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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 December 2005 the fourth consultation round was launched by the Commission and closed on 11 February 2006. The requests open for comments of this fourth consultation round represent the main scope of this report and of the current evaluation.

Table 1 below gives an overview over the corresponding set 3 of requests for exemption.

Table 1: Overview requests set 3

No.	Title	Applicant	Status Quo
1	On-Semi MCR265-10 SCR	Helval Merca Ltd	LTB issue (see report 8); questions sent out to applicant; answers received; evaluation pending.
2	Components NEC V55	CPG International	LTB issue (see report 8); final evaluation ready (see section 6.5.1).
3	The use of lead in solder applications for electronic components of musical instruments having an average lifespan in excess of 10 years	Allan Organ Company represented by Bristows	LTB issue (see report 8); reuse issue overlapping with set 1 request no. 20; final recommendation possible (see section 6.4.
4	Lead solder alloy in Surge protective devices (SPDs)	ZVEI	Overlapping with request no. 12 set 3; answers received; evaluation pending.
5	Inventory of Special ICs having tin-lead solder on/in leads/balls, used in specialist/professional equipment	Calibre	LTB issue (see report 8); final evaluation ready (see section 6.8)
6	Lead alloys as electrical/mechanical solder for transducers used in high-powered professional and commercial loudspeakers	Hosiden Besson Ltd	Overlapping with request no. 16 set 2; questions sent out to applicant; answers pending.

No.	Title	Applicant	Status Quo
7	Solder containing lead for applications where the local temperature exceeds 150 C and reliable operation for a minimum of 30,000 hours is required	ASCO	Overlapping with set 2 request no. 5; questions sent out to applicant; answers pending.
8	Tin-lead solder in the manufacture of professional audio equipment	Lectrosonics Inc.	Partly LTB issue (see report 8); draft final evaluation ready (see section 6.9).
9	Specific modular units including tin-lead solder being used in special professional equipment	Avolites Ltd	LTB issue (see report 8); answers received; evaluation pending.
10	Lead in electronic vacuum tubes	Kerp	Questions sent out to applicant; answers received; evaluation pending.
11	Lead in aluminium used in gas valves for domestic cooking appliances	SABAF	Questions sent out to applicant; answers received; evaluation pending.
12	“8. Cadmium and its compounds in electrical contacts except for applications of one-shot operation function such as thermal links and cadmium plating except for the applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to the restriction on the marketing and use of certain dangerous substances and preparations.”	NEC-SCHOTT	Overlapping with request no. 15 set 3; stakeholder meeting held. Draft final recommendation possible (see section 6.1).
13	Lead in solder of parts recovered from gaming/amusement machines put on the market before 1/07/06 and reused for the same purpose within a manufacturer’s closed loop until July 2014	BACTA	Reuse issue overlapping with set 1 request no. 20; questions sent out to applicant; answers received, evaluation pending.

No.	Title	Applicant	Status Quo
14	Lead in solders in components and assemblies used in non-consumer products, provided that: - such components and assemblies were purchased or are subject to a proven last-time buy contract placed before 1 July, 2006; and - such components and assemblies are used in models of EEE that were already available on the market before 1 July 2006	AeA	LTB issue (see report 8); Questions sent out to applicant & stakeholders; evaluation pending.
15	"8. Cadmium plating as defined in Directive 91/338/EEC except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations."	UMICORE	Overlapping with request no. 15 set 3; stakeholder meeting held. Draft final recommendation possible (see section 6.1).

4 Results

Two requests from set 2 still remain open for final recommendation (please refer to 7th monthly report). For these exemption requests 3&4 set 2 a final recommendation is not yet given since the consultants consider these requests to fall within the general and overall issue on last time buys (please refer to report 8) which has not yet been clarified in enough detail.

A detailed description of the requests still open for final recommendation is given in section 6 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 Last Time Buy (LTB) issue

A further screening of requests concerning LTB issues (especially the rather general request no. 14) has led to the conclusion that the questions that would need to be answered in order to be able to evaluate the requests according to Article 5 (1) (b) cannot be answered by the applicants (see also the recommendations in section 6.7 and 6.8). According to Article 5 (1) (b) LTB requests would thus in the majority not be apt for a positive recommendation.

However, as described in report 8, Article 5 (1) (b) might not be the adequate way of evaluating those requests. Should the Commission want to propos an exemption for LTB issues due to other considerations such as general environmental community policy or economic aspects, the consultants propose the following:

- Granting a general exemption would encourage misuse
- Exemptions should thus only be granted on the basis of a registration of companies considering themselves to fall under the category of LTB requests at the Commission or at national public authorities in charge of implementation.
- Such a registration should include (i) a list of the components/parts that are still in stock due to a last time buy, (ii) the amount of components/parts in stock, (iii) the time during which products containing these components/parts will be available on the market, (iv) the RoHS substances contained in these components/parts as well as their amount, (v) the reasons for which a LTB order had to be done and (vi) the reason why a RoHS compliant re-desgin was not feasible in time for 1 July 2006.
- Through such a registration procedure authorities are able to prevent misuse and control / monitor the amount of RoHS substances still coming into the market.

6 Requests open for recommendation

The following section contains draft and final recommendations for requests from set 2 and set 3. Furthermore it contains a corrigendum of a recommendation which has been published in report 4.

6.1 Corrigendum "Hexavalent chromium (CrVI) in passivation coatings – HP (set 1 request No. 5)"

The following recommendation has been adapted and corrected according to new conclusions drawn in the course of the evaluation work. Changes are described in detail in section 6.1.1s. The proposed wording replaces the wording proposed in section 5.10 in the third monthly report.

6.1.1 New situation

In it's third monthly report Öko-Institut e.V. included a recommendation concerning HP's request on the exemption of CrVI in passivation coatings until 1 July 2007. Therein Öko-Institut e.V. proposed that phase-out of CrVI in passivation coatings should be harmonised with Annex II of Directive 2000/53/EC (End-of-Life Vehicles).

A group of leading European manufacturers of household appliances argued in a recently received letter that RoHS compliance regarding passivation coating is possible for applications used in household appliances. Following this letter AeA sent out a counter-statement backed by arguments from HP stating that such compliance was not possible for the ICT sector. Following this, the consultant has asked the original applicant HP to confirm that the original request is now only valid for the ICT sector.

After having received a reply by HP the new conclusions are as follows:

- The applicant of the original request himself is now narrowing the need for an exemption of CrVI in passivation coatings to the ICT industry arguing that this sector has particular requirements to passivation coatings being simultaneous corrosion protection and electrical conductivity. According to AeA equipment without electrical conductivity in the finish loses its electro-magnetic interference (EMI) shielding.
- Therefore the statement of the group of European household appliance manufacturers can be considered as plausible: these companies could be able to reach RoHS compliance by 1 July 2006 since the concerned parts of the equipment appear to have other requirements than those of the ICT sector.

Thus applying criteria of article 5 (1) (b) to this new situation leads to the conclusion that the exemption should be narrowed to an exemption for CrVI passivation coatings in the ICT sector only and restricted to the simultaneous function of EMI since the applicant has mentioned specific applications for which an exemption is needed and since there is now knowledge on substitution possibilities in the household appliances sector.

Nevertheless - going beyond criteria of article 5 (1) (b) - it has to be stated that supply chains of the automotive industry and the ones of the electronics industry are often the same and that in practice it can not be guaranteed that supply and delivery channels can be properly separated in order to ensure RoHS conformity. This is especially the case for stocks that supply both industry sectors (e.g. a screw used in a car might just as well be used in a refrigerator).

Against this background verification and implementation of RoHS compliance in practice appears to be difficult. Coating of metal can be so thin that proof of conformity becomes impracticable.

6.1.2 Requested exemption

- Substance: Cr-VI
- Volume: less than 25.000 kg (EU figures)
- Function: corrosion protection of metal (i.e. steel and aluminium) parts with self-healing properties (continuous protection of substrate even if scratched)
- Specific application: widely used in EEE with metal parts, e.g. fasteners (screws, nuts, bolts), brackets, chassis, stand-offs; most relevant usage is on zinc-plated sheet steel parts
- Precise wording: Hexavalent chrome passivation coatings in the ICT sector.

6.1.3 Summary of justification for exemption

- Criteria for justification: Potential substitutes have been analysed and evaluated by industry. Most of them are technologically impracticable or bear environmental drawbacks, because of different reasons: Paints due to the reduction of conductivity,

stainless steel due to poor magnetic properties (and wastefulness of natural resources, especially chromium) and metallic nickel and chromium plating due to the lack of self-healing properties (and wastefulness of natural resources as well). Design changes, such as Cu screws instead of Fe screws are not practicable in general and would require a long time-line of re-engineering for the millions of parts affected. The only viable substitution alternative would be coated steel with trivalent chromium chromate coatings. They are supposed to have less effectiveness concerning corrosion protection, but nevertheless these new coatings are expected to meet the needs of the electronics industry. However, the commercial availability of these substitutes seems not to be efficient for the demand as the automotive industry being the driving force for substitution (due to much higher consumption volumes) has another phase-out time-line (1 July 2007) according to Directive 2000/53/EC. Furthermore, reliability tests with these substitution candidates still have to be carried out (currently, in most cases it is not possible for electronic companies to obtain samples of the new coatings for qualification tests). These constraints would not be compatible with the deadline of the RoHS Directive (1 July 2006). Without the sufficient supply of qualified substitutes, risk of application failure cannot be excluded. Furthermore, in the case of safety-critical applications, public safety could be compromised. Thus, a moratorium for the phase-out of Cr-VI for passivation coatings is requested until 1 July 2007.

- Critical review on relevant data and information (given by applicant or other parties): Stakeholder comment from Glenair confirms the statements from HP and indicates that a moratorium until 1 July 2007 would be the minimum; stakeholder comment from Nortel states that testing of trivalent chromium showed poor corrosion protection especially in harsh outdoor environments; testing of substitutes within a currently completed 9 month industry study in New Zealand shows, that alternatives for Cr-VI passivation exist:

  Sets of 10 Steel coupons were treated with:

  i. Henkel Alodine 1200 (Chromate or hexavalent chromium)

  ii. MacDermid ELV Blue (Product Number: IP74330)

  iii. MacDermid PK3 Blue

  Sets of 10 Aluminium coupons were treated with:

  i. Henkel Alodine 1200 (Chromate or hexavalent chromium)

  ii. Chemetall Oxsilan Al-0500

  iii. Henkel Alodine 4595

  iv. APS Chemicals Surtec 650 (TCP-HF)

  Things to observe in the results are:

  i. Chromate gives good performance on both Steel & Aluminium;

ii. At their best, most processes perform approximately as well as Chromate, although they are all more sensitive to salt fog exposure;

iii. The low values recorded for aluminium APS Mirror (finish) compared with APS Mill (finish) confirms the suggestion that surface roughness is a significant variable;

iv. The generally higher surface resistance values recorded on steel are probably due to that material's greater surface roughness.

- However, the practicability of these substitutes still has to be proven; JBCE has recently withdrawn its Cr-VI exemption request ("Alternative technology are just in sight practically"), but that exemption request only covered black colour Zinc plated parts; stakeholder comment from AeA (American Electronics Association) points out, that Nippon Steel has developed epoxy coating over sheet steel as substitute with equal properties like Cr-VI, but this substitute seems not to be available outside Japan, nor is it available as a coating for aluminium, not for post-treated applications such as nuts and bolts.

6.1.4 Final recommendation

- The assessment shows, that for many applications material substitutes newly exist or are available in the near future. Furthermore, the willingness of the industry to substitute Cr-VI can be observed. However, the technological feasibility of the most promising substitutes (above all Cr-III and epoxy coated steel) has to be qualified. A simple substitution of hexavalent material by these substitutes in most cases does not provide the desired level of corrosion protection. Actually, additional steps of adaptation (e.g. using a different substrate material, modifications in the pre-treatment) are necessary. With the first samples of the substitutes being just now available, an adaptation time-line of up to 18 months might be necessary.
- Furthermore, a phase-out of Cr-VI in passivation coatings should be harmonized with Annex II of Directive 2000/53/EC (on end-of-life-vehicles). Item 13 a) of this Annex includes the exemption for the use of hexavalent chromium in corrosive preventive coatings, which expires on 1 July 2007. Thus, in the field of electric and electronic products covered by RoHS Directive, the same time-line should be applied.
- With regard to the new situation as described in section 6.1.1 the consultant re-formulated its original recommended wording and narrowed the exemption to applications of the ICT sector. In order to be as precise as possible in the exemption wording the ICT sector was described as being products belonging to category 3 of the WEEE Directive.
- The exact wording recommended thus being:

"Hexavalent chromium in corrosive preventive coatings of unpainted metal sheetings and fasteners used for corrosion protection and Electromagnetic Interference Shielding in

equipment falling under category three of Directive 2002/96/EC (IT and telecommunications equipment) until 1 July 2007."

The consultants would nevertheless like to stress that other industry sectors than ICT may have problems in complying with RoHS by 1 July 2006 (see section 6.1.1). The new proposed wording has not been subject to a stakeholder consultation thus not giving stakeholders the chance to comment on the now narrowed exemption request. The new wording is mainly the outcome of a late stakeholder comment by Electrolux and other manufacturers of household appliances and the subsequent response by the original applicant HP.

6.2 Corrigendum "Lead in finishes of fine pitch components – HP (set 1 request No. 1_b)"

The following recommendation has been adapted and corrected according to new conclusions drawn in the course of the evaluation work. Changes are highlighted in italic and bold letters. The proposed wording replaces the wording proposed in section 5.1 in the fourth monthly report.

6.2.1 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.

6.2.2 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 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.
- ***Fine pitch connectors must be explicitly excluded from the scope of this exemption request. The whiskering mechanism is different, and the respective exemption requests referring to fine pitch connectors (second stakeholder***

[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

consultation, lot 1) were recommended to be declined. One of the applicants had withdrawn his request as he accepted gold as an alternative, RoHS compliant coating (see report 3 from November 2005).

6.2.3 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. ***To avoid misuse of this exemption, fine pitch connectors must be excluded from the scope of this exemption, as the respective exemption requests in lot 1 of the second stakeholder consultation were not recommended for an exemption.***

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. ***To avoid misuse of this exemption, fine pitch connectors must be***

excluded from the scope of this exemption, as the respective exemption requests in lot 1 of the second stakeholder consultation were not recommended for an exemption.

Summary of recommendations:

The following wording replaces the one in section 5.1 in the fourth monthly report! Changes are highlighted in bold and italic letters.

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

6.3 Changes in entry 8 of the RoHS Annex (set 3 request no. 12 and no. 15)

Within set 3 there are two exemption requests which deal with an amendment of the current wording of entry 8 of the RoHS Annex as amended by Commission Decision of 21 October 2005 (2005/747/EC).

The list below shows the evolution of the change in the wording concerning this entry.

- Original wording RoHS Directive: "**Cadmium plating** except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations."
- Amendment 10/2005: "**Cadmium and its compounds in electrical contacts and cadmium plating** except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations."
- Request Umicore: "**Cadmium plating as defined in Directive 91/338/EEC** except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations."
- Definition Cd plating in 91/338/EEC: "any **deposit or coating of metallic cadmium on a metallic surface**"
- Request NEC/Schott: "Cadmium and its compounds in electrical contacts **except for applications of one-shot operation function such as thermal links** and Cadmium plating except for applications banned under Directive 91/338/EEC amending Directive

76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations."

In order to better assess the requested changes in wording following general remarks are made:

- The amendment of entry 8 through Commission Decision 2005/747/EC in October 2005 has been perceived by industry as a change in scope of the exemption described in that entry[3]. Indeed, the new added wording "Cadmium and its compounds in electrical contacts" enlarged the existing exemption to the use of cadmium in non-metallic form in any application where a current flow is (or might be) interrupted. These devices are generally called switches or switchgear; the term includes relays, circuit breakers, contactors, cut-off protectors etc.
- The European Commission has neither carried out a stakeholder consultation nor an evaluation concerning the first amendment of entry 8 in October 2005 since it felt that the change in the wording was merely a clarification of the scope of the exemption and an alignment to the earlier Directive 91/338/EEC.
- The fact that the exemption is already part of the Annex to the RoHS Directive makes the requests evaluated different from usual requests brought forward. I.e. due to the existing exemption there is no incentive for industry to become RoHS compliant and to phase-out cadmium in electrical contacts and in cadmium plating within the next 4 years.
- Should the existing exemption be amended before the regular revision of the Directive's Annex by 2010, a transition period seems to be appropriate, since industry needs to prepare compliance. The extent of such a transition period is still to be determined.
- In general it has to be thought of a procedure in case a stakeholder comes up with an existing alternative or substitution possibility available on the market regarding an existing exemption within the 4 year period of the Annex' validity.
- The requested changes in wording are brought forward and commented by (i) suppliers of alternative materials to cadmium, (ii) suppliers of switches and relays

[3] Cadmium and its compounds in electrical contacts usually mean the use of AgCdO being an alloy / composite of non-metallic cadmium. This composite is prepared separately and attached to the support by mechanical or other means. "Compound" implies that it is homogeneous throughout the contact material. Cadmium plating as defined in Directive 91/338/EEC does thus not include the use of cadmium in such an alloy. Plating is only a surface coating / deposit of – in this case – metallic cadmium.

using AgCdO as contact material and by (iii) suppliers of one-shot operation thermo fuses.

In the following sections the two proposed amendments to this wording will be discussed. This will include the results of an expert meeting that took place in Hanau, Germany on 3 May 2006. During this meeting both requests were discussed among applicants and stakeholders having commented on these requests in order to get a better understanding on the technical issues.

6.3.1 Cd in electrical contacts – UMICORE (set 3 request no. 15)

The applicant requests a change in wording of the existing exemption on Cd in electrical contacts and platings (see list above). Being a supplier of cadmium-free contact materials, the applicant would like to have the existing wording amended in such a way that marketing of alternative materials is not hindered anymore.

Summary of justification for exemption

The applicant justifies his exemption request according to the following technical and environmental arguments:

- For the contact material silver cadmium oxide (AgCdO) used in electrical contacts alternatives exist for all applications. The usual alternatives being silver nickel (AgNi) for low current and silver tin oxide (AgSnO) for higher current applications. Some changes might be necessary in the construction of the equipment.
- A general exemption of AgCdO in electrical contacts is rejected since according to the applicant AgCdO has been replaced in the majority of applications in Europe. Thus a general exemption for AgCdO in electrical contacts would be a significant competitive disadvantage for the majority of European manufacturers of E&E equipment having replaced AgCdO by cadmium-free materials.
- A clear signal within the Directive that the overall goal of substituting cadmium-containing materials in E&E equipment is not weakened by a general exemption for cadmium in electrical contacts is wished. Furthermore the applicant does not want the overall cadmium ban set by Directive 91/338/EEC[4] to be weakened either.

A critical review of the documents made available by other parties lead to the following observations and conclusions:

[4] Directive 91/338/EEC refers to restriction on marketing and use of cadmium in certain applications. Exempted from the provisions of the Directive are: (i) safety applications and (ii) “electrical contacts in any sector of use, on account of the reliability required of the apparatus on which they are installed”.

- According to stakeholders electrical switches and automatic controls contain contact materials that need to have inter alia excellent electrical conductivity, durability and stability against welding. In particular those where the contact is used as the last step in the safety chain and no further mechanism is present to prevent fire hazards or electrical shocks to consumers (safety devices). Furthermore standards need to be met that require certain performance and endurance (e.g. some 10.000 operations), restricted thermal behaviour and no dysfunction or malfunction.
- Stakeholders have commented that cadmium in electrical contacts are used in a large variety of applications and that it can thus not be specified which of these fall under the scope of RoHS and which of the applications would have problems using cadmium-free alternatives. This is due to the fact that manufacturers of these applications do not know in which kind of applications their products are used and retailed by the last user (i.e. manufacturer of e.g. an E&E equipment).
- Following statement issued by a switch and relay manufacturer during the expert meeting on 3 May as an example for such a statement: “The applications of our customers are widely unknown to us. This means that even if we supply a product to our customers which is in the data sheet properties equal or superior to the existing product with AgCdO contacts, it might fail in the application. This we consider as a big safety risk.”
- Furthermore suppliers state that the loads used by their costumers in E&E equipment are widely spread: the load might be capacitive, inductive, resistive and the current can vary from a few mA up to the maximum current. This is one of the reasons why purchasers of switches and relays opt for AgCdO contact materials since these have proven to be long-term reliable in the past and satisfy safety requirements.
- The advantage of cadmium in electrical contacts is – according to stakeholders – to allow high current ratings (10 to 50 A), voltage of about 50 to 400 V, different electrical loads and ambient temperature above room temperature. Since requirements during life time of switches and relays are unknown or changing, there is no possibility to substitute AgCdO on a general basis (1:1 substitution).
- The only possibility seen by manufacturers of switches and relays is to substitute cadmium in electrical contacts used in applications with narrow load ranges or for unique appliances. Unfortunately manufacturers were not able to give details on such load ranges for which substitution is feasible. It was rather claimed that both substitution and non-substitution exist for all load ranges of switches.
- Examples of applications for which no substitutes could be found yet: microswitch, 45 A 250 V ac motor load, 20,000 cycles in a customer‘s application; microswitch, 35 A 13,5 V dc inrush current up to 80 A 50,000 cycles; general-purpose switch; motor

protectors (air conditioning and refrigeration systems); safety devices with working temperatures in excess of 100°C.

- Most important unsolved problems with substitutes based on AgSnO and AgZnO are: need initial surface material erosion to develop positive oxide characteristics and exhibit segregation effects under specific conditions which enlarge risk of welding[5].
- All suppliers agree that substitution is technically feasible but that a transition period is needed until all reliability problems of substitutes can be solved. Transition periods have been stated between 6 month and 4 years.
- Since stakeholders having commented on the requested change of the exemption are suppliers of applications using cadmium in electrical contacts (i.e. switches and relays), their statement are made from a view at the beginning of the supply chain – not being the ones that need to be RoHS compliant in the first place. The problem is thus that it is not known to the consultants what difficulties such a user of switches and relays has with cadmium-free contact materials. Nothing has been reported from this user side since the exemption in force does not encourage public reactions on pros and cons of cadmium-free contact materials used in E&E equipment.
- Conclusion: alternatives do exist for the use of AgCdO leading to good results in tests and trials. However, manufacturers of switches and relays do not know what (safety) requirements the end application has in which these alternatives would be used. Hence, a 1:1 substitution is not practicable. Substitution needs to be done in accordance to the requirements of the end product the switch and relay is used in. Since the variety of these applications seems to be huge, substitution can only be realised when a limited number of substitute materials have been found for AgCdO than can satisfy the large majority of product requirements.
- Under Directive 91/338/EEC cadmium in electrical contacts is exempted from the general ban due to safety reasons. A restriction of use under RoHS should thus clearly identify those applications which do not create a safety problem when using cadmium-free materials in electrical contacts depending on load characteristics.

Final recommendation

The situation concerning possible substitution of cadmium and its compounds in electrical contacts is complicated. A general exemption does not seem to be justified since alternative materials do exist and are already in use (position agreed by applicant and stakeholders).

[5] Welding being seen as a particular important issue regarding safety devices. One stakeholder commented that welding is seen early in the life time with Cd-free contacts.

Nevertheless, withdrawing the existing exemption immediately is not practicable since it can not be excluded that some of the alternative materials can lead to safety risks in certain applications falling under RoHS if the substitution is made without careful prior evaluation and testing.

Both parties – applicant and stakeholders – agreed that a transition period is needed to phase-out cadmium in existing applications.

Stakeholders are being asked to give more details on technical specifications of applications of cadmium in electrical contacts that can already be substitutes by cadmium-free alternatives. The exemption could thus be narrowed to those applications not fulfilling these specifications. Unfortunately it appeared not be practicable to give sufficient details on technical specifications in order to narrow the existing exemption.

The final recommendation is thus to withdraw the current exemption for cadmium and its compounds in electrical contacts within the next three years[6]. In order to allow industry to adapt production and product design this change in the Annex would though have to be announced immediately. The amended wording – coming into force on 1 July 2009 – would allow manufacturers of E&E equipment who have problems in using cadmium-free electrical contacts to bring forward exemption requests that would be of more specific nature. I.e. exemptions can than be granted for the use of cadmium-containing switches and relays in specific applications (that would then needed to be specified!) falling under the scope of RoHS. Thus avoiding a general exemption, giving an incentive on substitution of cadmium in electrical contacts and at the same time taking account of certain specific cases in which substitution is technically not feasible.

The proposed wording taking account of request 15 is to split the current wording in two:

8. (a) Cadmium and its compounds in electrical contacts until 1 July 2009 except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations.

AND

8. (b) Cadmium plating as defined in Directive 91/338/EEC except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations.

For the final wording proposed for both exemption requests, please refer to the final recommendation in section 6.3.2).

[6] Three years is a proposition by the consultants based on a request for a four year transition period from stakeholders and a two year transition period seen as acceptable by the applicant. The general message though is to set a clear time limit for the exemption of cadmium in electrical contacts and to withdraw this exemption latest during the revision of the Annex in 2010.

6.3.2 Cd in one-shot operations – NEC/Schott (set 3 request no. 12)

The applicant requests an explicit withdrawal of one-shot thermal cut-offs from the existing exemption of the use of cadmium in electrical contacts. Mechanical one-shot thermal cut-offs are considered to fall under the wording "cadmium and its compounds in electrical contacts"[7]. The proposed wording being:

Cadmium and its compounds in electrical contacts ***except for applications of one-shot operation function such as thermal links*** *and Cadmium plaiting except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations.*

Different types of thermal cut-offs

There are two types of thermal cut-offs (TCO): mechanical/pellet/contact type and alloy/eutectic/non-contact type (see Figure 1 below). According to the applicant NEC/Schott only the pellet type would fall under existing exemption, since only this one contains cadmium in a contact material. NEC/Schott produces both pellet and alloy type TCOs. The stakeholder Thermodisc only produces pellet type TCOs. One stakeholder, A.O.Smith, produces alloy type TCOs.

Alloy type TCOs contain both cadmium and lead. Should these be excluded from the current exemption then alloy type TCOs would need to fulfil RoHS compliance by 1 July 2006. Apparently there is insecurity as to whether alloy type TCOs are covered by the existing exemption. The question that needs to be addressed here is whether the cadmium contained in the fusible alloy can be described as either contact material or as cadmium plating. A previous request brought forward by the JBCE during the second stakeholder consultation, has been withdrawn by the applicant (please refer to third monthly report).

In the following it is assumed that it is only the pellet type TCO that is covered by the existing exemption in entry 8 of the RoHS Annex. Nevertheless, the Commission should clarify this question.

[7] There are also so-called eutectic one-shot thermal cut-offs. It needs to be clarified whether these would not fall under the wording "cadmium and its compounds in electrical contacts". Please also see section "Different types of thermal cut-offs".

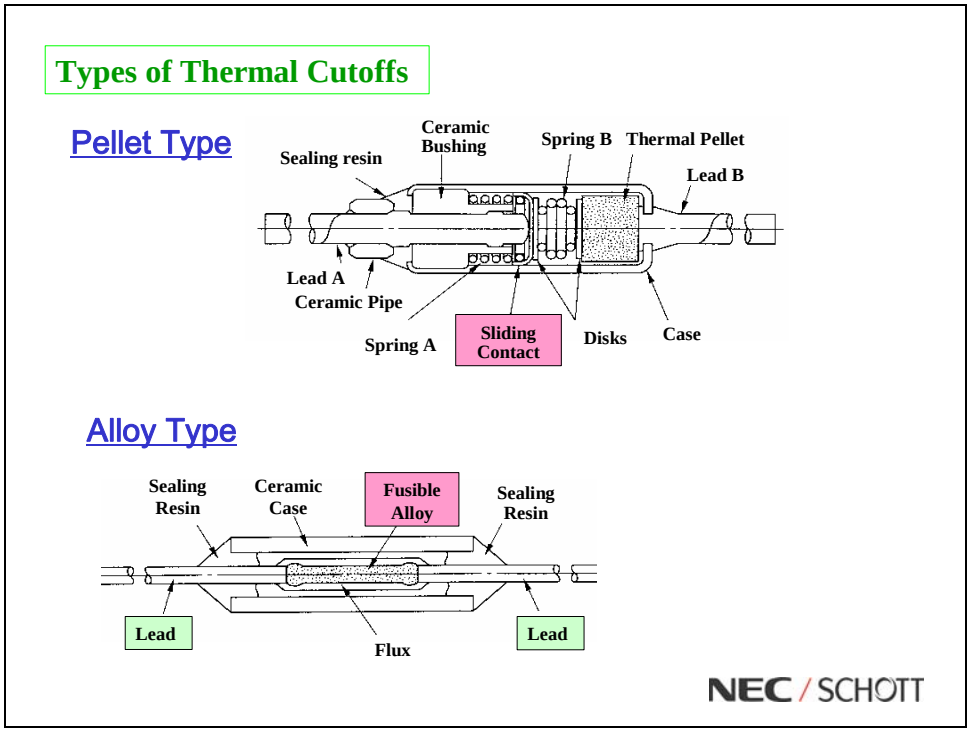

Figure 1: Different types of TCOs

Summary of justification for exemption

The applicant justifies his exemption request according to the following technical and environmental arguments:

- NEC-Schott uses AgCuO as a substitute for AgCdO. This substitute has been registered as a patent. The applicant declares to be ready to discuss the use of this specific substitute according to common patent rules.
- According to the applicant competitors are also already putting cadmium-free mechanical one-shot thermal-cut-offs onto the market. Hence, substitution does not seem to be the problem for other market actors.
- All NEC-Schotts' customers have approved cadmium-free mechanical one-shot thermal-cut-offs. No claims have arisen until now and there is no knowledge on problems having appeared during use.
- Electrical properties as well as environment impacts such as temperature, vibration and humidity are not only of high relevance for the long-term reliability, durability and safety of AC voltage household appliances and customer electronics but even more in the field of DC voltage electric devices frequently applied in the automotive industry.
- Extensive testing, including accelerated life tests required by the automotive industry, have proven that the cadmium-free contacts are equal or even superior in performance to those containing cadmium.

- All relevant safety standards were approved (e.g. IEC safety standard). Customers (inter alia the automotive industry having very strict requirements) have done safety tests themselves that met the requirements.
- Cadmium-free mechanical one-shot thermal-cut-offs have been on the market since 2003. The market experience of those products thus being three years. RoHS relevant applications in which these cut-offs are used are e.g. home appliances, office equipment and electric components.
- The applicant delivered extensive evidence and data supporting the above-mentioned statements.

A critical review of the documents made available by other parties lead to the following observations and conclusions:

- The issue does not seem to be RoHS compliant devices but rather long-term performance and field experience.
- RoHS compliant mechanical thermal cut-offs pass short-term standard (e.g. EN 60691) testing. Stakeholders though argue that from a customer perspective, short-term testing is not a substitute for long-term field experience.
- Other stakeholders argue that when putting an innovative (e.g. RoHS compliant) device on the market, they would market the device in a limited amount for a defined period of time (e.g. one year), see whether there are problems and claims and if not go into full marketing.
- Removing the exemption at this time would create confusion in the marketplace since customers opted not to change due to expected four year review of the Annex with existing exemption.
- Stakeholders arguing against a revision of the Annex before the four yearly review were not able to provide information on specific applications where substitution of cadmium is technically and scientifically impracticable and would thus justify an ongoing exemption.

Final recommendation

In this case the final recommendation is quite clear. The applicant has provided sound data and founded argumentation to support his request for withdrawing mechanical one-shot thermal cut-offs. It is therefore recommended to grant the request and thus limit the existing exemption to other applications of cadmium in electrical contacts. Because doing so immediately is not feasible since market actors need a transition period to switch to RoHS compliance it is proposed to allow a one year transition period.

The proposed new wording is thus (in line with the one proposed in section 6.3.1):

8. (a) Cadmium and its compounds in electrical contacts until 1 July 2009, except for mechanical pellet-type one-shot thermal cut-offs as from 1 July 2007 and except for

applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations.

AND

8. (b) Cadmium plating as defined in Directive 91/338/EEC except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations.

6.4 The use of lead in solder applications for electronic components of musical instruments having an average lifespan in excess of 10 years – Allan Organ Company (set 3 request no. 3)

6.4.1 Description of requested exemption

The Allen Organ Company (represented by Bristows) asks for an exemption for the use of lead in solder applications for electronic components of musical instruments having an average lifespan in excess of 10 years. The specific musical instrument in question are digital electronic organs, which are installed into churches for use in the playing of church music. These products are specifically designed to reproduce the tone and sound of traditional pipe organs, which they often replace. According to the applicant the products are mainly sold to ecclesiastical for use in public religious ceremonies and acts of worship. Approximately 25% of sales are made to private individuals. Allen Organ Company sold in 2004 127 church organs and in 2005 128 church organs into the entire EU.

Lead is used as lead-containing solder in the manufacture of the organs' circuit boards. Assuming an average weight of 200 kg per digital church organ the total quantity of lead used in solder for all of the Allan Organ Companys' products amounts to ca. 5,2 kg per year.

6.4.2 Summary of justification for exemption

According to the applicant digital electronic church organs do not fall under the categories set out in Annex 1A to the WEEE Directive. The applicant justifies his position as follows:

- The only possible category into which these kind of products could fall was considered to be Category 4 Consumer Equipment where as an example `musical instruments´ are listed.
- However there are several hints why digital electronic church organs do not fall under this category:

- The average lifespan of these products is measured in decades rather than years and typically much longer compared to consumer equipment.
- Because of the specialist nature and longevity the prices of the digital church organs are considerably higher in relation to typical consumer equipment. [8]
- For several reasons ecclesiastical institutions and private consumers are much more likely to repair their digital organs than to replace them.

Against the background that the Commission concluded that digital electronic church organs are musical instruments and that as such they fall within the Category 4 Consumer Equipment and are therefore in the scope of the ROHS directive the applicant requests an exemption bringing forward technical and negative health / environmental impact reasons which can be summarised as follows:

- The lead-free solder technology that has been developed does not have proven reliability over time. In contrast it is imperative that the solder is able to last for extremely long lifetime (due to the above mentioned longevity of digital church organs).
- The use of lead-free solder technology which has no proven longevity could lead to the necessity of more replacement of electronic components that currently occurs (and in succession to more electronic waste).

In order to take the specific situation of these kind of products into account the consultant consulted European manufacturers about their situation concerning the applicability of lead-free solder technology for digital church organs. Both manufacturers confirm that they are currently changing their production to lead-free solder technology.

6.4.3 Final recommendation

Against the above described situation substitution of lead containing solder through lead-free solder technology seems to be practicable. Therefore we recommend not granting an exemption.

[8] Church organs sold to individuals are sold at prices in the range of 7.000 to 40.000 Euro, organs destinated for ecclesiastical institutions range from 10.000 to 100.000 Euro.

6.5 Solder tin of the thermo fuse with a defined low melting point – FRIWO (set 2 request no. 18)

6.5.1 Description of requested exemption

The applicant requests an exemption for lead and cadmium in low melting solders, used in thermofuses of linear power transformers. The permormance of these power transformers range between 3 and 20 W.

The global annual amounts of lead used in this application are 20 kg per year, and 200 g of cadmium.

The low melting solders in the thermofuses guarantee the safety of the linear power transformers. In order to fulfil this functionality reliably, the solder alloys must have sharply defined low melting points.

The applicant proposes the following wording for the exemption:

Lead and cadmium in solders with melting points of 96, 124 and 145 °C for application in thermo fuses of linear power transformers

6.5.2 Summary of justification for exemption

6.5.2.1 Applicant's criteria for justification

No lead-free and cadmium-free alternatives are available for the low melting solders

- 96°C- fuse (Bi 46, Sn 34, **Pb 20**)
- 124°C- fuse (Bi 55,5, **Pb 44,5**)
- 145°C- fuse (Sn 50, **Pb 32**, **Cd 18**)

These solders are used in thermo fuses of linear power transformers in the performance range of 3 – 20 W. The melting points of any alternative alloys must be close to the above melting points to make sure to stick to the requirements according to the standard EN 60950. The applicant can not assure that the electrical power supplies will not fail safety, if he doesn't use the thermo fuses with a defined melting point (96°C, 124°C, 145°C).

The applicant provided a list showing all relevant alloys for the special applicant's melting point range (Statement Stannol.pdf).

Table 2: Low melting point alloys

Alloy	Solidus Melting Point	RoHS substance	Eutectic
Bi50Pb26,7Sn13,3Cd10	70	Lead/Cadmium	
In66,3Bi33,7	72	Lead-free	
Bi57In26Sn17	79	Lead-free	
In44Sn42Cd14	93	Cadmium	
Bi46Sn34Pb20	96	Lead	
Pb42Sn34Bi24	99,5	Lead/	non eutectic
In52,2Sn46Zn1.8	108	Lead-free	
In52Sn48	118	Lead-free	
Bi55,5Pb44,5	124	Lead	
Bi58Sn42	138	Lead-free	
In97Ag3	143	Lead-free	
Pb43Sn43Bi14	144	Lead	non eutectic
Sn50Pb32Cd18	145	Cadmium	

These alternative, RoHS conform alloys cannot suffice the requirements. To guarantee the required safety, the melting point must be sharply defined and reproduceable in which the alloys melt. Non-eutectic alloys are not appropriate as metallurgic changes during ageing can form low melting phases in the grain boundaries resulting in undue failure of the power transformer. The melting point range of RoHS conform alternatives is too wide and not reproduceable enough in order to suffice the safety requirements for the linear power

transformers. In case of Indium containing alloys there are not sufficient data available, which are relevant for the application, according to the applicant. For example tin/indium alloys are extremely soft, therefore creep resistance and fatigue behaviour are poor. Low melting alloy 108°C, 117°C, and 143°C are currently no solutions.

According to the applicant, an alternative design of the linear power transformers in the performance range of 3 – 20 W is not possible in order to achieve RoHS conformity.

The applicant says that switched mode power transformers are a RoHS compliant alternative technology for the AC-DC linear power transformers and will successively replace the linear ones in the next ten years. No alternative technology is available for AC-AC linear power transformers.

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

The supporting document from Stannol mentions several alternatives that are in line with the requirements of the RoHS directive, but that none of them is appropriate to replace the lead and/or cadmium containing solders in this safety relevant application. The applicant maintains that he can only produce his power transformers with thermofuses of these three cut-off temperatures. He says that design changes are not an option.

However, meanwhile there is external expertise that might prove this statement wrong. It is possible to produce these power transformers in line with the requirements of the RoHS directive:

RoHS compliant thermo fuses are available on the market. They have a higher tolerance concerning the cutoff-temperature of +0 to –10 K, instead of ±2 Kelvin. The use of such RoHS conform thermo fuses requires adaptations in the product design, so that even under full operation and most unfavourable conditions, it does not exceed the threshold of the cut-off temperature minus the 10 K tolerance. This will increase the production cost of the linear power transformers. If the tolerance of the thermofuse is only 2K, the material's thermal load capacity can be used almost completely saving copper in the coil and core sheet.

The applicant, according to the external expert, *such saved money with his patent of the non-RoHS compliant thermofuse, an advantage that he wants to maintain, of course. However, the RoHS directive has been known for years, and the manufacturers had time to adapt their products. Granting the exemption would be a clear competitional advantage discriminate the manufacturers that have additional cost for their RoHS compliant linear power transformers.*

Additionally, the applicant mentions that switched mode power transformers technologically are a RoHS compliant alternative to the AC/DC power transformers and will replace them in the next 10 years. As this technology is already available as a substitute, there is no need for an exemption for AC/DC power transformers.

Thus, the exemption request only remains relevant for AC/AC linear power transformers in the performance range of 3 – 20 W, which switched mode power transformers cannot replace. Here, the competitors' RoHS conform solutions need to be investigated further to check whether they can be produced in line with the requirements of the RoHS directive nevertheless.

The applicant, however, broaches the issue of the long delay between the submission of the exemption request and the final decision. In this case, the request had been sent to the COM in April 2005, and the review process only started in December 2005. For industry, these long delays cause undue insecurities until a final decision can be expected. The applicant therefore asks for a moratorium to end of 2006 to compensate for these long delays.

6.5.3 Final recommendation

The exemption should not be granted.

Switched mode power transformers are an alternative, RoHS compliant technology, which can at least replace the AC/DC linear power transformers, so that a general exemption for thermo fuses as the applicant had requested, is not justified.
Further on, an external expert stated that design changes facilitate the use of RoHS compliant thermo fuses in linear power transformers. The applicant was given the chance to react to this external expertise. He could not put forward plausible and particular arguments in line with Art. 5 (1) (b) of the RoHS Directive that would have justified the requested exemption nevertheless.

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

6.6.1 Description of requested exemption

SEIP (Sumitomo Electric Interconnect Products) has requested an exemption for the use of lead in solders within heat-shrinkable devices. Heat-shrinkable devices consist of a cable encapsulated by a plastic shell that is soldered in a first process step (lower temperature) and then processed with the goal to melt the plastic encapsulation (higher temperature) in order to protect the cable from external impacts. This application is mainly used in military applications but also in IT and communications equipment. Lead is needed in the solder due to its low melting point characteristic in order to be able to keep a lower process temperature for soldering.

The wording provided by the applicant is:

"*Lead based solders sealed or captured within heat-shrinkable components and devices*"

6.6.2 Summary of justification for exemption

According to the applicant the following criteria have been put forward as justification for the exemption request:

- Use in heat-shrinkable devices needs solders with a melting point in the range of eutectic SnPb. As they are used as preforms in the process, brittle materials, such as Bismuth and Antimony containing solders are not suitable (according to the applicant manufacture of preforms is not possible with these brittle alloys). Consequently, the applicant claims that there is no applicable solder alloy for this use.

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

Sumitomo states, that "the vast majority of devices are used for military applications ... or in the aerospace industry" (exempted anyhow). Requested to state the RoHS relevant applications Sumitomo named IT and telecommunications equipment. Sumitomo estimates a figure of 6,75 kg lead consumption by Sumitomo for these applications, but on a global scale as they can't give data on end use in the EU (as they supply their components to assemblers of end-products not to the end-user market directly).

Sumitomo has been asked to provide a confirmation from their solder manufacturer, that from their point of view there is also no alternative. The solder manufacturer Cookson Electronics denies the availability of an appropriate alternative for this specific application based on the following reasons:

- As the melting range of the solder is a crucial issue, such alloys as Sn90.5Ag2Bi7.5, Sn92Ag3.5Bi5Cu0.7 and Sn91.8Ag3.4Bi4.8 are outside of the temperature range
- Furthermore it is confirmed, that all Bi containing alloys are to brittle to make collars of. The main reason is the fact, that Sn and Ag form a brittle intermetallic with Bi. Cookson Electronics is not aware of any Sb containing solder, that melts in the required range.
- Some Zn containing solders are in the required temperature range, but too corrosive for these applications.
- Sn77.2Ag2.8In20 has been stated as being "too cost prohibitive" for this application.

It was asked, if – besides cost reasons – there are any technical obstacles regarding the SnAgIn solder for this specific application. Clarification provided by Cookson Electronics:

- "One issue is that the thermal fatigue resistance is relatively low for In alloy. Soldering is also made more difficult due to In having a relatively 'stable' corrosion layer which is difficult to reduce by the type and volume of fluxes required for this application. Remember we are placing a solder sleeve inside a heat shrink tube. With this application we need to find a way to have a balance between insuring that we have enough flux to make a proper solder connection, however not have too much flux or have too active a flux so that it does not cause reliability issues down the road. The fluxes required to

overcome this specific issue with In are not conducive to be used in this specific application."

Sumitomo stated that there are only two other competitors worldwide, manufacturing the same kind of devices: Raychem / Tyco Electronics and Phoenix Logistics. Phoenix Logistics clearly serves the military / aerospace sector, being not RoHS relevant. An inquiry at Raychem / Tyco Electronics lead to the following statement:

- "Tyco has decided not to produce a range of RoHS compliant 150C-rated parts to replace non-compliant parts that contain Sn63Pb37 solder.
- Tyco's approach has been to define two series of RoHS compliant alternatives:
  a. A series of 175C rated parts with Sn96Ag04 solder
  b. A series of 125C rated parts with Sn42Bi58 solder
- Tyco performed extensive work to ensure the manufacturability of these parts and their suitability as high-reliability replacements for the Sn63Pb37 containing parts.
- The 125C rated parts are also offered as alternatives to older RoHS non-compliant parts that contain lead and/or cadmium containing solders.
- Tyco customers of former 150C-rated parts (SnPb) are advised to switch over to either 175C rated parts or 125C rated parts - in case they are affected by the RoHS.
- Further details on the problem of solder sleeve manufacturing with Bi-containing alloys (see brittleness argument above) – if there is any such problem for the Tyco application - are kept confidential.

The applicant has been informed about this status to give the possibility to comment on it.

6.6.3 Final recommendation

Upon request the applicant was unable to specify, why the alternatives developed by its competitor are not applicable for him. Although the applicant claimed, that the competitor is willing to support the request for exemption due to severe reliability / quality problems with his alternative - problems, which the competitor did not mention before when contacted in the course of examining the request - there was no such statement received in due time. Therefore, based on the knowledge received through extensive information exchange with the applicant, it is **not recommended to grant an exemption** as

(1) clearly there is an alternative at least for certain applications covered by the wording proposed by the applicant,

(2) the applicant was unable to propose a more focussed wording, which covers only applications, where alternatives might not be technical feasible (if there are any such fields of application at all),

(3) Öko-Institut / Fraunhofer IZM are not aware, that there are fields of application, which do not allow to make use of the competitor's approach (including design changes to be made by the component user by e.g. change of surface finishes etc.).

6.7 NEC V55 microprocessor – CPG (set 3 request no. 2)

6.7.1 Description of requested exemption

CPG International requests a one-year exemption for the use of the component “NEC V55” as microprocessor on the main board of CPG International serial printers. These printers are developed for heavy duty printing applications in industrial, logistics and administrative environments. They have a life cycle of over 10 years and are sold in b2b markets. The exemption is required for lead which is present on the surface of the NEC V55 microprocessor pinout.

The lead amount represents 0,033g per microprocessor equivalent to 0,57% of the total component weight. The lead content in the homogeneous material (i.e. the pinout surface) is 18%. Considering the production volume between 1 July 2006 and 1 July 2007 (period for which the exemption is requested) to be approximately 10.000 boards, about 330g of lead will be put on the market by the NEC V55 boards used in CPG’s printers.

The applicant was asked whether his products might fall under an existing exemption (e.g. network infrastructure) or whether it was a finished product in order to asses the applicability of the ROhS Directive’s scope. According to the applicant, CPG’s serial printers are available as finished products on the market and can thus be considered to fall under category 3 of the WEEE Directive.

The wording for the exemption provided by the applicant is “*Single source electronic components where last buy order has been issued before July 1st 2005 are exempted until December 1st 2006*”. The consultant asked the applicant for a more precise wording and proposed “*lead in pinouts of the component NEC V55 used in serial printers*”. The applicant has replied with a new proposal for wording being “lead as solder in pinouts of the last-buy-order microprocessor NEC V55 used in serial printers”.

6.7.2 Summary of justification for exemption

The applicant justifies his exemption request according to the following technical and environmental arguments:

- The component NEC V55 is out of production: NEC announced V55 last buy in September 2002.
- Component substitution is not feasible since a software/hardware compatible device is not available. A full design change is currently under development.

- Last buy order has been issued: last buy orders were taken from March to July 2003 for an amount of 80.000 pieces of the NEC V55 component. A few thousand components have been found by brokers up to the end of 2005.
- Substitution is not feasible: the applicant states that a pin-to-pin alternative to NEC V55 does not exist - neither in NEC's microprocessors offer nor in other microprocessor producers' offer.
- The microprocessor NEC V55 belongs to the former product line which was launched in 2002 and for which customers request continuity.
- Full design change is under development: "a complete redesign of all CPG International products line has been considered and launched using new up-to-date RoHS compliant microprocessor."
- CPG's goal is to put the new serial printer products on the market starting from 1 January 2007. Production phase-out of NEC V55 platform will last from January to July 2007.
- Serial printer production can not cease in the meantime, since it represents 50% of the company's revenues.
- Elimination of lead from the NEC V55 pinout has been considered and activities have been conducted in order to reduce the lead amount below maximum concentration values. The applicant states that these activities have a greater negative environmental impact than the benefit of reaching RoHS compliance through lead elimination since lead in then concentrated in a tin bath (about 330 kg of pure tin containing 330 g of removed lead) which needs to be disposed of accordingly.
- Not getting an exemption would lead to the need to scrap left-over 10.000 pieces of NEC V55 components.

A critical review of the documents made available by the applicant and of further data and information given by other parties lead to the following observations and conclusions:

- Although being asked for, no sound evidence has been brought forward by the applicant concerning the announced NEC last buy in September 2002.
- The applicant has not explained in enough detail why last buy orders were taken in the course of the year 2003 and 2005 even though RoHS Directive was already in place by that time. No explanation/evidence has been given whether there has been a company policy on how to start a phase-out of the NEC V55 component, when such a policy has been put into place and why the deadline of 1 July 2006 could not be met.
- The applicant has not brought forward sufficient evidence/further information supporting the statement that an alternative to NEC V55 does not exist. The technical specifications of the components have not been detailed and it can thus not be evaluated why substitution is not possible.

- The applicant has not stated when exactly the redesign of CPG's product line has been launched. It can thus not be evaluated whether this has been done at an acceptable point of time after the RoHS Directive came into place.
- The applicant uses an economic argument to justify that production can not cease until phase-out is completed. This is not valid according to Article 5 (1) (b).
- The applicant has changed its initial request for half a year phase-out exemption for NEC V55 to a one-year phase-out period after having responded to the consultant's questions. The reason for this change has not been explained by the applicant.
- Argumentation given by the applicant on negative environmental impacts of removing lead from NEC V55 pinouts is comprehensible and has been supported by extensive documentation.
- The argument on negative environmental impacts of scrapping non-RoHs compliant components in case the exemption should not be granted is also comprehensible even though this has not been supported by documentation/evidence.

6.7.3 Final recommendation

Considering the above-mentioned arguments and the evaluation results, the recommendation would be not to grant an exemption since a redesign is feasible and the applicant could not prove why redesign could not be in place by 1 July 2006.

Nevertheless the attention is drawn to the fact that this exemption request belongs to the lot of the so-called LTB requests and that an evaluation sticking closely to Article 5 (1) (b) does not seem to be adequate (for the general discussion of this issue please refer to report 8).

In this particular case, the requested time period of a one year exemption together with the relatively small amounts of lead involved and the need to scrap remaining components in case an exemption is not granted lead to the conclusion that – from a general environmental point of view – an exemption seems to be recommendable; though this argumentation is not in line with Article 5 (1) (b).

6.8 Inventory of Special ICs having tin-lead solder on/in leads/balls, used in specialist/professional equipment – Calibre (set 3 request no. 5)

6.8.1 Description of requested exemption

The company Calibre - a UK-based SME – requests an exemption for the use of lead in tin-lead solder in/on image processing ICs. These devices are used in two product ranges: PV4 and PVPro – both image processors.

PV4 is an image processor board used in specialist LCD display applications including military, aerospace, transport, medical (endoscopy and surgery), process control, broadcast

and various other applications. According to the applicant some of the products do fall under the scope of RoHS.

PVPro is an image processor for large screen LED videowall displays and professional projection. It is used for professional display applications such as rental/staging, sports grounds, concerts, public information display and advertising/electronic signage.

Lead is contained in the tin-lead solder with 37% – 40% lead. Calibre estimates a total amount of lead within their devices to be 1.5 kg – 2 kg. The applicant cannot differentiate further how much of this amount is actually part of RoHS relevant applications sold in the EU. An estimation is given as 0,3 – 0,4 kg/a.

The proposed wording by the applicant is "*lead contained in solder within or on ICs used in specialist/professional equipment, where those ICs have already been manufactured prior to 1 July 2006 and where lead-free equivalents are not and never have been available for purchase*".

6.8.2 Summary of justification for exemption

The applicant justifies his exemption request according to the following technical and environmental arguments:

- The applicant states that no technically equivalent-lead-free substitute device is available. Calibre has requested RoHS-compliant, lead-free parts from its suppliers but was informed that there were not available.
- Devices are out of production and thus needed to be stocked to ensure continuous production: some of the devices have been out of production for approximately 2-4 years, others since 2005. According to the applicant no evidence on this matter can be supplied since Calibre is a small company to whom large producers would not give such evidence ("Obtaining specific discontinuation information is unrealistic for a very small company such as Calibre – the large IC manufacturers do not co-operate when such requests are made").
- Calibre has named a list of applications in which the components PV4 and PVPro are used. Only few of them appear to be RoHS relevant (e.g. displays for presentation use in education/presentation/training an rental/staging use of large screen LED videowalls not considered as fixed installation). The problem is that in some cases, Calibre does not control the end-use of its products since it is a manufacturer at the beginning of the supply chain for E&E equipment and does not follow the chain all the way until a RoHS relevant product is produced.
- Calibre placed a last-time buy in April 2005 for one type of IC since no lead-free version was available upon enquiry to the supplier.
- According to the applicant this last time buy order had to be issued since

  - The manufacturers/suppliers would not wait until RoHS came into force and all exemptions had been clarified. The applicant claims that he would not have been able to obtain components at that later time
  - A significant proportion of these components are for use in applications or markets outside the scope of RoHS
  - Calibre was aware that it would not be able to design-out these components before RoHS came into force
  - Calibre believes that a certain amount of customers will continue to demand supply of these products after RoHS has come into force since they believe their usage to be exempt.
- Total remaining production capacity for PV4 is approximately 4000 units based on stock of ICs which are no longer available for purchase. It is anticipated that this represents approximately 4 years of production.
- Total remaining production capacity for PVPro is approximately 500 units based on stock of ICs which are no longer available for purchase. It is anticipated that this represents approximately 4 years of production.
- PV4 and PVPro are both the subject of re-design using different lead-free parts. This is planned for PV4 during 2007 with phase-in in 2008 – according to the applicant such projects typically take 18-24 months to complete. The re-design of a replacement for PVPro is underway and it is expected that product samples may be available by early 2007.
- A redesign on time was not feasible since there were either no alternatives on the market or if there were they proved to be unsuitable (either due to performance or due to manufacturers refusing supply due to too small amounts).
- Due to customer requirements long phase-out periods are demanded by Calibre's customers and they are unwilling to change designs unnecessarily, therefore a realistic phase-out period for PV4 and PVPro is considered by the applicant to be 4 years from now; this is why 4 years of stock are presently held by Calibre.
- Calibre started working towards RoHS compliance in 2004 when new products were planned and investigation into RoHS compliant components was started. According to the applicant this continued through 2005 when the devices for which an exemption is requested were found not be replaceable with any technically suitable alternatives. Calibre is – according to an own statement – in the process of converting its soldering operations to lead-free in anticipation of RoHS compliance deadlines.
- Calibre states that the problem of using inventory of specialist ICs is something peculiar to the specialist low-volume electronics industry. For SMEs in low-volume specialist sectors, this is not possible since product lifecycles are comparably long and design changes slow.

- Calibre's main environmental argument is that the exemption request covers ICs which have already been manufactured by their respective manufacturers and are already held in stock at Calibre. According to the applicant they will be used in mixed process assembly, whereby the actual boards soldering will be lead-free. Therefore – the applicant argues – the use of these stock devices does not increase the amount of lead used or in the environment; the amount of lead used in the devices being very small anyhow. Furthermore the applicant argues that not granting the exemption request would lead to discarding new components thus wasting resources. The applicant thus also suggests to grant a general exemption for devices already in stock.

A critical review of the documents made available by the applicant and of further data and information given by other parties lead to the following observations and conclusions:

- The applicant has provided much information on his products and their design cycles as well as on the conditions under which the last time buy (LTB) order took place. As stated in the section on general LTB issues in the eigth monthly report, it is nevertheless not practicable to verify whether design changes have started early enough to be in compliance with RoHS.
- The applicant states the due to his size (3M Euro annual turnover and 30 employees) he is not able to provide according evidence on road-maps or similar to prove efforts made to start re-design early enough and to have started communication with suppliers in time to be RoHS compliant. This cannot be verified by the consultant.
- In this particular case most of the applications in which Calibre's products are used are outside the scope of RoHS. Since the applicant is not the manufacturer of RoHS relevant products put on the market as E&E equipment it is not possible for him to specify which applications would contain his components and be RoHS relevant at the same time.
- It is thus not possible to narrow the exemption wording to those applications. A wording as proposed by the applicant goes beyond what would be justified as an exemption according to Article 5 (1) (b) respectively cannot be verified. This could only be evaluated if a manufacturer of an E&E equipment using such components would ask for an exemption under RoHS.

6.8.3 Final recommendation

Considering the above-mentioned arguments and the evaluation results, the recommendation would be not to grant an exemption since a redesign is feasible and the applicant could not prove why redesign could not be in place by 1 July 2006.

Nevertheless the attention is drawn to the fact that this exemption request belongs to the lot of the so-called LTB requests and that an evaluation sticking closely to Article 5 (1) (b) does not seem to be adequate (for the general discussion of this issue please refer to eighth monthly report).

Furthermore it has to be stated that this request cannot be evaluated within the limits set by Article 5 (1) (b) since an evaluation on a company-individual basis is needed in order to properly judge whether criteria of Article 5 (1) (b) are met or not.

In this particular case the relatively small amounts of lead involved and the need to scrap remaining components in case an exemption is not granted lead to the conclusion that – from a general environmental point of view – an exemption seems to be recommendable; though this argumentation is not in line with Article 5 (1) (b). Furthermore, in this case, it has to be taken into account that it is a small company that would have to support severe economic consequences in case an exemption is not granted – although here again this argumentation is not in line with Article 5 (1) (b).

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

6.9.1 Description of requested exemption

Circuit Foil Luxembourg requests an exemption for hexavalent chromium (Cr-VI) in chromate conversion coatings as surface treatment. This treatment is used to protect copper foils in form of copper clad laminate (CCL) used for the production of printed circuit boards (PCB).

These kind of copper foils typically have a treated matte side and a brilliant shiny side. According to the applicant the protection of the treated matte side is imperative for avoiding any adverse chemical reactions between the treatment and the resin; the protection of the brilliant top side is mandatory, as any oxidation or tarnishing would negatively affect most of the subsequent process steps (like print and etch of PCB).

The conversion coatings are obtained by electrolysis out of dilute chromate containing solutions. The result of the cathodic electrodeposition is a mixture of Cr3+salt, metallic zinc and zinc salt precipitated as an extremely thin layer on the copper foil.

The main function of the coating consists in the protection of both sides of the copper foil against corrosion, whereas two types of corrosion exist (which are in fact connected):

- A slow corrosion due to natural oxidation during long-term storage of copper foil.
- An accelerated corrosion due to the lamination temperature (170 °C for FR4 prepreg, 220 °C for polyimide resins and up to 400 °C for Teflon resins) during the pressing and postbaking steps for the manufacture of the copper laminates.

Furthermore, the conversion coatings must on the one side provide an optimal conservation of copper / resin bond strength due to the resistance to chemical / thermal aggression on the copper foil treated side but on the other side also provide a very quick removal by gentle chemical etchants.

The total annual quantity in the EU was calculated from copper foil consumption in Europe for the CCL market (approx. 43,53 million m²) and from the typical residual content of < 0,002 µg/cm² of CrVI to be less than 900 g CrVI in 2004.

6.9.2 Summary of justification for exemption

The applicant justifies the request technically: no substitutes are known delivering the required protection against corrosion:

- The applicant has provided a list of different products and types tested in his facility. None of these products delivers the requested corrosion protection against thermal oxidation (2 hours stay in ventilated oven at 200 °C). Even at ambient temperature the development of corrosion after a few days storage was noticed.
- Cr3+ substitutes are often cited as a substitute for steel coating. According to the applicant the chemical reactions taking place at the interface metal / liquid with these Cr3+ substitutes do not allow to develop the type of zinc containing chemical species combination needed to achieve the maximum corrosion protection.

A number of contributions from stakeholder consultation support the request, but here it must be taken into account that these contributions do not relate to copper foils but to corrosion protection of other metals. On the other side one major manufacturer of household appliances argued not to accept this request as substitution of hexavalent chromium with Cr3+ substitutes were available. On closer examination of this argumentation this contribution is not applicable to the request of Circuit Foil too, as it relates again to corrosion protection of other metals.

6.9.3 Final recommendation

The applicant has withdrawn his request. The reasons given for the withdrawal are the fact that the content of CrVI in the copper foil is below the maximum concentration value fixed in Commission Decision 2005/618/EC and below the detection limit.

6.10 Tin-lead solder in the manufacture of professional audio equipment – Lectrosonics (set 3 request no. 8)

6.10.1 Description of requested exemption

The applicant applies for an exemption for the use of lead in solders of professional audio equipment. It is used in SnPb37 and SnPb40 solders with 37 % or 40 % of lead respectively. This solder is used to attach semiconductors and ICs to the printed wiring board in the assembly and soldering process in manufacturing of professional audio equipment. The applicant proposes the following wording for the exemption:

Continued use of tin-lead solder in the manufacturing of professional audio equipment until such time as it is practicable to convert to lead-free solder.

This solder is critical to the reliable operation of the equipment. It must withstand a wide range of operation temperatures, rough handling and physical shock as is common in the environments where they are normally used.

The total amount of lead involved in Lectrosonics products currently is around 300 g per year in Europe. New products will increase this amount to around 1,700 g of lead in the applicant's products shipped into Europe.

The products include radio microphone and audio transmission equipment used in field, and audio signal processing equipment used in fixed installations. They serve specialized professional customers such as national television networks and broadcasters, commercial sound system installations in fixed locations such as governmental meeting rooms, corporate boardrooms and schools. They are also used in location television and outdoor motion picture production. The service life of the products reaches up to 20 years, often followed by another 10 years of service to a secondary user.

6.10.2 Summary of justification for the exemption

6.10.2.1 Applicant's criteria for justification

The applicant bases his request on the very small quantity of lead contained in the solder, and the professional nature of the products and customers.

The applicant estimates that his conversion to 100% RoHS compliant parts, solders and processes will not be completed until early 2010. The investment in additional SMD production equipment must be made first. New staff must be hired and trained to operate the equipment, followed by the testing and re-design of well over 200 different circuit board assemblies. The resources needed to make the conversion are considerable.

<u>Minor amounts of lead</u>

The total shipments and amount of lead contained in finished assemblies is only up to 1,700 g. The products are used strictly in professional and commercial markets and enjoy long service lives, commonly up to 20 years. When products are retired from the first users, they typically move to a secondary market, which further extends the service life. When a product is retired and taken out of service it will disposed in accordance with WEEE directives, or returned to the factory in the USA for disposal in accordance with applicable recycling applications.

Custom made, single source and last time buy component issue

Several key components in each product are not available in lead-free versions yet. These are highly specialised IC and custom made components unique to the design of Lectrosonics products. For example, the transmitters include a circulator/isolator device in the output stage to suppress the generation of IM signals in the final amplifier. This part is custom made and available only from a single source. The noise reduction components known as compandors are also not available in lead-free versions. The finished products will not provide the required performance without these key components.

Several parts critical to the designs of the wireless equipment have become available in RoHS compliant versions only recently. The applicant also made “lifetime buys” of some other parts that are used in several products.

Samples have been received recently but testing has not been completed on ceramic resonators made by Skyworks-Transtec: SR9000 Series ceramic resonators on frequencies from 500 MHz to 950 MHz.

Samples have been ordered but not received yet for RF circulator/isolators made by Renaissance Electronics: part number 2SLE2NDL on a variety of frequencies for testing.

Lifetime buys (last buys) of IC noise reduction compandors have been purchased from On Semiconductor in France (formerly Motorola). The designs were purchased from Philips several years ago. Part numbers: NE571, NE572 and NE575.

Processing issues

Lead-free solders require higher temperatures to affix the components to the circuit boards. The key components listed in the previous paragraph and others used in the designs of various products will not survive the higher temperatures required to use lead-free solder. When higher temperature substitutes become available and the products can be manufactured with lead-free solders, a conversion to lead-free will take place.

When all general semiconductors are readily available in lead-free versions, research will begin to develop substitutes for the key components that currently prevent a conversion to lead-free assemblies. Research and testing will take place on substitute solders as they become available that can be used with all components.

6.10.2.2 Critical review of data and information given by the applicant or stakeholders

Minor amount of lead

Art. 5 (1) (b) of the RoHS Directive does not indicate minor amounts of a banned substance in a product as a reason for an exemption. The applicant’s argumentation that his products only contain a maximum of 1,700 g of lead per year in the EU is not in line with the RoHS Directive.

Custom made, single source and last time buy component issue

The applicant stresses the last-time-buy and single source issue in combination with the low volume of products. So far, however, the applicant could not yet explain why he did not start the design of new products in order to be RoHS compliant in time, nor did he submit the necessary confirmations from the respective manufacturers that the respective components will not be shifted to RoHS compliant versions. Further on, it is not clear, whether the respective components or at least some of them

- are RoHS compliant, but NOT qualified for the higher soldering temperatures in lead-free soldering
- are NOT RoHS compliant and are NOT qualified for the higher soldering temperatures in lead-free soldering

The applicant was given another chance to clear the open issues.

Processing issues

The applicant says that some components do not tolerate the higher soldering temperatures in lead-free soldering. Selective or hand soldering as the standard solution for this kind of problem, according to the applicant, is not a viable option. The low volume production, ranging from sometimes only one up to six units, and the high variety of products make it economically impracticable to install and to adapt the necessary special tools in particular for smaller components, where hand soldering is difficult. In particular, the wireless microphone and IFB equipment requires different parts values for different frequency ranges to operate from about 500 MHz to 850 MHz. Each frequency range is defined as a “block” covering 25.6 MHz, with 14 different blocks available. As the applicant produces only 12 of his products out of around 200 PWB assemblies for the European market, he does not want to install a lead-free soldering SMD line unless all products can be shifted to lead-free versions. Switching the existing lines or one of the lines from conventional production to lead-free soldering production and back is not viable either, as the setup and preparation time is too long.

These arguments are not technical or scientific ones, but economical ones and thus are not in line with the requirements of article 5 (1) (b).

Review of the Wording

The original wording the applicant had proposed is too general considering the reasons why the applicant wants to go on using this solder. In accordance with the applicant, the following wording had been agreed upon in case the exemption request can be recommended to be accepted.

“Use of lead in tin-lead solders to allow the attachment of customer specific and single source components to printed wiring boards used in professional wireless microphone, IFB and DSP-based audio signal processing equipment.”

The background of the request is not yet sufficiently clear in order to decide whether a fixed deadline should be integrated into the request.

6.10.3 Final recommendation

A final recommendation is not yet possible.

As the questions in the first round were not answered sufficiently, the applicant was sent another set of questions in April 27, which so far have not yet been answered:

The list of components you provided does not suffice the requirements. Please be aware that the applicant needs to provide all necessary evidence. Your request will be declined if the information you provide does not answer the questions.

1. From your answers it is not clear whether you only want to use SnPb-type solder to solder otherwise RoHS compliant components, or wether there are additionally non-RoHS compliant components involved, or maybe both.

   Please provide a list of all components, which are not qualified for the higher lead-free soldering temperatures so that you have to solder them with conventional SnPb-type solders.

   Additionally, please provide a second list with components, which are not RoHS compliant, but which you still want to use in products after the RoHS deadline July 2006. Please also specify why these components are not RoHS compliant.

   Both lists must suffice the following criteria:

   a. the components and their technical specification must be identifiable unequivocally,
   b. their manufacturers must be identifiable unequivocally,
   c. a confirmation from the component manufacturer of each of these compoentns must be included that the manufacturer will not offer RoHS compliant versions and higher soldering temperature qualified versions of these components.
2. You did not answer the question why it was not possible for you to start the redesign of your products in time. As we know from other similar requests with single source, low volume and customer made components involved, component manufacturers DO produce such components RoHS compliantly if the customer does a redesign in time for a new product line (not just shifting the existing one into a RoHS compliant version). The RoHS deadline has been known since 2002. Why was it not possible for you to start the redesign in time?
3. When will you be on the market with new products replacing the products, in which you want to use the non-RoHS compliant components and solders?

7 Further proceeding

The focus for the forthcoming work will lie on the closure of final recommendations of requests from set 3. The LTB issues will continue to be an important horizontal question which has to be analysed carefully.

The fifth consultation round has closed on 15 May (see Table 3 below). The requests of this consultation round will be evaluated as far as feasible with the available documentation. For this last round of exemption requests evaluation cannot be guaranteed in the same depth as before since the time span between closure of the stakeholder consultation and end of contract is very short (1,5 months). The evaluation will be part of the draft final report.

Table 3: Overview requests set 4

No.	Title
1	Cadmium and cadmium oxide in thick film pastes used on beryllium oxide substrates until January 1, 2008
2	Gaskets of butyl rubber material vulcanised with chinondioxim and lead tetraoxide, for use in Aluminium Electrolytic Capacitors
3	Sharp LQ104X2LX11 (formerly Fujitsu FLC26XGC6R-01)
4	Quartz Crystal Resonator and in Fine Pitch Electronics Systems used in the Swiss Watch Indust
5	Cadmium in opto- electronic components
6	Transducers used in professional loudspeaker systems, using tin-lead solder
7	Tin-lead solder in the manufacture of professional audio equipment
8	Components used in the manufacture of the Hog1000, Hog500, Event416, Event408, ESP2-24 and ESP2-48 lighting control consoles
9	Specific modular units, including tin-lead solder, being used in special professional equipment
10	Inventory of special ICS having tin-lead solder on/in leads/balls, used in specialist/professional equipment
11	Cadmium Mercury Telluride
12	Lead contained in Babbit lined bearings
13	Cadmium alloys as electrical/mechanical solder joints to electrical conductors located directly on the voice coil in transducers used in high-powered loudspeakers
14	Thermal cutoff with a fusible element that contains lead (and possibly cadmium, mercury and hexavalent chromium) for applications where normal operating temperature exceeds 140 C and reliable, predictable, operation for a minimum of 30,000 hours is required
15	Mercury free flat panel lamp
16	Electronic equipment where the reliability, durability and longevity of the equipment is paramount
17	Semi Red Brass C84400, 81-3-7-9 or a similar Brass material. Used on radio frequency line sections

No.	Title
18	Lead is used as an alloy to the copper in 6 to 8 % by weight. Needed for casting and machinability characteristics
19	Lead in solders for electronic equipments used for the monitoring, the protection and the safety of people in healthcare, telecare and emergency calls domains in professional and private sectors
20	FPGA devices manufactured by Xilinx (XC5202-6VQ100C, XC4003E-3VQ100C and XC4013E-3PQ240C) containing lead solder (Pb) used in the plating of the device terminations
21	Lead oxide in seal frit used for making window assemblies for argon and krypton laser tubes
22	Smart card readers (product: GemSelf700-MS2, GCR700-3ZS, Vodafone D2 , GCR760 and GemSelf750 SV)
23	Use of mercury in Babcock's DC plasma displays and use of Lead Oxide (PbO) in Babcock's DC plasma displays frit seal