europe.com) estimates the worldwide UV curing market based on the production of chemical raw materials. The share of the European market is roughly 30% of the global market. So the estimated amount of mercury annually entering the EU is **approx. 75 kg (for UV curing applications)**.

   According to Yole, disinfection will use 535,000 lamps. These lamps are responsible for a worldwide mercury usage of 268 kg and therefore **81 kg within Europe for disinfection**.

   The quantities of mercury that are placed on the market for gas discharge lamps for the industry are marginal compared with the quantity used for the generally used fluorescent lamps and energy-saving lamps.

   The Mercury-Report 2008 [2)] gives comparative figures about the use of mercury in industrial processes and products in the EU:
   - Total use of mercury 320 … 530 t/a
   - for lamps: 11-15 t/a, including energy-saving lamps, equivalent to approx. 3% of total use
   - for HID (High Intensity Discharge) lamps: 1.1 …1.5 t/a, which besides special lamps also largely include lamps for illumination, equivalent to 0.3% of total use
   - for UV curing and disinfection: 156 kg/a, equivalent to approx. 0.4 per mille of total use and/or 1.2% of the amount used in lamp production.

   Please supply information and calculations to support stated figure.

   1) Report “UV LED Comprehensive Survey”, Yole Développement 2012, page 40

   2) Mercury Report 2008: "Options for reducing mercury use in products and applications, and the fate of mercury already circulating in society", COWI 2008, Table 0-1, http://ec.europa.eu/environment/chemicals/mercury/pdf/study_report2008.pdf

6. Name of material/component: Mercury in discharge lamps

7. Environmental Assessment: Please refer to Environment Protection Agency (http://www.epa.gov/mercury/eco.htm

   LCA: ☐ Yes
   ☒ No

(B) In which material and/or component is the RoHS-regulated substance used, for which you request the exemption or its revocation? What is the function of this material or component?

Mercury is used in medium-pressure lamps in a liquid form. During the starting phase of these lamps, the mercury is vaporised and, therefore, raised to higher energy levels (made unstable). The drop from these higher energy levels (return of the electrons from the higher energy level) causes the emission of UV light with the characteristic spectral lines. These spectral lines supply the necessary photons for UV curing and disinfection. See Annex I.

(C) What are the particular characteristics and functions of the RoHS-regulated substance that require its use in this material or component?

The mercury (Hg) within the lamps is able to provide the radiation spectrums needed for UV processes. In the polymerisation of layers, so-called photo-initiators (PIs) are needed. The photo-initiator is a component of the UV printing ink or the emulsion used as a curing agent. The PIs react to the UV light created by means of mercury especially in the UVC and UVB range. The UVC and UVB light acts as a catalyst and initiates the polymerisation process. In disinfection, the radiation especially produced by mercury ensures the destruction of DNA. See Annex II

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5. Information on Possible preparation for reuse or recycling of waste from EEE and on provisions for appropriate treatment of waste

1) Please indicate if a closed loop system for EEE waste of application exists and provide information of its characteristics (method of collection to ensure closed loop, method of treatment, etc.)

UV lamp manufacturers offer users the redemption of their mercury vapour lamps for recycling purposes. Worn-out lamps are handed over to a certified waste management company which takes over the responsibility for the recycling of the mercury lamps. (see Annex V, example of certification – waste management company of IST Metz, Nürtingen)

The mercury containing lamps are dismantled and the mercury is recycled. According to www.lightcycle.de/ruecknehmer/altlampen-recycling.html the recycling rate for mercury is 99.8%.

Users who do not return their lamps are instructed (mandatory part of the instruction for use / instruction manual, duty for marking with symbol for separate collection, see Annex III) to have the used mercury lamps disposed of by a certified waste management company. ISO 14001 and EMAS (Eco-Management and Audit Scheme) certified users will ensure this recycling process.

2) Please indicate where relevant:

☒ Article is collected and sent without dismantling for recycling

☐ Article is collected and completely refurbished for reuse

☐ Article is collected and dismantled:

- ☐ The following parts are refurbished for use as spare parts: _____
- ☐ The following parts are subsequently recycled: _____

☐ Article cannot be recycled and is therefore:

- ☐ Sent for energy return
- ☐ Landfilled

3) Please provide information concerning the amount (weight) of RoHS substance present in EEE waste accumulates per annum:

☐ In articles which are refurbished _____

☒ In articles which are recycled The worst case will be that all annually delivered lamps will be replaced within one year, which will result in 75 kg for UV curing and 81 kg for disinfection within Europe.

☐ In articles which are sent for energy return _____

☐ In articles which are landfilled _____

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6. Analysis of possible alternative substances

(A) Please provide information if possible alternative applications or alternatives for use of RoHS substances in application exist. Please elaborate analysis on a life-cycle basis, including where available information about independent research, peer-review studies development activities undertaken

There is no alternative chemistry for mercury for the creation of a typical UV spectrum, especially in the UVC range, that is known of. Therefore, LED-UV is presented in comparison in the following statement as an alternative technology.

(B) Please provide information and data to establish reliability of possible substitutes of application and of RoHS materials in application

LED-UV technology is an alternative to conventional UV curing by means of UV mercury pressure lamps.

Assessment of its applicability in printing:

In digital printing, e.g., large-format inkjet printing systems, LED-UV units have been used successfully for some years already. They are mostly integrated in the printing heads. The radiation dose of LED-UV units is lower compared to the

conventional medium-pressure mercury lamps. Since printing is done in several passes (multi-pass technology), polymerisation is ensured by moving the UV-LED radiation units over the same spot several times. In single-pass digital printing systems, in addition conventional UV dryers are often used in end-of-press drying in order to guarantee through-curing of the layers (inter alia, dependent of the printing speed).

The situation is different in conventional printing methods (offset printing, flexographic printing, gravure printing, screen printing) which account for approx. 90% of the total printing volume of the products made in Europe. For these processes, higher amounts of energy, which are at present only achieved by medium-pressure mercury lamps, are required for UV drying for the following reasons:

- High printing speeds in sheetfed offset and web offset printing machines
- the required minimum distance and the process-related flexible distance between the substrate and the UV lamps
- reliable through-curing of ink and coating layers to ensure low migration (low-molecular components), especially in food packaging

The available LED-UV technology is mainly effective in the UVA range. Since the UVA range in the spectrum is near visible light, pre-curing of the inks may occur which has negative effects on the printing process.

The absorption spectra of photo-initiators in the LED printing inks which initiate the polymerisation process must be matched with the emission spectra of the LED-UV lamps.

The development of printing inks which are suitable for the radiation spectra of the UV-LEDs is impeded by the limited availability of suitable photo-initiators for UV printing inks (see Annex II with the photo-initiators most commonly available on the market). Due to the new CLP classification of the photo-initiators, their number in the market will continue to decrease. The printing ink industry resorts to selecting the photo initiators that are most suitable for LED-UV inks from the photo-initiators available in the market and in this respect makes compromises with regard to the range of applications. (The European umbrella association of the printing ink manufacturers Eupia – www.eupia.org – has been asked for an opinion on this matter.)

The absorption curves of the photo-initiators show that most of those that can be used have their main absorption bands in the UVB and UVC range.

At present, the radiation energy of LED-UV lamps in this spectral range is too low for the through-curing of ink and coating layers and the operation of UV dryers in an economical and energy-efficient way. Furthermore, UV-LEDs emit only in a very narrow-band range. Reliable curing is, however, needed for compliance with the European requirements for low migration of substances from food packaging materials (Regulation (EC) No 1935/2004 on materials and articles intended to come into contact with food). The synthesis, approval and registration (REACH) of new suitable photo-initiators requires substantial research efforts and tests which, at the moment, are disproportionate considering the amounts of ink produced.
Furthermore, the ink manufacturers state that the development of new LED-UV printing inks, their CMR (CMR=Carcinogenic, Mutagenic and toxic to Reproduction) testing and approval takes 5 to 7 years and, therefore, is not economically reasonable considering the present market volume.

UV-LEDs cannot be used for disinfection since wavelengths of 265 nm or lower are required for the destruction of DNA and this cannot be achieved by UV-LEDs. As an alternative, chemical substances could be used for disinfection. UV radiation is, however, a safer option since germs may become resistant to chemical substances.

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7. Proposed actions to develop possible substitutes

(A) Please provide information if actions have been taken to develop further possible alternatives for the application or alternatives for RoHS substances in the application.

Shorter LED wavelengths are technically available in R+D, but are expensive and not powerful enough.

(B) Please elaborate what stages are necessary for establishment of possible substitute and respective timeframe needed for completion of such stages.

Short-wavelength LEDs should be available commercially, and output must be increased at least by a factor of one hundred.

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8. Justification according to Article 5(1)(a):

(A) Links to REACH: (substance + substitute)

1) Do any of the following provisions apply to the application described under (A) and (C)?

☐ Authorisation

- ☐ SVHC
- ☐ Candidate list
- ☐ Proposal inclusion Annex XIV
- ☐ Annex XIV

☐ Restriction

- ☐ Annex XVII
- ☐ Registry of intentions

☐ Registration

2) Provide REACH-relevant information received through the supply chain.
Name of document: _____

(B) Elimination/substitution:

1. Can the substance named under 4.(A)1 be eliminated?

☐ Yes. Consequences? _____

☒ No. Justification: Mercury is the functional component of a mercury discharge lamp and is needed to create the desired UV radiation spectrum. A reduction of the amount of mercury in a certain range or the complete elimination in the lamp is not possible. Please refer also to 4 (B) and 6 (A).

2. Can the substance named under 4.(A)1 be substituted?

☐ Yes.

- ☐ Design changes:
- ☐ Other materials:
- ☐ Other substance:

☒ No.

Justification: Mercury discharge lamps generate UV radiation in a range between 200 and 440 nm. This UV spectrum will fulfil the requirements set up in the industry with respect to mechanical properties (abrasion resistance, durability), non-yellowing, insensitivity to day light, avoiding inhibition and killing of germs.

For some special kinds of application, UV-LED technology is a suited alternative to the conventional technology. For these application fields, special chemical formulations have been developed. But nevertheless, these are only a few applications which can be processed with UV-LED.

This is due to the technical properties of the UV-LEDs (please consider the monochromatic nature of the emitted UV radiation of an LED; referring to the state of technology: only wavelengths ≥ 365 nm with good optical exploitation are currently available; in addition, the UV-LED is very expensive in comparison to mercury discharge lamps.)

3. Give details on the reliability of substitutes (technical data + information): Please see justification above (B 2.)
4. Describe environmental assessment of substance from 4.(A)1 and possible substitutes with regard to
    1) Environmental impacts: http://www.epa.gov/mercury/eco.htm
    2) Health impacts: http://www.epa.gov/mercury/effects.htm
    3) Consumer safety impacts: There is no impact if UV equipment is used in a proper way and the manual is respected

⇨ Do impacts of substitution outweigh benefits thereof?
Please provide third-party verified assessment on this: There is no chemical substitution available, only a limited substitution by LED technology

(C) Availability of substitutes:

a) Describe supply sources for substitutes: There are various producers of LED arrays who assemble UV curing arrays based on LED chips. Please find below a list of producers: IST Metz GmbH, Integration Technology, Heraeus Noblelight, Hönle AG, etc. (listing without claim of completeness). But nevertheless, LED technology cannot replace mercury vapour lamps in most applications.

b) Have you encountered problems with the availability? Describe: LED chips with reasonable optical outputs at wavelengths down to 365 nm are available. But for most of the applications also radiation at a lower wavelength is needed. (More precisely: the broad UV spectrum of a medium-pressure mercury vapour lamp is needed). At lower wavelengths, there are no LED chips with good optical yields and reasonable prices available.

c) Do you consider the price of the substitute to be a problem for the availability?
☒ Yes ☐ No

d) What conditions need to be fulfilled to ensure the availability? The technology of LED chips production needs to be improved to produce powerful chips also at lower wavelengths in the UV range.

(D) Socio-economic impact of substitution:

⇨ What kind of economic effects do you consider related to substitution?

- ☒ Increase in direct production costs
- ☒ Increase in fixed costs
- ☒ Increase in overhead
- ☒ Possible social impacts within the EU
- ☒ Possible social impacts external to the EU
- ☐ Other: _____

⇨ Provide sufficient evidence (third-party verified) to support your statement: The prices of LED-UV inks are currently approx. 2/3 higher than those of conventional printing inks. One reason is the higher proportion of photo-initiators in order to achieve adequate curing even with the lower radiation dose of the UV-LEDs. The investment costs of the LED-UV modules for the curing process are substantially higher compared to conventional UV lamps (variety of chips required, integration of optical components and the related construction and connection technology). High expenses are needed for the development of materials and the implementation of reliable processes along the total value chain. The production of certain printed products could be transferred to other regions of the world, which would have direct effects on the employment situation in the European printing industry. Social effects are seen with regard to food safety (migration of low-molecular substances in the event of inadequate curing by means of UV-LED) and/or water treatment (lack of safe and environmentally friendly substitute technology).

9. Other relevant information

Please provide additional relevant information to further establish the necessity of your request:

The creation of UV light with shorter wavelengths in the UVC range by mercury is the most powerful light source and will ensure the process of surface hardness and disinfection, like killing germs.

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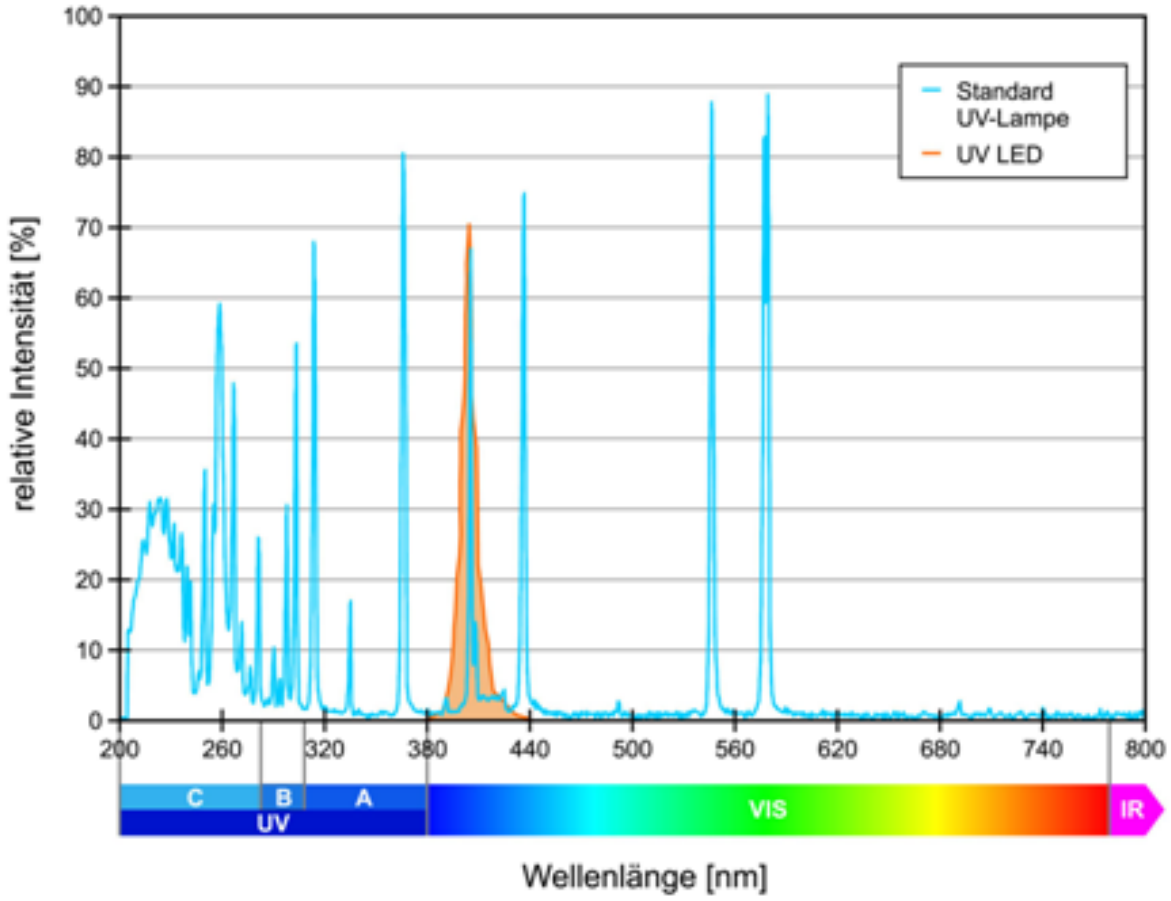
10. Information that should be regarded as proprietary

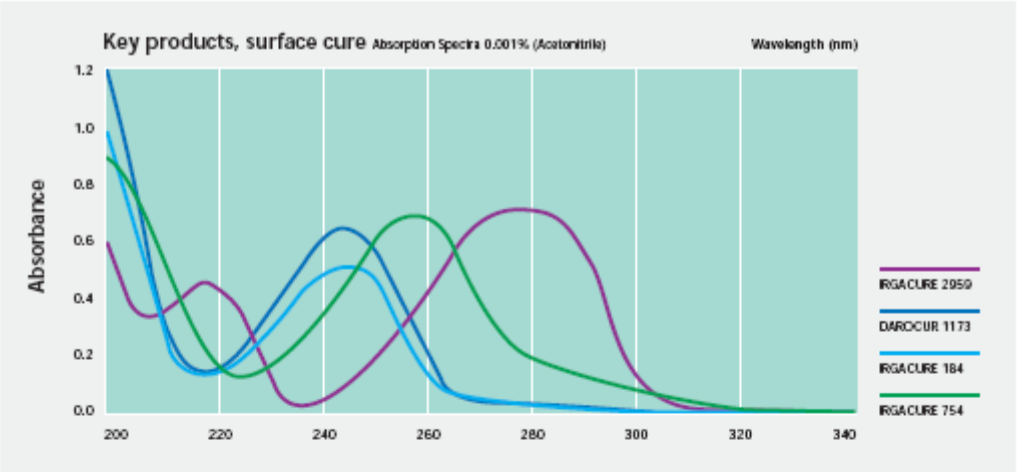
Please state clearly whether any of the above information should be regarded as proprietary information. If so, please provide verifiable justification:

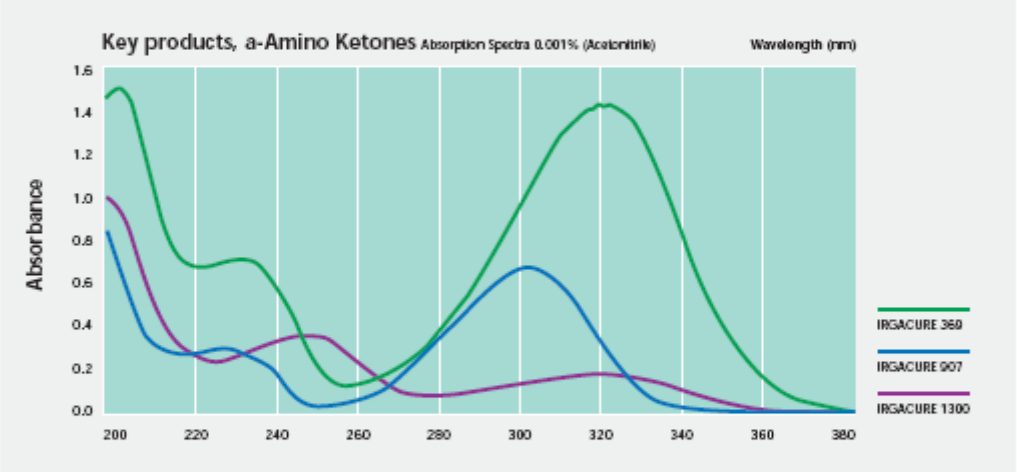
_____

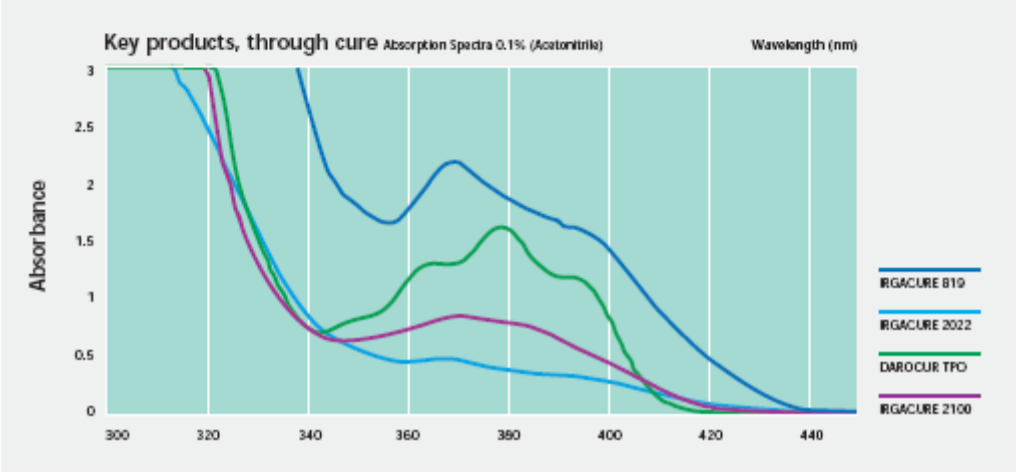
ANNEX I: DIFFERENT LAMP SPECTRUM



ANNEX II: ABSORBANCE OF PHOTOINITIATORS







ANNEX III: Marking

UV medium-pressure discharge lamps shall be marked with a symbol (crossed-out wheeled bin) according to 2012/19/EU, Annex IX, which indicates the duty of separate collection.

ANNEX IV:

The VDMA is acting as an authorized representative for the below listed companies. The submitted request form is an elaboration of information of the named companies.

Heidelberger Druckmaschinen AG
Kurfürsten Anlage 52 – 60
69115 Heidelberg
Contact person:
Mr. Klaus Blank
Phone: (+49 6221) 92-39 74
E-mail: klaus.blank@heidelberg.com
Internet: www.heidelberg.com

Koenig & Bauer AG
Friedrich-Koenig-Str. 4
97080 Würzburg
Contact person:
Mrs. Mariann Banki
Friedrich-List-Str. 47
01445 Radebeul
Phone: (+49 351) 8 33-29 53
E-mail: mariann.banki@kba.com
Internet: www.kba.com

IST METZ GmbH
Lauterstr. 14 – 18
D-72622 Nürtingen

Contact person:
Mr. Stefan Feil
Phone: (+49 7022) 60 02-7 00
E-mail: stefan.feil@ist-uv.com
Internet: www.ist-uv.com

Technigraf GmbH
Auf der Struth 4
61279 Grävenwiesbach
Internet: www.technigraf.de

Contact person:
Mr. Claus Drews
Phone: (+49 6086) 96 26-24
E-mail: c.drews@technigraf.de

Internet: www.technigraf.de

MÜLLER MARTINI
Druckmaschinen GmbH
Feldbergstr. 20
79689 Maulburg
Contact person:
Mr. Marcus Stich
Phone: (+49 7622) 3 98-1 73
E-mail: marcus.stich@de.mullermartini.com
Internet: www.mullermartini.com

manroland web systems GmbH
Alois-Senefelder-Allee 1
86153 Augsburg

Contact person
Mr. Stefan Albrecht
Phone: (+49 821) 4 24-30 50
E-mail: stefan.albrecht@manroland-web.com
Internet: manroland-web.com

ANNEX V:

Example of certification – waste management company of IST Metz, Nürtingen.

ZER-QMS

QUALITÄT KOMPETENZ

ZERTIFIKAT

Die ZER-QMS
bescheinigt hiermit, dass das Unternehmen

AREIS GmbH
Entsorgung & Industrieservice A.RUESS
Benzstr. 20, 72649 Wolfschlugen

einen Überwachungsvertrag, Nr. **942/2534/Efb** abgeschlossen hat.

Im Rahmen dieses Überwachungsvertrages wurde der Nachweis erbracht, dass das Unternehmen die Anforderungen der Entsorgungsfachbetriebeverordnung erfüllt und daher nach § 56 KrWG berechtigt ist, die Bezeichnung

Entsorgungsfachbetrieb

für den in der Anlage näher bezeichneten Standort
und die zugehörigen Tätigkeiten zu führen.
Die Anlage ist Bestandteil der Urkunde und umfasst **drei** Seiten.

Begutachtungsdatum: **04.11.2013**
Nächste Begutachtung: **November 2014**
Dieses Zertifikat ist gültig bis: **03.05.2015**

Köln, den 26.11.2013

(Zertifizierungsstelle)

(Reinhold Naß, Sachverständiger)

ZER-QMS, Zertifizierungsstelle,
Qualitäts- und Umweltgutachter GmbH,
Volksgartenstr. 48, 50677 Köln

Zertifizierungsstelle,
Qualitäts- und Umweltgutachter GmbH

Anlage zum Zertifikat
Überwachungsvertrag Nr. 942/2534/Efb
der ZER-QMS

(Zertifizierungsstelle, Qualitäts- und Umweltgutachter GmbH, Volksgartenstr. 48, 50677 Köln)

Das Zertifikat ist gültig für die nachstehende Betriebsstätte und die zugehörig aufgeführten Tätigkeiten bis zum 03.05.2015:

AREIS GmbH
Entsorgung & Industrieservice A.RUESS
Benzstr. 20
72649 Wolfschlugen

Entsorgernummer, Beförderernummer, Entsorgernummer: H03400367

Sammeln und **Befördern** von
allen Abfällen nach der Verordnung über das Europäische Abfallverzeichnis
(AVV - Abfallverzeichnis-Verordnung)

Lagern von
Abfällen mit den nachfolgend aufgeführten Abfallschlüsselnummern:

ASN	Bezeichnung
02 01 08*	Abfälle von Chemikalien für die Landwirtschaft, die gefährliche Stoffe enthalten
02 01 09	Abfälle von Chemikalien für die Landwirtschaft mit Ausnahme derjenigen, die unter 02 01 08 fallen
02 02 04	Schlämme aus der betriebseigenen Abwasserbehandlung
03 02 01*	Halogenfreie organische Holzschutzmittel
03 02 02*	Chlororganische Holzschutzmittel
03 02 03*	Metallorganische Holzschutzmittel
03 02 04*	Anorganische Holzschutzmittel
03 02 05*	Andere Holzschutzmittel, die gefährliche Stoffe enthalten
03 02 99	Holzschutzmittel a. n. g.
06 01 01*	Schwefelsäure und schweflige Säure
06 01 02*	Salzsäure
06 01 03*	Flusssäure
06 01 04*	Phosphorsäure und phosphorige Säure
06 01 05*	Salpetersäure und salpetrige Säure
06 01 06*	Andere Säuren
06 01 99	Abfälle a. n. g.
06 02 04*	Natrium- und Kaliumhydroxid
06 02 05*	Andere Basen
06 02 99	Abfälle a. n. g.
06 03 14	Feste Salze und Lösungen mit Ausnahme derjenigen, die unter 06 03 11 und 06 03 13 fallen
06 04 04*	Quecksilberhaltige Abfälle
06 07 03*	Quecksilberhaltige Bariumsulfatschlämme
07 01 03*	Halogenorganische Lösemittel, Waschflüssigkeiten und Mutterlaugen
07 01 04*	andere organische Lösemittel, Waschflüssigkeiten und Mutterlaugen
07 02 03*	Halogenorganische Lösemittel, Waschflüssigkeiten und Mutterlaugen
07 02 04*	andere organische Lösemittel, Waschflüssigkeiten und Mutterlaugen
07 02 08*	andere Reaktions- und Destillationsrückstände