This initial feedback is submitted on behalf of participants in the Umbrella Project (“UP”)´s Exemption #13(b) series technical Working Group (“WG”) (hereafter referred to as “UP Exemption #13(b) series WG Participants”)

Questionnaire 1 (Clarification) Exemption 13b of RoHS Annex III

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*Current wording of the exemption:*

For categories 1 - 7 and 10

*13b-I Lead in ion coloured optical filter glass types*

*13b-II Cadmium in striking optical filter glass types; excluding applications falling under point 39 of this Annex*

*13b-III Cadmium and lead in glazes used for reflectance standards*

For categories 8, 9 and 11

*13b Cadmium and lead in filter glasses and glasses used for reflectance standards*

Requested validity periods: *Maximum (5 and 7 years respectively)*

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## 1. Acronyms and Definitions

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|---|---|
| Cd | Cadmium |
| Pb | Lead |

## 2. Background

Bio Innovation Service, UNITAR and Fraunhofer IZM have been appointed[1] 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.

Spectaris e.V. submitted a request for the renewal of the above-mentioned exemption, which has been subject to a first review. As a result we have identified that some information is missing. Against this background, the questions below are intended to clarify aspects concerning the request at hand.

We ask you to kindly answer the below questions until 22nd February 2021 latest.

[1] It is implemented through the specific contract 070201/2020/832829/ENV.B.3 under the Framework contract ENV.B.3/FRA/2019/0017

### Remark

You request the renewal of exemption 13(b) for all EEE of categories 8, 9 and 11 while this exemption remains valid for in-vitro diagnostic devices until 2023, and until 2024 for industrial monitoring and control instruments and for EEE of category 11. In line with the Commission approach, we would like to point out that, should the exemption be renewed for these subcategories of EEE, the new exemption validity periods would start with the official renewal date of the exemption, which would very probably be before 2023 and 2024 respectively.

## 3. Questions

1. You state: “The exemption renewal request covers all types of products that require these exemptions, but excludes information on cadmium and lead in glazes used for reflectance standards as the applicants are not expert in these products” (exemption 13(b)-III).

   We have not received any additional requests/information from third parties. However, the exemption request made is for the entire 13b series. Who will provide the missing information justifying the renewal of the exemption? Please be aware that it is the applicant’s obligation to provide the necessary evidence that substitution or elimination of restricted substances is scientifically and technically impracticable. Without such clear evidence, RoHS Art. 5(1)(a) and the terms of references for this review project does not allow the consultants to recommend the renewal of the exemption.

2. You marked every category (from 1 to 11) as relevant. However, the list of concerned applications beginning on page 2 of the exemption request form does not provide examples for all categories.

   a. Please provide examples for each category.

   From our point of view, it cannot be excluded that for special applications in categories 1 and 2 (large household appliances, small household appliances) the exemptions 13b, 13bI, 13bII and 13bIII are used. Cadmium and lead filter glass may also be used in many other types of equipment such as lighting applications, leisure products, medical devices and automatic dispensers.

   Optical production is a highly fragmented business. There are some big companies but also a lot of small and medium sized companies in this market. It is very likely that such small and medium sized optical manufacturers, which are often very specialized and application driven companies make use of exemptions 13b, 13bI, 13bII and 13bIII for other categories, like, 1, 2, 5, 7 and 10 and buy cadmium and/or lead filter glass from distributors and so were not able to provide examples of uses in all RoHS categories. However, more information has been provided since writing the exemption renewal request and an indicative example of a category 10 application is bar code readers which have been known to be incorporated into category 10 applications.

   b. Category 11 is mentioned only once (optical filters for laser applications) – please specify and also explain why you consider the related use to be in EEE of category 11.

We have provided an example in our exemption application (optical filters for laser applications) and we have recently become aware of another application; logistic sorting equipment such as

letter or parcel sorters. However, there will be other examples as has been explained in the answer to question 2a.

c. Can you give an overview of the most important categories in terms of quantities for the use of lead, cadmium and both of them in applications (respectively 13b-I, 13b-II and 13b)?

Based on the examples provided in our request for the renewal of RoHS exemptions 13b, 13bI, 13bII and 13bIII we are aware of, these would be the categories, 3, 4, 5, 6, 8, 9 and 11.

3. You request the renewal of exemption 13(b) for devices of cat. 8, 9 and 11. Why can devices of these categories not use at least the current exemptions of the 13(b)-series to reflect the status of science and technology? Devices of these categories are in the scope of the RoHS Directive since 2011, and the current exemptions of the 13(b)-series have been listed on Annex III for several years as well.

We would like to propose two options:
**Option 1**: Return to the wording of 13b for all categories 1 to 11. This is the simplest option and the scope would be identical to 13b for 8, 9 and 11 plus 13b-I, 13bII and 13bIII for categories 1 – 7 and 10.
**Option 2**: It would be possible to include categories 8, 9 and 11 in exemptions 13bI, 13bII and 13bIII only if some changes are made. This is because infrared interference filters with lead would not be covered by the current wording of 13bI which is limited to ion colored glass. Suggested wording could be:

13bI – Lead in optical filter glass types and in infrared interference filters
13bII - Cadmium in optical filter glass types; excluding applications falling under point 39 of this Annex
13bIII - Cadmium and lead in glazes used for reflectance standards

We do not see any reason to specify “ion coloured” or “striking” in the above wording.

4. Under question No. 5 (page 6) you state: „The total weight of Pb- and Cd-filter glass placed on the Global market is accordingly 120 tons p.a. and there of approx. 40 tons placed on the EU market. […] The lead proportion of filters varies from 0.3 to 60 % and on average it is about 13 %. Thus for those lead-based filter glass types the EU consumption of lead used in EEE in scope of RoHS is about SCHOTT data only 46 kg Pb per year (globally 115 kg). Filters coated with lead compounds for infrared analysis are used in small numbers in the EU with each filter containing only a few milligrams of lead (the coatings are typically 0.35 µm thick) and so much less than 1 gram of lead is used for this application annually.“

a. 13 % of 40 tons (or 120 tons globally) are more than the declared values (46kg Pb per year for EU, 115kg globally). Have you made any other assumptions to justify this?

Calculations of data based on SCHOTT refer to specific data and weighted calculations. While information on average lead proportion in filters (named 13%) refers to the average per all related filter glass types, the calculation on the Pb equivalent (46kg) is based on production data (produced glass, used lead oxide and derived lead equivalent) and assumptions on global production quantities analogously.
By calculating based on weighted data, the result of stated Pb equivalent is significant lower than calculating the 13% of lead oxide of the glass tonnage (for clarification: lead oxide is used in powder batch preparations and the percentage data had been provided referring on

the lead oxide share in %, since this had been the reported data of previous applications on the exemptions).
On a global level, no data from glass-specific tonnage and references to applications are available. Accordingly, for the share of globally produced filter glasses the assumptions have been made on catalogue data and market study as well as on literature about applications and glass research.

b. Compared to the Exemption Request 13(a), the amount of substance entering the EU market annually is significantly lower. 275 tons Pb per year were estimated for 13(a), but only 46 kg Pb per year – or 13 % of 40 t respectively? - for 13(b). According to your data, the percentage by weight in the glass is of similar magnitude. What causes the large differences in expected annual totals?

Optical glass in scope of exemption 13a is colourless glass used for a very wide variety of applications, some in significant quantities, whereas lead-based glass filters have fewer end uses, none of which require large quantities of these materials. In related technical applications a typical filter has dimensions of a few mm² and a thickness of a few mm, while optical glass applications have very much bigger dimensions.
Calculations based on weighted data, please refer to answer 4a.
The market demand for lead-containing glass types has been stable since 2014. Based on this stability, we estimate that global production of lead based optical glass used in EEE to be 1.250 tons per year. About 40% of EEE is placed on the EU market so this will contain 500 tons of lead based optical glass. Calculated with the average lead content of approximately 55% lead that would be 275 tons of lead p.a.

The amount of lead in glass filters is 46 kg of Pb per year. With the lead content of 13% this converts to 354 kg of Pb in filter glass (well below 1 ton).

c. Does the indication "less than 1 gram" refer to the complete annual consumption in the EU for Pb in the application mentioned?

Yes, this is correct for lead uses in infrared interference filters.

5. In the section “Lead in Filter Glass” on page 15 et sqq. of your exemption request you describe details for striking glass filters (13(b)-I) and ion-colored filters (13(b)-II), but also other types of filters, e.g. interference filters etc., whose allocation to the two aforementioned exemptions is not clear. You also describe the use of lead etc. in filter glass in this section where it is not quite clear to which exemption this refers.

We kindly ask you to specify the information so that the related exemptions are clearly identifiable.

In the section “lead in filter glass” we describe glass colouring with ions, the coloured glass itself (here: VG9 from SCHOTT) with additionally lead with a concentration of 15%.
This belongs to exemption 13bI.

The advantage of this VG9 filter are very steep edges for the separation of the desired transmitted light from the undesired light which is to be strongly blocked.

The interference filters belong to exemption 13b and are connected – as can be seen from our renewal request for this exemption – with a category 9 application, i.e. an accurate chemical analysis of trace concentrations of gases. Please refer also to page 20 – 21 of our renewal exemption request.

Lead is not used in “striking” glass, only cadmium.

6. You state that “The green glass filter VG9 is the last remaining regularly manufactured type of a family of VG glass coloured with chromium III and copper II ions in a lead silicate glass matrix.”

    a. Does this mean that VG9 is the last remaining type of ion-colored filter glass using lead, or that it is the last type of ion-colored filter glass which uses $Cr^{3+}$, $Cu^{2+}$ and lead?

VG9 is the last remaining type of ion-colored filter glass using lead and $Cr^{3+}$, $Cu^{2+}$, resulting in the characteristic green bandwidth and steep edge of this filter glass that is regularly manufactured.

    b. Are there lead-free solutions available for filters for other colors?

Yes, lead free filters are available, but for the application in fluorescence microscopes mentioned in the renewal request on page 15 the necessary performance can be only accomplished with this VG9 filter. Colour itself is not the main technical criterion, but cut off wavelength and whether this is sharp. VG9 has very specific properties that are required for this specified use.

7. You explain that “Although only one type of filter (VG9) is made as a standard product at present, it is conceivable that a use may arise from an equipment manufacturer who has no alternative to using a type of lead glass filter that is not currently produced as a standard product and so this material will need to be covered by this exemption 13b.”

Why must it be covered by 13(b)? Exemption 13(b)-I would also cover it, possibly after inclusion of cat. 8, 9 and 11 into its scope, correct? (see also question 3)

As we have detailed in our answer to question 3, this exemption is partially covered by exemption 13b. Exemption 13bI could work only, if it would be extended to all device categories, including categories, 8, 9 and 11, and, importantly, amend the current 13bI wording to also include infrared interference filters.

8. You describe three types of optical filters that could be an alternative for cadmium-containing filter glass and that these alternatives are used for some applications: Additives other than Cd, thin film coatings on transparent substrates, and transparent plastics with organic pigments

    a. For which applications in which categories are these cadmium-free filter glasses used?

**Additives other than Cd:**
As we have stated in the discussion for alternative additives other than Cd (please refer to page 23 of our renewal exemption request), research has been carried out for many decades to look for alternatives to cadmium, but with no success. Since such alternatives have not been produced and marketed, there are also no applications for these types of filter known to us.

**Thin-film coatings:**
We would again point to the shortcomings of these thin-film-coatings as compared to glass filters, i.e.: viewing angle dependency leading to ghost images and transmission of light not only in the main band but in unwanted side-bands at lower intensity.

**Transparent plastics with organic pigments:**

We have described one example for low-end optics in children toys, cat. 7 (please refer to page 30 of our renewal application request). We would again point to the shortcomings of these transparent plastics with organics. The main disadvantages are:

- Plastics are easily scratched.
- They are affected by humidity as all plastics absorb water from humid air.
- They are affected by high temperatures (distort, degrade, change colour). Optical filters are used with lamps that can become very hot as well as with laser light sources that heat the filter. Apart from heat transmitted by the lamps, most filters function by adsorbing light of certain wavelengths and transferring the absorbed energy into heat.
- Organic pigments fade when exposed to ultraviolet light and polymers are also affected causing colour changes. Brittle fracture may also occur when exposed to UV light.
- Image quality tends to be poor as the surfaces of plastic filters are easily warped, so are not optically flat.
- Some polymer filters with organic pigments have relatively poor maximum transmission percentages at wavelengths of light that should pass through the filter.
- Some polymer filters transmit light at wavelengths where light needs to be blocked.

Furthermore, the slope is not as steep as for Cd-containing filter glass and transmission is significantly lower, please refer to pages 30 – 34 of our renewal exemption request for more details.

These alternatives are used if they provide technical performance that these uses require. There is also a desire by manufacturers to avoid products containing cadmium if this is technically achievable.

b. Why are they used in these applications instead of cadmium-containing ones?

Please refer to the answer for question 8a.

9. You mention the recently patented quaternary $Cu_2ZnSnSe_4$ in silicate glass, which appears to be an effective sharp cut-off filter in the as-annealed condition, but the cut-off wavelength is in the ultraviolet region and so is not a substitute for cadmium chalcogenides.

a. Where would you see applications for this new filter glass?

The patent does not mention possible uses for filters made with this material which is not commercially available. This type of filter could not be used as a substitute for filters in scope of 13b because it does not block 100% of light at wavelengths above the cut-off value, only 90% according to the patent.

b. Where would these applications overlap with those of cadmium-containing filter glass? Maybe the UV-cut-off wave length might not be an obstacle in all cases where Cd-filter glass is applied?

See answer to Q9a. Please note that there was an error in the exemption renewal request. This patent is for infrared and visible wavelengths.

10. You state that there are no environmental impacts related to the uses of cadmium and lead in filter glasses. What about mining and refining of those metals which often takes place in low and middle income countries with low environmental and often also technical standards?

We state that environmental impacts are not applicable to our exemption renewal request and this is because it is based only on the first bullet justification of Article 5.1a. of the RoHS-Directive.

11. You say that cadmium and lead filters are more expensive than other types of filters. Could you kindly give us some typical price ranges for the various of filter glasses for both the lead/cadmium containing ones and the lead-/cadmium-free ones to allow some insights into the price differences?

The price range and ratio accordingly are significant depending on the filter glass type and the used ingredients to produce filters with the optical characteristics. Cadmium and lead filters are a minimum of 2-3x as expensive as lead-/cadmium-free filters and mainly in a range of 5x up to 10x more expensive.

**Please note that answers to these questions will be published as 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.**

**It would be helpful if you could kindly provide the information in formats that allow copying text, figures and tables to be included into the review report.**