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Adaptation to scientific and technical progress under Directive 2002/95/EC

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4.19 Exemption No. 13

"Lead and cadmium in optical and filter glass"

4.19.1 Description of exemption

In an earlier report on technical adaptation Goodman et al. came to the following conclusions [1]:

- "Most optical glass currently used in electrical equipment is now lead-free but there are certain specific applications where a combination of properties is required and these can be achieved only with lead."
- However, "in a few specific applications, no alternative matches all of the characteristics. Some examples of applications for optical glass which contain lead include:
  - There are no alternatives to lead optical glass for projectors (described below)
  - Certain types of lenses such as those used in surveying equipment and certain professional;
  - camera lenses;
  - Some types of gradient index lens (e.g. Selfoc);
  - Micro-lithography equipment;
  - Certain types of high quality printers;
  - Other applications currently outside of the scope of the RoHS Directive, i.e. medical devices;
  - and Monitoring and control instruments."

To clarify the scope, Goodman et al. proposed in this case a guideline as follows [1]: "Optical components used in electrical equipment such as glass lenses, optical filters and prisms where no lead-free alternative is suitable. Lead in the glass of electronic components is not included in this exemption as this is covered by item 5 of the Annex of the RoHS Directive."

In relation to applications of categories 8 and 9 Goodman summarised the current use of lead in optical glass as follows [4]:

- Reason for the use of lead: "Most optical glass currently used in electrical equipment is now lead-free but there are certain specific applications where a combination of properties are required and these can be achieved only with lead."
- Availability of substitutes for lead: "Most optical glass currently used in electrical equipment is now lead-free but there are certain specific applications where a combination of properties are required and these can be achieved only with lead."

Based on data provided by Schott as the last optical lead glass producer outside China the annual amount of lead glass is presented as follows: [11]

Year	Lead glass produces by Schott [tons]	Lead equivalent [tons]
2005	440	270
2006	180	100
2007	240	140

Today, lead glass corresponds to 1,0–2,4% of total production; in contrast in 1996 the percentage had been more than 30%. The total amount of Cd-containing glass is estimated as 56 tons in 2007.

Concerning the substitution progress, Spectaris and Schott provided the following information:

- Consumer optics oriented companies replaced all their lead glass types by lead, arsenic-free glass types. New developed glass types since then are all lead, arsenic free.
- Schott replaced 66 glass types but maintained about 25 glass types due to inquiries from high end optics.

4.19.2 Justification by stakeholders

During this review, several contributions were provided:

- In their joint industry contribution COCIR, Eucomed and EDMA argued, that lead in glass would be essential for top optical performance, being especially important for devices that use very small lenses like endoscopes [2]. Furthermore medical imaging would require very good colour reproduction e.g. for identification of cancer tissues. Without cadmium in filter glass sensitive biological samples would not be protected from UV-radiation, thus enabling a sharp cut-off edge of certain spectral parts.
- Referring to a ceramic colour standard used to calibrate and check measurement performance of spectrophotometers and optical devices, CERAM Technology Ltd. explained that the steep reflectance slopes required cannot be achieved without Lead and Cadmium. In addition the alternatives often would have complex reflectance curves which make results from such standards hard to interpret in terms of instrument performance [3].
- In a letter for SPECTARIS Prof. Tünnermann points out that if a broad spectral transmission from the ultraviolet to the near infrared spectral region is needed, dense flint glasses with lead-doping as high-index material would be indispensable. Even in applications where no specific requirements concerning the uv-transmission are existing lead-free optical systems would require a larger number of optical elements compared to systems based on high-index flint glasses. Consequently lead-free optical systems would require more basis raw material. [5]

- In their joint contribution several European optical stakeholders provided a detailed overview about typical applications of lead containing optical glasses and cadmium containing filter glasses [6]. Furthermore the technical functionality of lead containing optical glasses (colour correction, transmission in the UV spectral region) as well as of cadmium containing glasses is described in depth.
- Further comprehensive contributions were received from the Test&Measurement Coalition [7], JBCE [8], EICTA and AeA [9], Schott [10] and Zeiss [11].

4.19.3 Critical review and recommendation

Data and information provided by various stakeholders give evidence that there are some applications where the use of lead and/or cadmium in optical glass will be necessary, as there are no viable substitutes. However, the wording of the current exemption was expected to be too wide, why a discussion was held with stakeholders how to narrow the scope. Both, a more precise wording based on specific applications as well as a wording reflecting the specific function of lead or cadmium respectively were discussed. Although stakeholder could provide an enumeration and list of application examples, this list would be by no means fully exhaustive, because applications which make use of these glasses would be possibly several hundreds in number.

Against this background we recommend to keep the material specific wording, but to re-word the existing exemption into two parts reflecting the fact, that cadmium is only in use in filter glasses:

- *(13a) Lead in white glasses used for optical applications.*
- *(13b) Cadmium and lead in filter glasses.*

For both parts, 31 July 2014 is proposed as expiry date.

4.19.4 References

[1] Goodman, P. et al.; Technical adaptation under Directive 2002/95/EC (RoHS) – Investigation of exemptions. Contract No. ENV.A.2/ETU/2004/0002. Leatherhead 2004

[2] Joint Industry contribution to the ÖKO Institute's consultation on the Actual Exemptions from the RoHS Directive. Brussels, 01 April 2008

[3] Sean Hillman, CERAM Technology Limited; Addition to Exemption No. 13 Lead and Cadmium in Optical and Filter Glass. Submitted 20 March 2008

[4] Goodman, P.; Review of Directive 2002/95/EC (RoHS) Categories 8 and 9. Final Report. Leatherhead 2006

[5] Tünnermann, A.; Letter to SPECTARIS. Jena, 17 March 2008

[6] SPECTARIS, Photoindustrieverband e.V., eurom, Photonics Cluster (UK), GIFO, EPIA, ESGA; Contribution Of The European Optical Stakeholders. Berlin, 26th march 2008

[7] Test & Measurement Coalition; RoHS Directive Scope Review. Contribution to Öko-Institut study on RoHS current exemptions. 01 April 2008

[8] Japan Business Council in Europe (JBCE); 13. Lead and cadmium in optical and filter glass. 01 April 2008

[9] Joint response from EICTA and AEA Europe to the general and specific questionnaires relating to exemption 13. 04 April 2008

[10] Dr. Peter Hartmann; Ecological Aspects / EC Directive RoHS, Hazardous Substances in Glasses. Presentation 05 June 2008

[11] Dr. H. Gross, Dr. U. Hamm; Prolongation of Exemption #13 “Lead and Cadmium in Optical and Filter Glass”. Presentation Version 1.2, 04 June 2008