Answers to Specific Questions Exemption 13

"Lead and cadmium in optical and filter glass"

Note:
In the context of the previous evaluation in 2004, it was concluded that "most optical glass and optical filters do not require lead or cadmium" although for a small number of specific applications lead and cadmium were required since substitutes could not meet all necessary characteristics provided by lead and cadmium.

1. Please specify these small number of applications (differentiate between applications using optical glass and those using filter glass): which applications currently fall under the scope of the RoHS Directive? Please provide a **comprehensive list** with allocation to WEEE (Directive 2002/96/EC) categories. Which applications fall under category 8 & 9 of the WEEE Directive? Which applications are covered by exemption 5 ("lead in glass of cathode ray tubes, electronic components and fluorescent tubes")?

Exemption 13 is used for a small number of components contained in the following wide range of image equipment, optical equipment:

	Category	Optical glass	Filter glass
1	Large home appliances	Probably no use.	Probably no use.
2	Small home appliances	Probably no use.	Probably no use.
3	IT, communication equipment	Copy machine, projector, scanner, Fax, printer, other image equipment, and so on	
4	Consumer appliances	TV (projection type), other image equipment, and so on	
5	Lighting equipment	Lighting equipment for special purposes of use (may be used as a possibility)	
6	Power tools	Probably no use.	Probably no use.
7	Toy, leisure, exercise	Possible use.	Possible use.
8	Medical equipment	Endoscope, other medical service optical goods, and so on	
9	Monitor,	Measuring, weighing or adjusting appliances for as laboratory	

	controller	equipment, other monitoring and control instruments used in industrial installations, and so on (*As it is especially difficult to specify the scope of this category, specification cannot be easily made.)	
10	Vending machine	Probably no use.	Probably no use.

［Relation with Exemption 5］

Materials classified in Exemption 13 may be used for some electronic parts, but electronic parts manufacturers in general do not disclose related information.
Such electronic parts may be used in Categories 3, 4, 8, 9, and so on.

2. Which of the applications covered by exemption 13 are available as RoHS **compliant products** (i.e. without lead and cadmium) on the EU market? Which applications are currently not available as RoHS compliant products?

On the EU market, RoHS compliant products are now available in all categories, but it is unknown whether there are products which are believed to not use Exemption 13 (due to existence of electronic parts described in Item 1 and other causes). It is estimated, however, that most cameras and interchangeable lenses do not use Exemption 13.
For products using Exemption 13, please refer to Item 1.

3. Are there different **technical characteristics** between optical and filter glass? If so, what are the different technical functionalities of lead and cadmium in these types of glasses?

Difference exists.
For optical glass, cadmium can contribute as composition with high refractive index and low dispersion, whereas lead significantly contributes as composition with high refractive index and high dispersion, as well as component with high transmittance of the near ultra violet light, low photoelasticity coefficient, and abnormal partial dispersion.
Optical glass containing lead, which makes good use of such advantages, is used as core material of high-performance optical fibers, and also applied to SELFOC lens.
For filter glass, lead and cadmium can contribute to transmission or absorption of the light of the specific wavelength in harmony with other various types of composition.
In the melting process of both glasses, lead and cadmium contribute to the melting

characteristics with the other compositions or stability of production, and especially lead sharply contributes to reduction of melting temperature.

4. Which are the technical characteristics related to the use of lead and cadmium that are essential for the **technical functionalit**y of applications / products related to exemption 13? List those applications named under point 1 for which substitution is technically not feasible and justify.

The following technical characteristics are utilized for various applications as respectively exemplified below. In addition, related specifications are required, those technical characteristics will be used in the future as well.
Various types of data on such optical technical characteristics are entered in ERA Technology's report at the time of the previous research, and can be referred to.

* Attached document (1) ; extract of TAC presentation by ERA (Oct 2004)

・Low photoelasticity coefficient:
Projection equipment using high-performance PBS (polarization beam splitter) (some of TVs and projectors, etc.), optical equipment installing optical systems applying polarization characteristic, and so on;

・Transmission / absorption of the specific wavelength light:
some image equipment using various types of filter, and so on;

・Combination of high refractive index, high dispersion, high transmittance of the near ultra violet light and abnormal partial dispersion:
special optical equipment and the like/ medical service optical goods/ measuring equipment installing optical systems which require sophisticated optical design, optical equipment requiring special specifications, and so on;

* Attached document (2) ; Related data of abnormal partial dispersion of optical glass

・High-performance optical fiber, SELFOC lens:
copying machine, endoscope, scanner, optical equipment installing high-performance optical fiber requiring flexibility without reducing refractive index and transmittance, and so on.

5. What has changed since the **last evaluation** in 2004? What is the current status of **R&D effort**s towards substitution of lead and cadmium in the different applications?

The content of ERA Technology's report at the time of the last evaluation is based on the essence of optical materials, which is therefore considered to have the general value, and is effective still now and in the future as well.
Many optical glass manufacturers have almost completed development of optical materials not using lead and cadmium at the time, and thereafter have produced poor results although they continue to make efforts.
In this connection, Japanese optical glass manufacturers have completely discontinued the use of cadmium in the 1970s.
It is difficult to develop substitute materials for filter glass for technical reasons, so substitute materials are not developed.
Substitution of many filter glasses has proceeded due to transition to digital processing of the color tone data with the digitization of cameras, and move for interference filter using thin film coating.
However, interference filter is inferior to filter glass materials at incidence angle characteristic of the light, durability, and so on.
For infrared absorption filter glass which is increasing for various types of image sensors using silicon semiconductors, substituted material without cadmium have been developed, and substitution has been promoted.
While development of substitutes for fiber glass and SELFOC lens has been attempted after that, no substitute materials have been developed.
Equipment manufacturers, which achieved technically possible substitution to the considerable extent in most product areas at the time, have subsequently accelerated substitution based on their further devising or improvement of optical design, and at least Japanese corporations are likely to have completed substitution for products that can be substituted in all product areas.
It is necessary to make continued efforts over the very long period of time from commencement of development of optical materials to their use for optical equipment as well as general use, and the Japanese industry spent more than 20 years in this process.
Optical equipment manufacturers will in the future as well carefully analyze optical characteristics of new substitute materials to be provided, and likely utilize such materials, if usable, as much as possible, considering specifications of equipment,

through tests of optical performance, processing nature, and durability at the time of use for products and other tests.

6. Are manufacturers still **investigating alternatives**?
   a. If yes, please provide a **roadmap** or similar evidence showing until when they intend to replace lead in glass in the applications mentioned above.
   b. If no, please explain and justify why no further research has been undertaken against the background that the RoHS Annex is subject to regular revisions.

Please refer to Item 5.
Although manufacturers continue investigation of alternatives, they have already faced the limits that cannot be passed, which come from the essence of materials and technology, so further results cannot be expected in materials areas where substitution has proceeded. Even though equipment manufacturers request for manufacturers of SELFOC and filter glass to conduct development substitute materials, but substitute materials are not developed successfully.
Manufacturers considered that Exemption 13 should be maintained in the future.

7. Please state for applications name under point 1 the **amount of lead and cadmium** used per application, the lead content in the homogeneous material, the annual production volume as well as the number of applications related to exemption 13 put on the EU market annually.

We cannot obtain any available statistical data to fully answer this question.
However, the amount of lead used in connection with Exemption 13 has sharply dropped primarily due to contribution of substitution for camera lenses, among others, in the past ten years, and the move was accelerated with RoHS directive.
The amount of cadmium used is much smaller than lead.
It is assumed that materials in Exemption 13 now exist in a variety of optical equipments by a small amount, each.
Efforts made by the optical glass industry and optical equipment industry to reduce lead and cadmium contained in optical materials are very extensive, and we would like this fact to be highly appreciated.