Öko-Institut e.V.
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# Adaptation to scientific and technical progress under Directive 2002/95/EC

**Monthly Report 4**

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# Content

# 1 Background and Objectives

Article 4 (1) of Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment provides “that from 1 July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, PBB or PBDE”. The annex to the Directive lists a limited number of applications of lead, mercury, cadmium and hexavalent chromium, which are exempted from the requirements of Article 4 (1).

Article 5 (1) (b) of the Directive provides that materials and components can be exempted from the substance restrictions contained in Article 4 (1) if their elimination or substitution via design changes or materials and components which do not require any of the materials or substances referred to therein is technically or scientifically impracticable, or where the negative environmental, health and/or consumer safety impacts caused by substitution outweigh the environmental, health and/or consumer safety benefits thereof.

On the basis of this provision the European Commission has received (and is still receiving) from industry additional requests for applications to be exempted from the requirements of the directive. These requests need to be evaluated in order to assess whether the request for exemption fulfil the above mentioned requirements of Article 5 (1) (b). Where the requirements are fulfilled the Commission proposes a draft decision amending the RoHS Directive.

Against this background Öko-Institut e.V. and Fraunhofer Institute for Reliability and Microintegration IZM have been commissioned by the European Commission with technical assistance for the evaluation of requests for exemptions submitted according to Article 5 (1) (b). The main objective of this technical assistance consists in a clear assessment of whether the requests for exemptions are justified in line with the requirements listed in Article 5 (1) (b).

## 2 General Procedure

For details on the general procedure of the evaluation of the requests for exemption please refer to the first monthly report.

## 3 Scope

In this report final recommendations for remaining open requests from set 1 are given. With only one exemption: Request 1_b could not be finalised yet due to delay in response by the applicant. An overview of requests from set 1 and their status quo as well as the report in which a final recommendation has been set is given in Table 1 below.

Furthermore, an overview of the status quo for requests of set 2 is given in Table 2 below. After the third consultation round had ended on 28 October 2005, the requests and corresponding documents were subject to a first screening after which questions for clarification have been sent out to the applicants. The questions can be found in the Annex 1 to this report.

Table 1: Overview status quo requests set 1

| No | Title of group | Current status |
|---|---|---|
| 1 | Lead in tin whisker resistant coatings for fine pitch applications | Final recommendation for request 1_a and 1_d given in third monthly report. Final recommendation possible for request 1_b (see section 5.1). Request 1_c has been withdrawn (see third monthly report). |
| 2 | Lead bound in glass, crystal glass, lead crystal or full lead crystal in general | Final recommendation given in third monthly report. |
| 3 | Chromium (also in oxidation state (VI)) and Cadmium as colouring batch addition each form up to a content of 2 % in glass, crystal glass, lead crystal or full lead crystal used as decorative and / or functional part of electric or electronic equipment | |
| 4 | Solders containing lead and/or cadmium for specific applications | Final recommendation for request 4_a possible (see section 5.2). Final recommendation for request 4_b given in second monthly report. Request 4_c has been withdrawn by the applicant (see third monthly report). |

| No | Title of group | Current status |
|---|---|---|
| 5 | Hexavalent chromium (CR VI) passivation coatings | Final recommendation given in third monthly report. |
| 6 | Lead in lead oxide glass plasma display panels and other technology large-sized flat display panels | Final recommendation possible (see section 5.5) – overlapping with request 19 from set 2. |
| 7 | Lead in connectors, flexible printed circuits, flexible flat cables | The request has been withdrawn by the applicant (see third monthly report). |
| 8 | Lead oxide in lead glass, bonding materials of magnetic heads and magnetic heads | The request has been withdrawn by the applicant (see third monthly report). |
| 9 | Cadmium as doping material in avalanche photodiodes (APDs) for the optical fibre communication systems | The request has been withdrawn by the applicant (see third monthly report). |
| 10 | Lead in optical isolators | Final recommendation given in third monthly report. |
| 11 | Lead in sheath heater of Microwaves | The request has been withdrawn by the applicant (see third monthly report). |
| 12 | Cadmium pigments except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to the restriction on the marketing and use of certain substances | Final recommendation given in second monthly report. |
| 13 | High Intensity Discharge (HID) lamps for professional U.V. applications, containing lead halide as radiant agent | Final recommendation given in second monthly report. |
| 14 | Discharge lamps for special purposes containing lead as activator in the fluorescent powder (1% lead by weight or less) | Final recommendation given in second monthly report. |
| 15 | Discharge lamps containing lead in the form of an amalgam | Final recommendation given in second monthly report. |
| 16 | Mercury free flat panel lamp | Final recommendation given in second monthly report. |
| 17 | Special purposes Black Light Blue (BLB) lamps, containing lead in the glass envelope | Final recommendation possible (see section 5.3). |
| 18 | Low melting point alloys containing lead | Final recommendation given in second monthly report. |
| 19 | Galvanised steel containing up to 0.35% lead by weight and aluminium with an unintended lead content up to 0.4% lead by weight in electrical and electronic equipment | Final recommendation given in second monthly report. |

| No | Title of group | Current status |
|---|---|---|
| 20 | Lead in solder and hexavalent chromium in surface treatment, in parts recovered from production printers and copying equipment, sold, rented or leased or otherwise returned from professional users other than private households, originally put on the market before 1 July 2006, and reused for the same purpose within the original manufacturer's closed loop system until 1 July 2011. …. | Final recommendation given in second monthly report. |
| 21 | Cadmium sulphide photocells | Close to final recommendation – minor clarifications still necessary (see section 5.6) – overlapping with request 10 set 2. |

Table 2: Overview status quo requests set 2 to be reviewed

| No. | Title | Applicant | Status Quo |
|---|---|---|---|
| 2 | Mercury in switches | Pickering | Questions to applicant sent out (see Annex 1) – no reply yet |
| 3 | Special ICs having tin-lead solder plating on leads used in professional equipment | Thomson | Questions to applicant sent out (see Annex 1) – reply received |
| 4 | Specific modular units including tin-lead solder being used in special professional equipment | Thomson | Questions to applicant sent out (see Annex 1) – reply received |
| 5 | Solders containing lead and /or cadmium for specific applications where local temperature is higher than 150 deg C and which need to work properly more than 500 hours | Schlumberger | Questions sent out to external expert for prior clarification (see Annex 1) – no reply yet |
| 6 | Lead in solder for printed circuit boards for emergency lighting products | LIF | Questions to applicant sent out (see Annex 1) – reply received |
| 7 | Hexavalent chromium (Cr-VI) in chromate conversion coatings as surface treatment | Circuit Foil | Questions to applicant sent out (see Annex 1) – no reply yet |
| 8 | Lead in gas sensors | Dräger | Questions to applicant sent out (see Annex 1) – no reply yet |

| No. | Title | Applicant | Status Quo |
|---|---|---|---|
| 9 | PbO (Lead in Seal Frit) used for making BLU (Back Light Unit Lamp) for LCD televisions | Samsung | Final recommendation possible (see section 5.4) – overlapping with request 16 set 1. |
| 10 | Cadmium in opto-electronic components | TESLA | Close to Final recommendation – minor clarifications still necessary (see section 5.6) - overlapping with request 21 set 1. |
| 11 | Non-consumer mechanical power transmission systems including speed reducers and mechanical couplings which rely on electrical/electronic components for safe control and operation | FALK | Questions to applicant sent out (see Annex 1) – no reply yet |
| 12 | Electrical and electronic components contained in heating ventilating and air conditioning building systems, commercial refrigeration systems and transport refrigeration systems | Carrier | Questions to applicant sent out (see Annex 1) – no reply yet |
| 13 | Cadmium-bearing copper alloys | Symbol | Questions to applicant sent out (see Annex 1) – no reply yet |
| 14 | Electrical/electronic components contained mobile and stationary air compressors and vacuum systems, compressed air contaminant removal systems and pneumatic contractor's air tools | Sullair | Questions to applicant sent out (see Annex 1) – no reply yet |
| 15 | Electrical/electronic equipment that are: used in transport - aviation, aerospace, road, maritime, rail; installed in to the fabric of buildings – elevators, escalators, moving walks, dumb waiters, and heating, cooling and ventilation systems, and fire and security systems; used in the energy generation and transmission; used in mining and mineral processing; used for non-consumer mechanical power transmission systems; industrial process pumps and compressors; used in industrial refrigeration; and used in military applications | United Technologies | Questions to applicant sent out (see Annex 1) – reply received |
| 16 | Lead alloys as electrical/mechanical solder for transducers used in high-powered professional and commercial | Meyer Sound | Questions sent out to stakeholder for prior |

| No. | Title | Applicant | Status Quo |
|---|---|---|---|
| | loudspeakers | | clarification (see Annex 1) – no reply yet |
| 17 | Cadmium oxide | INMET | Questions to applicant sent out (see Annex 1) – reply received |
| 18 | Solder tin of the thermo fuse with a defined low melting point | Stannol | Questions to applicant sent out (see Annex 1) – reply received |
| 19 | Lead in lead oxide glass used in plasma display panel (PDP) | KEA | Final recommendation possible (see section 5.5) - overlapping with request 6 set 1. |
| 20 | Lead in solder on small PCB and tinned legs of primary components | e2v | Questions to applicant sent out (see Annex 1) –reply received |
| 21 | Use of the not lead free component NEC V25 in the Memor 2000 | Datalogic | Questions to applicant sent out (see Annex 1) – reply received |
| 22 | Lead used in shielding of radiation for Non Medical X-ray equipment | l3com | Questions to applicant sent out (see Annex 1) – reply received |
| 23 | Lead based solders sealed or captured within heat-shrinkable components and devices. | SEIP | Questions to applicant sent out (see Annex 1) – reply received |

# 4 Results

It was possible to give final recommendations for all but one request from set 1.

Concerning overlapping issues between requests from set 1 and set 2 (e.g. request 6 set 1 with request 19 and request 9 set 2; request 21 set 1 with request 10 set 2) final recommendations were elaborated taking all relevant requests into account so as to avoid conflictive results.

As concerns set 2, a first screening of the documents after closure of the stakeholder consultation had taken place. Documents other than the requests themselves had been looked at in order to identify their relevance for each single request for exemption. The according classification of the documents can be seen in the overview in Annex 2 of the third monthly report.

Following this step all requests from set 2 available on 28 October 2005 have been checked with a view to determine the need for further clarification. Furthermore stakeholder comments were screened in order to attribute individual comments to the relating requests. Depending on the quality of the requests questions have been sent out to applicants and stakeholders were necessary. These questions can be found in the Annex 1 to this report.

It can be noted that in most instances data and information given in the requests do not meet the criteria set by the Commission on the consultation website. Nor are most of the requests justified in line with Article 5 (1) (b) of the RoHS Directive. It was therefore necessary to start an extensive clarification procedure with the applicants before going into detailed evaluation (e.g. in some requests it is not even clear what substance/application the exemption is requested for).

A detailed description of the requests ready for final recommendation is given in section 5 including the description of the request for exemption (substance, function, application, wording), the summary of the justification for exemption and a critical review of available data and information as well as the final recommendation by the contractor.

# 5 Status of remaining requests set 1 and requests set 2

The following section contains the status quo of the remaining request from set 1 for which no final recommendation can be given yet (request No. 21). Furthermore the following section contains final recommendations for requests from both set 1 and set 2.

## 5.1 Lead in finishes of fine pitch components – HP (set 1 request No. 1_b)

### 5.1.1 Description of requested exemption

- Substance: Lead in tin-lead finishes with typically less than 20 mass-% of lead
- Function: Prevention of whisker growth
- Specific application: Finishes on fine pitch components with a pitch of less than 0.65 mm
- Wording as requested by applicant: Lead in tin-lead finishes on fine pitch components with a pitch of 0.65 mm or less until 2010.
- The exemption would result in the use of 2 to 2000 metric tons of lead in the EU, based on the content of 0.1 to 1 mg of lead in a typical electronic component, around 1 mg to 1 g of lead per product and the shipment of EEE into the EU.

### 5.1.2 Summary of justification for exemption

**Criteria for justification**

- No long time experience on whisker formation from lead-free tin-based finishes.
- Great deal of uncertainty regarding environmental factors (e.g. high air humidity and high temperature) that might affect whisker growth.
- Whisker mitigation techniques applied by component manufacturers actually mitigate whisker growth, but cannot reliably prevent whiskers growing to a length that can be critical for fine pitch components.
- Discussions on whisker standard tests ongoing without a result yet due to these uncertainties. Hence, no standard test is available at the moment allowing reliable results on whiskering of tin-based lead-free finishes.
- Nickel-palladium (Ni/Pd) and nickel-palladium-gold (Ni/Pd/Au) are technically viable lead-free substitutes for components with copper lead[1]-frames, but not available sufficiently to cope with the demand until July 2006. Component manufacturers focused their efforts on tin-based lead-free plating.
- No such whisker free alternative finishes available on nickel-iron lead-frames.

**Critical review on data and information (given by applicant or other parties)**

- The principle mechanisms of whisker growth are known, but currently failures resulting from whiskers from tin-based lead-free finishes in fine pitch components cannot be excluded reliably and generally.
- A general recommendation to use tin-based lead-free finishes cannot be given at the moment. Users of fine pitch components will have to decide on a case-to-case base.
- The applicant submitted a paper (Quist IPC San Jose Apr05 Cypress Customer Preferences.pdf[2]) where it is pointed out that there is a lack of production capacity and availability of fine pitch components with NiPdAu plating.
- The applicant argues that he cannot find all necessary fine pitch components with NiPd or NiPdAu finishes
- For NiFe-lead-frame components, NiPd and NiPdAu finishes technically are not a viable alternative. NiFe-lead-frames and Cu-lead-frames both have their technical indications of use (electrical and thermal conductivity, coefficient of thermal mismatch

[1] Technical remark: The word “lead” in “lead-frame” in this context does not refer to the chemical element lead (Pb), but means the chassis on which chips are attached in components.

[2] See Annex 2

between chip and lead-frame,…) and thus cannot generally be substituted with each other. Substitution of NiFe-components by copper-lead-frame components with NiPd or NiPdAu finishes therefore is no generally viable alternative.

### 5.1.3 Final recommendation

Specific mitigation techniques can reduce tin whisker growth on tin-plated surfaces. However, whiskers still grow to a length that can become critical for fine pitch components. The whiskers on mitigated tin surfaces occur under specific testing conditions. It is contentious whether or not these testing conditions are relevant for the real life situation. This discussion is still ongoing in standardisation committees which are working on a standard whisker test. A final result of this discussion is not yet available and it cannot yet be foreseen when a final standard whisker test will be decided upon. It can therefore not be neglected that a certain risk may remain in using pure tin finishes on fine pitch components. .

Manufacturers must decide themselves whether and in which applications they use tin-based lead-free finishes. This means that, until more experience allows a clearer estimation of the risk, a viable other lead-free alternative needs to be available when compliance with RoHS is required. Manufacturers would thus not be forced to take the risk using fine pitch components with tin-based lead-free finishes if they consider it too risky for their application.

Nickel-palladium-gold and nickel-palladium are such other lead-free alternatives, which are already applied on a small number of components. However, they are only applicable on components with copper lead-frames. As the applicant states, on nickel-iron lead-frames, corrosion problems bar their use.

It is therefore recommended to grant an exemption for fine pitch components with NiFe lead-frames until 2010, as requested.

For fine pitch components on copper lead-frames, the availability of components with NiPdAu and NiPd finishes for the deadline July 2006 is still limited. The component manufacturers, according to the applicant, focused on tin-based lead-free finishes and thus neglected investing into alternatives. The documentation submitted makes this argumentation plausible, although exactly quantified data are not available as this information was not accessible for the applicant, if available at all.

It is therefore recommended to grant the exemption for fine pitch components on copper lead-frames for two years. Until then, the component manufacturers have time to react to the market demand.

**Summary of recommendations:**

- Grant exemption for lead in finishes of NiFe-lead-frame components with the following wording:
  Lead in finishes of fine pitch components with a pitch of 0.65 mm or less with NiFe lead-frames until 2010.

- Grant exemption for lead in finishes of copper-lead-frame components with the following wording:
  Lead in finishes of fine pitch components with a pitch of 0.65 mm or less with copper lead-frames until 2008.

## 5.2 Solders containing lead for specific applications – Syfer (set 1 request No. 4_a)

### 5.2.1 Description of requested exemption

Solders containing lead for specific applications, namely:

Solders used for soldering to machined through hole discoidal and planar array ceramic multi layer capacitors.

**Substance**

Lead

**Function of the Solder**

Provide the combination of a suitable melting point and ductility of 50Pb/50In or 60In/40Pb solders. The ductility of this solder avoids cracking of the ceramic layer during and after soldering due to thermal mismatch.

**Specific application**

Solders used for soldering to machined through hole discoidal and planar array ceramic multi layer capacitors for EMC discrete filters, filter assemblies and filtered connectors.

The quantity of lead in the solder joints of each filter depends on the design. The applicant estimated by experiment that the quantity of lead is typically 5mg per joint. This approximates to 0.75% of the total filter weight maximum.

Filters assembled at the applicant's manufacturing sites during 2003 used approximately 4Kg of lead total in solder joints and approximately 3kg in 2004.

This request affects a small number of manufacturers, and for certain components the applicant claims to be the market leader. Therefore it is estimated that the total amount of

lead in such kind of components is in the same order of magnitude as stated by the applicant.

**Precise wording**

Lead in solders for the soldering to machined through hole discoidal and planar array ceramic multi layer capacitors.

### 5.2.2 Summary of justification for exemption

According to the applicant, lead-free solders in connection with gold plated terminations cause cracking of the ceramic bodies after the soldering process due to thermal mismatch (CTE). As a main reason for the CTE is the copper alloy pin, alternative pin materials have been tested, but are not a viable substitute. The alternative materials do not provide suitable resistivity to allow sufficient current flow without excessive temperature rise.

Some companies may intend using PdAg terminations replacing gold together with lead-free solders. This avoids the cracking of the ceramic bodies. Tests, however, show that such devices show considerable deviations from the designed capacitance causing unacceptable losses of the filtering properties beyond the acceptable tolerances. The reason is the weaker – compared with gold terminations - adhesion between the ceramic and the AgPd plating causing lift-offs and/or the leaching of the PdAg layer, both in combination with lead-free solders. The problem does not exist with lead-containing solders. The loss of capacitance due to these failure modes affecting the filtering performance of the device may result in severe medium- and long-term reliability problems.

According to the applicant, in some applications, clips are an alternative to the use of solders. However, their use is principally limited to bigger through hole sizes as the clip needs space. Additionally, the use of clips may be limited due to required electrical parameters, which the clip affects. A general rule whether clips can be used as an alternative is therefore not at hand, but rather requires a case to case consideration.

The applicant reasons that the use of high-melting SnPb solders with more than 85 % of lead is a possible substitute. As this substitute would increase the amount of lead used in this application as well as the energy consumption and would require new soldering equipment, this alternative is not considered to be a viable and sound alternative. According to the applicant, alternatives therefore do not exist and an exemption is required for this use of lead.

### 5.2.3 Final recommendation

The presented arguments are plausible and supported by appropriate documentation. The use of high-melting solders with more than 85 % of lead, which are already exempted, could be a solution, but would even increase the use of lead and energy.

For some applications, the use of clips is an alternative, but must be considered on a case to case basis, according to the applicant. As a result, a generally appropriate substitute technically and scientifically is not at hand. It is therefore recommended to grant this exemption. The scientifically and technically accurate wording for this exemption, in line with Art. 5 (1) (b) of the RoHS Directive, should be

“Lead in solders for the soldering to machined through hole discoidal and planar array ceramic multi layer capacitors”.

## 5.3 Special purposes Black Light Blue (BLB) lamps, containing lead in the glass envelope – ELCF (set 1 request No. 17)

### 5.3.1 Description of requested exemption

The European Lamp Companies Federation (ELCF) requests an exemption for PbO in the glass envelope of Black Light Blue (BLB) lamps. Typical applications of this kind of lamps are money checking, lamps for leak detectors, disco-lighting etc.

These lamps efficiently emit near ultraviolet rays at 315nm to 400nm which have strong photochemical and fluorescent effects. Through the usage of a special deep blue filter glass visible rays and transmits near ultraviolet rays are absorbed.

According to the applicant lead is essential for creating optimal optical properties: maximum transmission of UV light and minimum visible light transmission.

The total annual amount of lead in this application is about 50.000 kg p.a. (total EU market, 2004 figures). Compared to the usage of Pb respectively PbO in other discharge lamp applications (see monthly report 2, section 5.5 to 5.8) these figures are comparatively high.

### 5.3.2 Summary of justification for exemption

The applicant justifies the request for exemption based on technical criteria:

- Substitution is currently technically not feasible, no glass recipes are known that result in an acceptable transmission spectrum.
- Earlier efforts to substitute Pb have led to a published patent, WO 96/21629, published 18 July 1996, the implementation of which could not be realised up to now, due to a number of technical reasons.
- Earlier patented lead-free BLB glass appeared to yield a very large lamp emission reduction over time. This would result in an unacceptably short lamp life.

As reaction to additional questions by the consultants ELCF provided further information. According to the applicant in the mean time, substantial technical progress has been achieved, which makes it possible to decide on the technical feasibility in 2006.

### 5.3.3 Final recommendation

Information delivered by the applicant is complete and comprehensible. Basically this exemption request should be granted according to Article 5 (1) b, as at the moment no substitutes are existent providing the functionality. However the exemption should be restricted for the time period the applicant mentioned to be necessary to decide on the technical feasibility.

Against this background we suggest the following wording:

"Lead oxide in the glass envelope of Black Light Blue (BLB) lamps, exemption until 31/12/2006."

## 5.4 PbO (lead in seal frit) used for making BLU (Back Light Unit Lamp) for LCD televisions – Samsung (set 2 request No. 9)

### 5.4.1 Description of requested exemption

Samsung Corning Co. Ltd requests an exemption for the use of lead oxide as seal frit used for producing Black Light Unit (BLU) lamps. These kinds of lamps are used as a light source called Backlight Unit (BLU) for Liquid Crystal Displays (LCD). One newly-designed kind of BLU are the flat fluorescent lamps (FFL) which make it possible to use only one flat fluorescent lamp driven by one driving circuit in the BLU for large-size LCD panels instead of up to 20 lamps and as many driving circuits as light source for one 32" LCD panel.

According to an assumption of the applicant the total amount of lead oxide used for this application accounts for about 10.000 kg p.a.

The requested exemption described here is nearly in full accordance to the request of the European Lamp Companies Federation (ELCF) on "mercury free flat panel lamp assembled by using lead containing glass solder" (set 1 request 16; final recommendation see report 2 section 5.8).

### 5.4.2 Summary of justification for exemption

The request for exemption is based on technical criteria as well as on environmental/toxicological criteria:

- A number of possible substitutes for PbO as sinter material was evaluated (bismuth glass, zinc borate glass, tin phosphate glass). None of these potential substitutes met the required properties being softening temperature (adjustable between 350 to 600 ), adhesive strength, thermal expansion coefficient (similar to glass substrate) and chemical stability.
- Possible substitutes require higher calcination temperatures to improve the sintering characteristics leading to add ional energy consumption during production.

Furthermore lead oxide-free glasses would require more energy due to the high softening temperature of these glasses.

- From a toxicological point of view all raw and basic materials used for possible substitutes are critical.

### 5.4.3 Final recommendation

Data and information given by the applicant are complete and comprehensible. Basically this exemption request should be granted according to Article 5 (1) b, as at the moment no substitutes are existent providing the functionality of the seal frit adequately.

Analogous to the above mentioned exemption requested by ELCF and considering running activities in developing lead oxide-free substitutes the exemption at hand should be reviewed again latest in 2010 if not part of the four-yearly review of the RoHS Annex before.

In the second monthly report a wording was recommended for request 16 set 1 which restricted a possible exemption to the application mentioned therein (*"Lead as glass solder typically with 70wt%PbO in mercury free flat panel lamps type PLANON"*). Since now nearly full accordance between request 16 set 1 and request 9 set 2 has been assessed, a common wording encompassing both requests should be used for granting an exemption. **Thus the original wording for request 16 set 1 is herewith withdrawn and should therefore not be used for further decision making!**

Against this background we suggest the following wording for both request 16 set 1 and request 9 set 2:

"Lead oxide in glass used for bonding front and rear glass substrates of flat fluorescent lamps used for Liquid Crystal Displays (LCD)."

## 5.5 Lead in lead oxide glass plasma display panels and other technology large-sized flat display panels – JBCE/JEITA (set 1 request No. 6); lead in lead oxide glass used in plasma display panel (PDP) – KEA (set 2 request No. 19)

### 5.5.1 Requested exemption

The Japan Business Council in Europe (JBCE), the Korea Electronics Association, LG Electronics and Samsung SDI request an exemption for lead in lead oxide glass used in plasma display panel (PDP). Furthermore JBCE stated in February 2005 that surface conduction electron emitter display (SED) was meant to refer to “other technology large-

sized flat display panels" [3]: Due to the fact that the reasons are almost similar for using lead oxide glass both for Plasma Display Panels (PDP) and for Surface-Conduction Electron-emitter Display panels it is meaningful to cover these requests simultaneously. Moreover there are overlapping issues to the use of lead oxide in seal frit.[4]

For both display technologies lead oxide glass is used for the main structural elements of the panel except the substrates.

For PDP the following elements are made of materials containing lead oxide:

- Front and rear glass dielectric layer
- Bus electrode
- Black stripe
- Address electrode
- Barrier ribs
- Seal frit
- Frit Ring

Although there are considerable differences between PDP and SED both technologies are currently using lead oxide glass for sealing of casing (glass frit) and print pastes.

On a quantity basis the front and rear glass dielectric layer, the barrier ribs and the seal frit are the most relevant part concerning the usage of lead oxide glass.

According to the assumption of the applicants the total amount of lead oxide in glass used for PDP accounts all together for about 400.000 kg p.a. (EU figures). Due to the fact that SED technology is still under development annual quantities can not be estimated at this moment.

### 5.5.2 Summary of justification for exemption

The request for exemption is mainly based on technical criteria. According to data and information given by the applicants the main reasons for using lead oxide glass can be summarised as follows:

No substitute glass material exists covering the needs

- for electric specifications (contact resistance) and colour specifications of bus electrode and black stripe;
- for colour specifications of dielectric layer;

[3] This wording was used in the earlier checklist submitted by JBCE in September 2004.

[4] See set 1 request No. 16; final recommendation in report 2 section 5.8 and set 2 request No. 9, final recommendation in this report section 5.4

- for dielectric and discharge specifications for rear panel;

Furthermore no substitute glass material exist which gives a low softening point available for sealing.

Based on additional data and information given by the applicants there are several approaches for realising lead-free PDP. Comparable to lead in seal frit used for making BLU (Back Light Unit Lamp) possible substitutes for PbO are bismuth glass, zinc borate glass, and tin phosphate glass). Nevertheless according to the applicants the first lead-free PDP will not be introduced before 2006-2007.

### 5.5.3 Final recommendation

Data and information given by the applicants are complete and comprehensible. The presented arguments are plausible and supported by appropriate documentation. Basically this exemption request should be granted according to Article 5 (1) b, as at the moment no substitutes are existent providing the functionality of lead oxide glass.

Taking into account running activities in developing lead oxide-free substitutes the exemption at hand should be reviewed again latest in 2010 if not part of the four-yearly review of the RoHS Annex before.

We suggest the following wording for the exemption:

"*Lead oxide in plasma display panels (PDP) and surface conduction electron emitter displays (SED) used in structural elements; notably in the front and rear glass dielectric layer, the bus electrode, the black stripe, the address electrode, the barrier ribs, the seal frit and frit ring as well as in print pastes.*"

## 5.6 Cadmium sulphide photocells – Perkin Elmer/Philips (set 1 request No. 21_a/b); cadmium in opto-electronic components – TESLA (set 2 request No. 10)

### 5.6.1 Description of requested exemption

All three requests (request No. 21_a/b set 1 and request No. 10 set 2) refer to the same general application: the use of cadmium compounds in photocells (i.e. photoresistors). The different applicants though name different specific kinds of application for which they require an exemption.

Perkin Elmer requests an exemption for

"Cadmium sulphide photocells for burner controls, automatic light switches, commercial light control systems and audio equipment, safety relevant controls in automotive appliances".

Philips requests an exemption for

"Use of CdS photocells in daylight responsive dimming systems".

TESLA requests an exemption for

“Cadmium in opto-electronic components” naming “photocells for detection and measurement light level in visible spectrum, analogue optocouplers for application in signal control (especially in professional acoustics), optoelectronic wear-less potentiometers for avionics and power plant automation”.

The function of cadmium in the photocells is being a photosensitive material working in a photoelectric light sensor used as photoresistor in different applications. The particularity of photoresistors is to have a spectral response which matches the characteristics of the human eye ideally. The cadmium is contained in a thin layer of CdS which can be applied onto a suitable carrier (e.g ceramic substrate) either by spray coating or screen printing or by way of vacuum deposition (which leads to thinner layers and lower Cd content). Following activation and mechanical masking or photolithography process produce the photosensitive structure.

Perkin Elmer states that the amount of cadmium in every single device amounts to 0,01 – 0,1 weight%. In 2004 this applicant had distributed a total of 5,4 kg of cadmium through trade with photoresistors (compared to about 350 t of cadmium being traded annually in the EU for the use of cadmium in pigments).

### 5.6.2 Summary of justification for exemption

All applicants claim that it is in principle technically possible to substitute photoresistors with photodiodes or phototransistors but that these alternatives have strong disadvantages. These being:

- High component count (further electronics required) – according to Philips silicon sensors (i.e. photodiodes) can be used only in combination with a transimpedance amplifier (current to voltage converter) with trimmable gain. Furthermore an infrared rejection glass filter is required to bring the sensing range closer to the CIE photopic curve.
- Redesign of printed circuit board/changes in existing circuitry
- Inferiority in light detection performance (spectral sensitivity)
- Small amount of cadmium used

The critical review of documents and further information has lead to the following observations and conclusions:

- Photoresistors and photodiodes cover different wavelengths of light. Another difference between the two components is their inertia which can be relevant for different types of applications.
- Due to the fact that CdS photoresisors typically have high impedance performance in most typical application circuits a transimpedance amplifier needs to be used. Nevertheless this is also the case for the use of photodiodes in circuits. Hence, in that respect, there is no difference between the two components.

- Not all applications mentioned by the applicant fall under the scope of the RoHS Directive. Indeed, some applications fall under category 9 of the WEEE Directive (i.e. monitoring and control devices such as burner controls and signal controls). Others are covered by another legislation (e.g. safety controls in automotive appliances).
- Hence only a few selected applications of CdS photocells are relevant under RoHS (e.g. auto-focus control in slide projectors, exposition and diaphragm control in cameras and possibly light control devices such as dimming systems). It is assumed that as long as the main purpose of an equipment is not to control or to monitor it should fall under the scope of the RoHS Directive (e.g. the main function of a light control device in a dimming equipment is not to control but to allow required lighting).
- Substitutes seem to be available though with higher demand in material and especially in electronic circuitry.
- The annual amount of cadmium used in RoHS relevant applications of photocells is relatively small compared to other applications.
- Since CdS containing photocells can neither be considered as electrical contacts accounting for their electrical reliability nor can the CdS within a photocell be considered as a cadmium plating, there is no doubt that the application which is looked at here is not covered by the existing exemption under entry 8 Annex of the RoHS Directive.
- As a result of an LCA on CdS photoresistors and photodiodes made available by Philips it can be stated that „it does not make any difference from an environmental point of view“ whether it is photoresistors or photodiodes that are used. The environmental impact is in both cases dominated by the gold in bondwires. It is thus not the CdS layer which is responsible for the main environmental impact. Nevertheless this statement can not be used directly in the argumentation for the requested exemption since the alternative to photoresistors would not be a 1:1 exchange of the component with photodiodes but a substitution making higher material demand necessary.

### 5.6.3 Final recommendation

Due to information made available to the contractor shortly before closing edition of this final version of the fourth monthly report, minor clarifications are still necessary and a final recommendation can not be given at this state.

## 6 Further proceeding

The focus for the forthcoming work will lie on the closure of final recommendations of requests from set 1. At the same time, requests from set 2 will be evaluated as far as answers have been provided to the questions sent out.

# Annex 1: Questions to applicants

## Mercury in switches – Pickering (set 2 request No. 2)

- It is not clear which specific applications the switches you require exemption for are used. Please specify the exact technical specificity/type of the switches and the applications they are used in as well as the exact technical functionality of the used Mercury. We need this information in order to assess i) whether the applications concerned fall under the scope of RoHS, ii) whether there are any overlaps with other requests and iii) what are the exact applications concerned.
- The EU Commission states: "Homogeneous material means a material that can not be mechanically disjointed into different materials. The term "homogeneous" means "of uniform composition throughout". Examples of "homogeneous materials" are individual types of: plastics, ceramics, glass, metals, alloys, paper, board, resins, and coatings. The term "mechanically disjointed" means that the materials can, in principle, be separated by mechanical actions such as: unscrewing, cutting, crushing, grinding and abrasive processes." Please specify the amount of Mercury used in the homogeneous material according to above mentioned definition.
- Please find attached a stakeholder comment by several environmental NGOs concerning your request which you can also find posted on the Commission's website. We kindly ask you to comment their position regarding substitution possibilities for mercury in switches regarding substitution of Mercury in the applications your require exemption for (inter alia cf. page 2 "Mercury relays [and switches] are a large group of products which have gradually been replaced by electrical and electronic alternatives." and page 5 "[...] there are no technical obstacles to replacing electrical components, conventional relays and other contacts [...] with equivalent mercury-free components.").
- Please also comment the substitution possibilities named for mercury switches in the attached report "Mercury In Electrical Products" (cf. section 4.5) with regard to their ability to be used for the applications you request an exemption for.

## Special ICs having tin-lead solder being used in special professional equipment – Thomson (set 2 request No. 3)

- You say that the amount of lead involved is less than 10 kg per year. Please specify this figure: is this the figure only valid for Thomson's products globally or only for the products sold in Europe? Please provide the total figure for Europe and worldwide (preferably for a recent year).

- Please specify the re-design circles for professional TV broadcasting equipment: in what time periods are the designs re-worked? As you know that your design circles and commercial life times of your products might be longer than for other products, why was or is it not possible for you to react adequately to the requirements of the RoHS Directive?
- How much time is required to re-design this equipment (time to market)?
- In which time periods are the products re-designed normally?
- When did you order the last of the components you want to have exempted?

### Specific modular units including tin-lead solder being used in special professional equipment – Thomson (set 2 request No. 4)

- Do you want to go on using lead in solders for soldering and/or for SnPb finishes? What does "…as part of some components" mean?
- In case of the solder, did you (or why not?) check, whether the assembly can be done with lead-free solders? If yes, what were the results?
- You say that the amount of lead involved is less than 50 kg per year. Please specify this figure: is this the figure only valid for Thomson's products globally or only for the products sold in Europe? Please provide the total figure for Europe and worldwide (preferably for a recent year).
- Please specify the re-design circles for professional TV broadcasting equipment: in what time periods are the designs re-worked? As you know that your design circles and commercial life times of your products might be longer than for other products, why was or is it not possible for you to react adequately to the requirements of the RoHS Directive?
- How much time is required to re-design this equipment (time to market)?
- In which time periods are the products re-designed normally?
- When did you order the last of the components you want to have exempted?

### Solders containing lead and /or cadmium for specific applications where local temperature is higher than 150 deg C and which need to work properly more than 500 hours – Schlumberger (set 2 request No. 5)

For this request it was decided to address an external expert in order to get a better understanding of the request before sending out questions for clarification to the applicant.

In this regard, Prof. Andrew A. Shapiro, who is with the Jet Propulsion Laboratory, California Institute of Technology, has been contacted. He is an expert for interconnection technologies for aerospace applications, experienced in requirements of harsh environments. He has

been asked about appropriate RoHS compliant high-temperature solders, which meet the technological requirements (need to remain reliable over 500 hours at temperatures up to 170 °C) as set out in the exemption request by Schlumberger. A first feedback indicates that AuSn (80/20) might be a replacement. Once a more detailed feedback is received from Prof. Shapiro - to be expected by mid December - the applicant will be contacted to ask for further clarifications on these potential alternatives.

## Lead in solder for printed circuit boards for emergency lighting products – LIF (set 2 request No. 6)

The justification you give for your request on "Lead in solder on printed circuit boards used in emergency lighting products" is based on grounds, which apply to leadfree soldering in general. To our understanding the justification does not list any reasons, which specifically apply to emergency lighting products. Although it is acknowledged, that the transition process is related to technical difficulties, it has to be stated, that in general technical alternatives to lead-free solders are available. Therefore, please state below, what are the unique problems and obstacles with lead-free alternatives for emergency lighting products – if there are any.

1) Please describe the requested exemption in detail:

- What is the application in which the substance/compound is used and for which the exemption is requested?
- What is the specific (technical) function of the substance/compound in this application?
- What is the amount (in absolute number and in percentage by weight) of the substance/compound in i) the homogeneous material (please refer to the Commission's interpretation[5]), ii) the application and iii) total EU annually for RoHS relevant applications?
- Please provide an unambiguous wording for the requested exemption!

2) Please justify you request according to Article 5 (1) (b) RoHS Directive whereas:

- Substitution of concerned hazardous substances via materials and components not containing these is technically or scientifically impracticable;

[5] See FAQ document on RoHS and WEEE Directives available at http://www.europa.eu.int/comm/environment/waste/weee_index.htm

- Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically impracticable;
- Negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh environmental, health and/or consumer safety benefits thereof.

  - For the argumentation of justification please provide sound data/evidence on why substitution/elimination is 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…).
  - Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale.
  - Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes will be available by 1 July 2006 or at a later stage.
  - Please indicate if any current restrictions apply to such substitutes, If yes, please quote the exact title of the appropriate legislation/regulation.
  - Please indicate benefits/advantages and disadvantages of such substitutes.

## Hexavalent chromium (Cr-VI) in chromate conversion coatings as surface treatment – Circuit Foil (set 2 request No. 7)

- Please specify the amount of CrVI in your copper foils in the homogeneous material as defined by the Commission FAQ paper (see http://www.europa.eu.int/comm/environment/waste/weee_index.htm). Please use the international standard unit µg/cm².
- Please also specify the amount of CrVI in the typical applications you mentioned in your request (i.e. CCL or CB). Please also state the amount of CrVI used in these RoHS relevant applications for the EU market annually (preferably for the year 2004).
- Is the function of CrVI in the application on copper foils only corrosion protection or are there other properties resulting from CrVI (e.g. electrical conductivity, peel strength of laminates using copper foil)?
- Are the CCL you produce used in both automotive and electronic industries?
- Trivalent chromium is often cited as a substitute for CrVI for steel coating. Please explain whether this substitute is technically feasible for your application and if not why it is technically not suited. You say that "copper foils employing these substitute coatings for uses in electronic products are currently not available and don't respond to current requests from the CCL and PCB manufacturers". Please specify when they will be available and what the requests exactly are (i.e. technical requirements).

- You named "today's substitution process without CrVI" - please specify what substitutes you mean by that.
- Would a harmonisation with the timeline of the ELV Directive (i.e. an exemption for the use of CrVI until 1 July 2007) allow you to achieve substitution of CrVI in copper foils in the meantime? If so, what are the substitutes you would use?
- If well-understood it is only for the high process temperatures in case of the use of PTFE based substrates that substitution of CrVI is a problem. Is that correct? Could an exemption not be limited to applications on PTFE based substrates?
- You state that some suppliers have been tested with regard to CrVI substitution: please specify which substitutes were tested and why they were not able to fulfil the requirements (please specify the technical aspects!).

## Lead in gas sensors – Dräger (set 2 request No. 8)

- As far as we know gas sensors are generally used in products included in category 8 (medical devices) and category 9 (monitoring and control instruments) of the WEEE Directive and thus do not fall under the scope of the RoHS Directive.
- Should you require an exemption under the RoHS Directive, please specify for which applications exactly you require an exemption and to which category of the WEEE they belong. The function of the substance you want exempted (i.e. lead) has to be clearly explained. An exemption can only be granted for the use of a substance in a specific application.
- Please formulate your request according to the format provided by the Commission under http://www.europa.eu.int/comm/environment/waste/rohs_3_consult.htm: "In particular, stakeholders are requested to provide, for each entry, information on: the current existence of feasible substitutes in an industrial and/or commercial scale; any restrictions that apply to such substitutes; the costs and benefits and advantages and disadvantages of such a substitutes; provide a precise wording for each exemption. Stakeholders are requested to support, as far as possible, their contribution with technical and scientific evidence."

## Non-consumer mechanical power transmission systems including speed reducers and mechanical couplings which rely on electrical/electronic components for safe control and operation – Falk (set 2 request No. 11)

1) Please describe the requested exemption in detail:

- For which substance(s) or compound(s) is the exemption requested?
- What is the application in which the substance/compound is used and for which the exemption is requested?

- What is the specific (technical) function of the substance/compound in this application?
- Please justify why this application falls under the scope of the RoHS Directive (e.g. is it a finished product? is it a fixed installation? what category of the WEEE Directive does it belong to? Please refer to the Commission's scope criteria*).
- What is the amount (in absolute number and in percentage by weight) of the substance/compound in i) the homogeneous material (please refer to the Commission's interpretation*), ii) the application and iii) total EU annually for RoHS relevant applications?
- 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 (please refer to http://www.europa.eu.int/comm/environment/waste/weee_index.htm).
- Please provide an unambiguous wording for the requested exemption!

* See FAQ document on RoHS and WEEE Directives available at http://www.europa.eu.int/comm/environment/waste/weee_index.htm

2) Please justify you request according to Article 5 (1) (b) RoHS Directive whereas:

- Substitution of concerned hazardous substances via materials and components not containing these is technically or scientifically impracticable;
- Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically impracticable;
- Negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh environmental, health and/or consumer safety benefits thereof.
  - For the argumentation of justification please provide sound data/evidence on why substitution/elimination is 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…).
  - Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale.
  - Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes will be available by 1 July 2006 or at a later stage.
  - Please indicate if any current restrictions apply to such substitutes, If yes, please quote the exact title of the appropriate legislation/regulation.
  - Please indicate benefits/advantages and disadvantages of such substitutes.

## Electrical and electronic components contained in heating ventilating and air conditioning building systems, commercial refrigeration systems and transport refrigeration systems – Carrier (set 2 request No. 12)

1) Please describe the requested exemption in detail:

- For which substance(s) or compound(s) is the exemption requested?
- What is the application in which the substance/compound is used and for which the exemption is requested?
- What is the specific (technical) function of the substance/compound in this application?
- Please justify why this application falls under the scope of the RoHS Directive (e.g. is it a finished product? is it a fixed installation? what category of the WEEE Directive does it belong to? Please refer to the Commission's scope criteria#).
- What is the amount (in absolute number and in percentage by weight) of the substance/compound in i) the homogeneous material (please refer to the Commission's interpretation#), ii) the application and iii) total EU annually for RoHS relevant applications?
- Please check and justify why the application you request an exemption for does not overlap with already existing exemptions respectvely does not overlap with exemption requests covered by previous consultations (please refer to http://www.europa.eu.int/comm/environment/waste/weee_index.htm).
- Please provide an unambiguous wording for the requested exemption!

#See FAQ document on RoHS and WEEE Directives available at http://www.europa.eu.int/comm/environment/waste/weee_index.htm

2) Please justify you request according to Article 5 (1) (b) RoHS Directive whereas:

- Substitution of concerned hazardous substances via materials and components not containing these is technically or scientifically impracticable;
- Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically impracticable;
- Negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh environmental, health and/or consumer safety benefits thereof.

- For the argumentation of justification please provide sound data/evidence on why substitution/elimination is 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…).

- Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale.
- Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes will be available by 1 July 2006 or at a later stage.
- Please indicate if any current restrictions apply to such substitutes. If yes, please quote the exact title of the appropriate legislation/regulation.
- Please indicate benefits/advantages and disadvantages of such substitutes.

## Cadmium-bearing copper alloys – Symbol (set 2 request No. 13)

1) Please describe the requested exemption in detail:

- For which substance(s) or compound(s) is the exemption requested?
- What is the application in which the substance/compound is used and for which the exemption is requested?
- What is the specific (technical) function of the substance/compound in this application?
- Please justify why this application falls under the scope of the RoHS Directive (e.g. is it a finished product? is it a fixed installation? what category of the WEEE Directive does it belong to? Please refer to the Commission's scope criteria#).
- What is the amount (in absolute number and in percentage by weight) of the substance/compound in i) the homogeneous material (please refer to the Commission's interpretation#), ii) the application and iii) total EU annually for RoHS relevant applications?
- 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 (please refer to http://www.europa.eu.int/comm/environment/waste/weee_index.htm). For instance, applications might be covered by entry 8. of the RoHS Annex (cf. Commission Decision 2005/747/EC). Please specify for which applications other than those covered by this entry you request an exemption for.
- Please provide an unambiguous wording for the requested exemption!

#See FAQ document on RoHS and WEEE Directives available at http://www.europa.eu.int/comm/environment/waste/weee_index.htm

2) Please justify your request according to Article 5 (1) (b) RoHS Directive whereas:

- Substitution of concerned hazardous substances via materials and components not containing these is technically or scientifically impracticable;

- Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically impracticable;
- Negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh environmental, health and/or consumer safety benefits thereof.

  - For the argumentation of justification please provide sound data/evidence on why substitution/elimination is 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…). For instance, you state that "other alloy systems are under development to address hazardous substance concerns". Please specify "other alloy systems" and "under development".
  - Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale.
  - Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes will be available by 1 July 2006 or at a later stage.
  - Please indicate if any current restrictions apply to such substitutes. If yes, please quote the exact title of the appropriate legislation/regulation.
  - Please indicate benefits/advantages and disadvantages of such substitutes.

## Electrical/electronic components contained mobile and stationary air compressors and vacuum systems, compressed air contaminant removal systems and pneumatic contractor's air tools – Sullair (set 2 request No. 14)

1) Please describe the requested exemption in detail:

- For which substance(s) or compound(s) is the exemption requested?
- What is the application in which the substance/compound is used and for which the exemption is requested?
- What is the specific (technical) function of the substance/compound in this application?
- Please justify why this application falls under the scope of the RoHS Directive (e.g. is it a finished product? is it a fixed installation? what category of the WEEE Directive does it belong to? Please refer to the Commission's scope criteria#).
- What is the amount (in absolute number and in percentage by weight) of the substance/compound in i) the homogeneous material (please refer to the Commission's interpretation#), ii) the application and iii) total EU annually for RoHS relevant applications?
- 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 (please refer to

http://www.europa.eu.int/comm/environment/waste/weee_index.htm). For instance, applications might be covered by entry 8. of the RoHS Annex (cf. Commission Decision 2005/747/EC). Please specify for which applications other than those covered by this entry you request an exemption for.

- Please provide an unambiguous wording for the requested exemption!

#See FAQ document on RoHS and WEEE Directives available at http://www.europa.eu.int/comm/environment/waste/weee_index.htm

2) Please justify your request according to Article 5 (1) (b) RoHS Directive whereas:

- Substitution of concerned hazardous substances via materials and components not containing these is technically or scientifically impracticable;
- Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically impracticable;
- Negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh environmental, health and/or consumer safety benefits thereof.

  - For the argumentation of justification please provide sound data/evidence on why substitution/elimination is 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…).
  - Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale.
  - Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes will be available by 1 July 2006 or at a later stage.
  - Please indicate if any current restrictions apply to such substitutes. If yes, please quote the exact title of the appropriate legislation/regulation.
  - Please indicate benefits/advantages and disadvantages of such substitutes.

**Electrical/electronic equipment that are: used in transport -aviation, aerospace, road, maritime, rail; installed in to the fabric of buildings – elevators, escalators, moving walks, dumb waiters, and heating, cooling and ventilation systems, and fire and security systems; used in the energy generation and transmission; used in mining and mineral processing; used for non-consumer mechanical power transmission systems; industrial process pumps and compressors; used in industrial refrigeration; and used in military applications – United Technologies (set 2 request No. 15)**

1) Please describe the requested exemption in detail:

- For which substance(s) or compound(s) is the exemption requested?
- What is the application in which the substance/compound is used and for which the exemption is requested?
- What is the specific (technical) function of the substance/compound in this application?
- Please justify why this application falls under the scope of the RoHS Directive (e.g. is it a finished product? is it a fixed installation? what category of the WEEE Directive does it belong to? Please refer to the Commission's scope criteria#).
- What is the amount (in absolute number and in percentage by weight) of the substance/compound in i) the homogeneous material (please refer to the Commission's interpretation#), ii) the application and iii) total EU annually for RoHS relevant applications?
- 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 (please refer to http://www.europa.eu.int/comm/environment/waste/weee_index.htm). For instance, applications might be covered by entry 8. of the RoHS Annex (cf. Commission Decision 2005/747/EC). Please specify for which applications other than those covered by this entry you request an exemption for.
- Please provide an unambiguous wording for the requested exemption!

#See FAQ document on RoHS and WEEE Directives available at http://www.europa.eu.int/comm/environment/waste/weee_index.htm

2) Please justify your request according to Article 5 (1) (b) RoHS Directive whereas:

- Substitution of concerned hazardous substances via materials and components not containing these is technically or scientifically impracticable;
- Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically impracticable;

- Negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh environmental, health and/or consumer safety benefits thereof.

  - For the argumentation of justification please provide sound data/evidence on why substitution/elimination is 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…).
  - Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale.
  - Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes will be available by 1 July 2006 or at a later stage.
  - Please indicate if any current restrictions apply to such substitutes. If yes, please quote the exact title of the appropriate legislation/regulation.
  - Please indicate benefits/advantages and disadvantages of such substitutes.

### Lead alloys as electrical/mechanical solder for transducers used in high-powered professional and commercial loudspeakers – Meyer Sound (set 2 request No. 16)

Questions were not sent out to the applicant himself but to the Norwegian Pollution Control Authority (sft) (stakeholder comment) beforehand:

- In your comment to the above mentioned request you state that "...lead-free solders exist and have been used by other professional sound equipment manufacturers. Alternatives like mechanical connections can also be used if all other fails". Please, give further detail of which competitors of the applicant you are aware using RoHS compliant alternatives (thorough description of the application is needed). Name a contact person in these companies, if possible. Furthermore, please state how "mechanical connections" could replace electrical solder in the mentioned application (detailed technical explanation if possible).

### Cadmium oxide – INMET (set 2 request No. 17)

- Please specify the exact applications for i) Cd as an alloy component in brazing alloys and ii) Cd in contact materials: In what form is the element Cd contained in these two cases? Please describe the physical and chemical properties of these alloys and contact materials and why Cd is indispensable in these materials and in the application you use it for. What are typical applications related to this use of Cd? What are the quantities of Cd used (for each specific application + for EU market in RoHS relevant applications in total)?

- What is the technical functionality of Cd in the relevant applications? You mention "specific and unusual properties of those materials" - what are these exactly?
- The Annex of the RoHS Directive has already been amended for Cd and its compounds in electrical contacts (entry No 8). Please specify how your request differs from that already existing exemption! Please accordingly provide a clear wording for your request!
- You mention the implementation of Cd substitutes of similar technical and technological properties: what are these substitutes? Please specify their specific properties for the relevant application. Are these substitutes available by 1 July 2006? If there are not available please explain why.
- Moreover, Article 5 (1) b of Directive 2002/95/EC provides that materials and components can be exempted from the substance restrictions if their elimination or substitution via design changes or materials and components is technically or scientifically impracticable, or where the negative environmental, health and / or consumer safety impacts caused by substitution outweigh the environmental, health and / or consumer safety benefits thereof. Within your application, you stated that the implementation of Cd substitutes is possible. But you also mention necessary investments and possible negative effects on employment. However, this justification is not in line with Article 5 (1) b and therefore we ask you to further describe and quantify possible other reasons (e.g. environmental aspects), which might show that the substitutes are not viable (i.e. please explain why design changes or alternative technologies are not a viable possibility for your application to become RoHS compliant).

## Solder tin of the thermo fuse with a defined low melting point – Stannol (set 2 request No. 18)

- What is the annual quantity of lead used in this application by FRIWO (for the European market and worldwide)? What is the quantity of lead in each single application respectively in the homogeneous material?
- Please explain in more details, which RoHS compliant alloys are available, which are appropriate, and which ones are not appropriate for your application.
- Please explain in more details, why these alloys are not appropriate for the use in thermo fuses. In case these data are not available, please explain why such data are not available, as the time for implementation of the RoHS Directive has been known for several years already. In case you have done research on viable substitutes/alternatives please provide accurate scientific and technical data outlining the results of your research.

- Why must the melting points of the solders in the fuses be exactly as they are now (explain in detail from a technical point of view)? Can a redesign of the application allow the use of alternative, RoHS compliant solders with a different melting point? What would be the problem encountered with substitutes/redesigned applications?
- Please explain the use and functionality of these thermo fuses in your products. Why can an alternative product design not completely make the use of such thermo fuses obsolete?
- We have noticed that the application you are requesting an exemption for does also contain cadmium. Nevertheless your request only relates to lead. According to Article 4 (1) of the RoHS Directive putting EEE on the market containing cadmium will also not be allowed as from 1 July 2006. An exemption only for lead will thus not be enough to keep your product on the market. You should clarify whether the amount of cadmium in the homogeneous material is less than the one regulated by Commission Decision 2005/618/EC on maximum concentration values. If not, you should address the European Commission in order to clarify whether you need to put forward a separate request for the use of cadmium in your application. As for now, for our evaluation of your request, we can only consider your exemption request for lead.

## Lead in solder on small PCB and tinned legs of primary components – e2v (set 2 request No. 20)

- Please give a detailed specification of the technical function of the PWB or the circuit on the PWB. What is a "primary component"?
- Why should e2v stop selling such products into this market, as the re-design version is already underway, even if it might not be ready for the deadline? Why would e2v withdraw from the market and should not be able to further support their customers technically and within the frame of its warranty obligations? The use of such PWBs as spare parts for the equipment sold before the deadline is allowed under RoHS.
- Are there any alternative suppliers of this kind of PWB in Europe or elsewhere that would or can produce the PWB in a RoHS compliant version?
- Why do you request an exemption for 2 years, if the alternative product is already available around mid 2007?

## Lead used in shielding of radiation for Non Medical X-ray equipment – Datalogic (set 2 request No. 21)

1) Please describe the requested exemption in detail:

- For which substance(s) or compound(s) is the exemption requested?

- What is the application in which the substance/compound is used and for which the exemption is requested?
- What is the specific (technical) function of the substance/compound in this application?
- What is the amount (in absolute number and in percentage by weight) of the substance/compound in i) the homogeneous material (please refer to the Commission's interpretation#), ii) the application and iii) total EU annually for RoHS relevant applications?
- 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 (please refer to http://www.europa.eu.int/comm/environment/waste/weee_index.htm). For instance, applications might be covered by entry 8. of the RoHS Annex (cf. Commission Decision 2005/747/EC). Please specify for which applications other than those covered by this entry you request an exemption for.
- Please provide an unambiguous wording for the requested exemption!

#See FAQ document on RoHS and WEEE Directives available at http://www.europa.eu.int/comm/environment/waste/weee_index.htm

2) Please justify your request according to Article 5 (1) (b) RoHS Directive whereas:

- Substitution of concerned hazardous substances via materials and components not containing these is technically or scientifically impracticable;
- Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically impracticable;
- Negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh environmental, health and/or consumer safety benefits thereof.

  - For the argumentation of justification please provide sound data/evidence on why substitution/elimination is 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…).
  - Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale.
  - Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes will be available by 1 July 2006 or at a later stage.
  - Please indicate if any current restrictions apply to such substitutes. If yes, please quote the exact title of the appropriate legislation/regulation.

- Please indicate benefits/advantages and disadvantages of such substitutes.

## Lead used in shielding of radiation for Non Medical X-ray equipment – l3com (set 2 request No. 22)

0) Please justify why this application falls under the scope of the RoHS Directive (e.g. is it a finished product? is it a fixed installation? what category of the WEEE Directive does it belong to? Please refer to the Commission's scope criteria#). In our understanding your application falls under category 9 of the WEEE Directive and thus does not fall under the scope of RoHS. Should you be able to confirm/support this by sufficient evidence then you can leave out all questions below since there would be no need for an exemption.

1) Please describe the requested exemption in detail:

- For which substance(s) or compound(s) is the exemption requested?
- What is the application in which the substance/compound is used and for which the exemption is requested?
- What is the specific (technical) function of the substance/compound in this application?
- What is the amount (in absolute number and in percentage by weight) of the substance/compound in i) the homogeneous material (please refer to the Commission's interpretation#), ii) the application and iii) total EU annually for RoHS relevant applications?
- 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 (please refer to http://www.europa.eu.int/comm/environment/waste/weee_index.htm). For instance, applications might be covered by entry 8. of the RoHS Annex (cf. Commission Decision 2005/747/EC). Please specify for which applications other than those covered by this entry you request an exemption for.
- Please provide an unambiguous wording for the requested exemption!

#See FAQ document on RoHS and WEEE Directives available at http://www.europa.eu.int/comm/environment/waste/weee_index.htm

2) Please justify your request according to Article 5 (1) (b) RoHS Directive whereas:

- Substitution of concerned hazardous substances via materials and components not containing these is technically or scientifically impracticable;
- Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically impracticable;

- Negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh environmental, health and/or consumer safety benefits thereof.

  - For the argumentation of justification please provide sound data/evidence on why substitution/elimination is 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…).
  - Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale.
  - Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes will be available by 1 July 2006 or at a later stage.
  - Please indicate if any current restrictions apply to such substitutes. If yes, please quote the exact title of the appropriate legislation/regulation.
  - Please indicate benefits/advantages and disadvantages of such substitutes.

### Lead based solders sealed or captured within heat-shrinkable components and devices – SEIP (set 2 request No. 23)

- You state, that "only two other companies in the world manufacture this type of products". Please name these competitors.
- Solder manufacturers, such as Indium claim that "Solder preforms come in a variety of shapes and sizes and in virtually all materials offered by the Indium Corporation". In the light of this statement please provide alloy compositions (Sb and Bi containing), that meet the melting point requirements of your application. Provide scientific/technical evidence from a solder manufacturer, such as Indium, that they are not able to manufacture preforms, that meet your specification, due to brittleness.

## Annex 2: Additional information request 1_b set 1

See attached document (file name: “Quist IPC San Jose Apr05 Cypress Customer Preferences.pdf”).