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

Response from EICTA, AeA Europe, EECA ESIA and ZVEI to the general and specific questionnaires relating to exemption 5

"Lead in glass of cathode ray tubes, electronic components and fluorescent tubes"

31. March 2008

Content

General questionnaire

Note: Electronic Components with Lead in Glass are commonly used throughout the electronics industry. Information given herein is based both on general information and as well on specific information for products falling in WEEE Cat. 3.

1. For which substance(s) or compound(s) should the requested exemption be valid?	Lead used in the cone glass of cathode ray tubes (CRTs) and in glass of electronic components. Lead in the other applications mentioned in the current exemption 5 may still be necessary in WEEE Cat. 3 and other applications, but no input on those is given in this paper.
2. What is the application in which the substance/compound is used for and what is its specific technical function?	a) Lead contained in low melting type glass for electronic components, like thick film paste for hybrid integrated circuits, resistors, capacitors, etc. b) Lead contained in low melting type glass for protection – hermetical seals, e.g. Crystal Units, Crystal Oscillators, Glass diodes c) Lead contained in low melting type glass in glass frit d) Lead in the cone glass of CRTs is used for the protection of users against x-ray radiation.
3. What is the specific (technical) function of the substance/compound in this application?	Specific physical properties, e.g.: a) To reduce melting temperature and to soften the sintered material b) Hermetic encapsulation, e.g. sensors for high temperature applications, to guarantee matching to a specific thermal expansion coefficient c) To guarantee a sufficient adhesion between ceramic element and metal electrode or between semiconductor device and glass d) Lead is the only effective way to absorb x-ray radiation during the operation of the tube
4. Please justify why this application falls under the scope of the RoHS Directive (e.g. is it a finished product?	Electronic components mentioned in 2 above do not fall directly under the scope of RoHS themselves, but become parts of products that are under RoHS. Those components, however, are used within EEE according to the scope of RoHS. The CRTs could be considered a component as well.
- Is it a fixed installation?	The components relevant to this exemption are used in fixed installations and products that are not part of fixed installations.
- What category of the WEEE Directive does it belong to?).	Used by EEE of all WEEE categories. Within the scope of EICTA, products are mostly falling under category 3 "IT and telecommunications equipment" of WEEE.
5. What is the amount (in absolute number and in percentage by weight) of the substance/compound in:	No information as of the date of the completion of this response *One EU supplier for passive components:* b) 10 Mio Pcs/a c) 150 Mio Pcs/a Note: JEITA will separately provide information about the number of components and amount of lead d) No data are available for CRTs at this time.

i) the homogeneous material1	In order to answer this question we need information from suppliers, which are not available because of the size of the market and the many companies involved
ii) the application, and	- Resistors - Capacitors - Thermistors - Piezo 0.618 to 1.092 mg / part (Crystal Oscillator) -Glass diodes (hermetical sealed leaded glass diode).
iii) total EU annually for RoHS relevant applications?	No data available
6. Please check and justify why the application you request an exemption for does not overlap with already existing exemptions respectively does not overlap with exemption requests covered by previous consultations.	Not applicable
7. Please provide an unambiguous wording for the (requested) exemption.	e.g. harmonization with ELV exemption 11: Electrical components which contain lead in a glass or ceramic matrix compound as well as Lead in cone glass of CRTs (strictly based on health and safety issues).
8. Please justify your contribution according to Article 5 (1) (b) RoHS Directive whereas:	
o Substitution of concerned hazardous substances via materials and components not containing these is technically or scientifically either practicable or impracticable;	Alternative glasses have different physical / chemical properties and therefore are not usable. Many kind of glass compositions have been studied for lead free glasses. But none of the compositions can satisfy the conditions listed below yet: -Affinity with materials, -low softening points, -match of thermal expansion, -weather resistance. a) Several types of compositions have been developed and tested for lead free glass frit. Unfortunately they are inferior in their weather resistance characteristics. b) application for hermetical sealing: Lead free glass materials are available in general, but problems remain: - Process temperature for alternative glass materials too high (glass melting temp must be lower than temp for attachment of active device) - Unpredictable interaction between glass and ceramic resp. wire material c) application for contacting / resistive layers

	d) Application for CRTs in the upcoming control equipment where the need is based on the functionality of that technology, which cannot be replaced with flat panel techniques due to speed issues.
o Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically either practicable or impracticable;	Application for hermetical sealing: Low temperature glass is used in Crystal Unit package sealing because of its easiness of packaging process and high reliability. Lead in the cone glass is the only effective method to shield x-rays emanated from the electron beam in CRTs.
o Negative environmental, health and/or consumer safety impacts caused by substitution are either likely or unlikely to outweigh environmental, health and/or consumer safety benefits thereof (If existing, please refer to relevant studies on negative or positive impacts caused by substitution).	Lead in glass is bound very strongly and therefore will not easily separate from the glass, so that risk for the environment is low
9. Please provide sound data/evidence on why substitution / elimination is either practicable or impracticable (e.g. what research has been done, what was the outcome, is there a timeline for possible substitutes, why is the substance and its function in the application indispensable or not, is there available economic data on the possible substitutes, where relevant, etc.).	Lead-free types of glass, see specific question 4. There are some candidates for low melting type glass, but each of them has their own weak points.
10. Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale for similar use.	Application for hermetical sealing: There are no substitute measures for low melting type glass for package of Crystal Unit and/or Crystal Oscillator.
11. Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes were available by 1 July 2006 or at a later stage.	No substitutes are yet available for the large variety of applications
12. Please indicate if any current restrictions apply to such substitutes. If yes, please quote the exact title of the appropriate legislation/regulation.	not relevant

13. Please indicate benefits / advantages and disadvantages of such substitutes.	See 9. – technical disadvantages
14. Please state whether there are overlapping issues with other relevant legislation such as e.g. the ELV Directive that should be taken into account.	ELV – same electronic components (resistors, capacitors, thermistors, piezo., glass diodes, etc.)
15. If a transition period between the publication of an amended Annex is needed or seems appropriate, please state how long this period should be for the specific application concerned.	
16. Additional comments	There are many different applications of lead-containing glass in different types of electronic components, each of them having different requirements concerning physical / chemical properties.

Specific questionnaire

Questions	Comments
1. Please specify in detail the "electronic components" in the wording above where lead is used in glass.	- resistors - capacitors - (hermetically sealed) oscillators - PTCs - discrete semiconductors like diodes, transistors Applications of lead-containing borosilicate glass * Pre-coating for thick film resistors * Surface protection coating * Vacuum (adhesion) assurance * Resistor binder (adhesion assurance for ceramic base materials) * Electrode binder (adhesion assurance for ceramic base materials) Components with lead-containing borosilicate glass * Varistors * Chip resistors * Strain sensors * Bridge rectifying devices * Power transistors * Power thyristors * Quarts oscillators Ruthenium lead oxide + (Borosilicate glass) / resistor thickfilm layer / Chip resistors, Strain sensors Conductive materials (Au, Ag, Pd, etc.) + (Borosilicate glass) / external electrodes / Chip resistors, Varistors
2. Please state the amount of lead used per application, the lead content in the homogeneous material, the annual production volume as well as the number of applications put on the EU market annually in applications falling under the scope of RoHS for a. cathode ray tubes	a) no data are available as the ICT/CE sector is phasing out CRTs in favor of flat panel displays. However, CRTs are needed in the measuring and specialty equipment where we have no insight into further details. b) electronic components (Crystal Oscillators): from 0.618 to 1.092 mg / part. Borosilicate glass / Surface protection coating / 45 to 50 wt% lead concentration

<table>
<tr><td>b. electronic components (if possible specified in more detail, see question 1)
c. fluorescent tubes.</td><td>Borosilicate glass / Electrodes / 1 to 57 wt% lead concentration
Borosilicate glass / Resistor binder (adhesion assurance for ceramic base materials) / 3 to 30 wt% lead concentration
Ruthenium lead oxide / Resistor / 56.9 wt% lead concentration

c) not known</td></tr>
<tr><td>3. Please provide detailed information about the specific function and related performance criteria of lead in glass for
a. cathode ray tubes
b. electronic components (if possible specified in more detail, see question 1)
c. fluorescent tubes.</td><td>a) Shielding of emanating x-rays, which is only effective using lead and cannot be substituted. The alternative barium can only be used for the front glass.
b) depending on the varieties of different applications of lead-containing glass in electronic components, physical / chemical properties like affinity to the materials in use, melting point, coefficient of expansion, resistance against humidity, etc. are required
c) not addressed within this response</td></tr>
<tr><td>4. What technical characteristics do substitutes need to fulfill as a minimum requirement?</td><td><table><tr><th>Characteristics</th><th>Pb glass</th><th>Zn glass</th><th>P-Sn glass</th><th>Na-Al-P-B</th></tr><tr><td>Affinity</td><td>Good</td><td>Not good</td><td>Not good</td><td>Good</td></tr><tr><td>Low melting point</td><td>Yes</td><td>No</td><td>Yes</td><td>Yes</td></tr><tr><td>Coefficient to thermal expansion</td><td>Good</td><td>Good</td><td>Good</td><td>Not good</td></tr><tr><td>Weather resistance</td><td>Good</td><td>Good</td><td>Not good</td><td>Not good</td></tr></table>High adhesion (Affinity with materials), high softening points, weather resistance and high reliability.</td></tr>
<tr><td>5. Please provide evidence that manufacturers have put effort in research on alternatives for lead. What are the alternatives to lead and which ones are (likely to be) used as substitutes? Are there any results about strengths and weaknesses expressed in results relating to (technical) performance criteria?</td><td>See above</td></tr>
<tr><td>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</td><td>a) Yes.
Given the wide use of this exemption and the lack of substitutes to date, it is difficult to predict an expiry date at present.

The use of CRTs in the ICT/CE sector is decreasing dramatically while the use of CRTs in the measurement sector is still required in order to control such equipment. This sector is dependent on CRT technology because of its capability to follow the increasing speed of modern electronics.</td></tr>
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to regular revisions.	
7. Assuming the current exemption will be given an expiry date, what date do you think is technologically feasible for industry?	Given the wide use of this exemption and the lack of substitutes to date, it is difficult to predict an expiry date at present.