Öko-Institut e.V.
Institut für angewandte Ökologie
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Öko-Institut e.V.

Dipl.-Ing. Carl-Otto Gensch

Dipl.-Ing. Stéphanie Zangl

Dipl.-Ing. Martin Möller

Dr. Joachim Lohse

Fraunhofer Institut IZM

Dr. Jutta Müller

Dipl.-Ing. Karsten Schischke

Dipl.-Ing. Otmar Deubzer

Öko-Institut e.V.
Geschäftsstelle Freiburg
Postfach 500240
D-79028 Freiburg
Tel. +49 (0) 7 61 – 45 295-0
Fax +49 (0) 7 61 – 4 52 95 88
Hausadresse
Merzhauser Str. 173
D-79100 Freiburg
Tel. +49 (0) 761 – 45 295-0
Fax +49 (0) 761 – 4 52 95 88

Büro Darmstadt
Rheinstraße 95
D-64295 Darmstadt
Tel. +49 (0) 6151 – 81 91 - 0
Fax +49 (0) 6151 – 81 91 33

Büro Berlin
Novalisstraße 10
D-10115 Berlin
Tel. +49 (0) 30 – 28 04 86-80
Fax +49 (0) 30 – 28 04 86-88

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 section 5); questions sent out to applicant; answers received; evaluation pending.
2	Components NEC V55	CPG International	LTB issue (see section 5); draft evaluation ready (see section 6.1.1); answers applicant pending.
3	The use of lead in solder applications for electronic components of musical instruments having an average lifespan in excess of 10 years	Bristows	LTB issue (see section 5); reuse issue overlapping with set 1 request no. 20; questions sent out to applicant; answers received; evaluation pending.
4	Lead solder alloy in Surge protective devices (SPDs)	ZVEI	Overlapping with request no. 12 set 3; questions sent out to applicant; answers pending.
5	Inventory of Special ICs having tin-lead solder on/in leads/balls, used in specialist/professional equipment	Calibre	LTB issue (see section 5); draft evaluation ready (see section 6.4); answers applicant pending.

No.	Title	Applicant	Status Quo
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.
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 section 5); questions sent out to applicant; answers pending; draft evaluation ready (see section 6.6).
9	Specific modular units including tin-lead solder being used in special professional equipment	Avolites Ltd	LTB issue (see section 5); questions sent out to applicant; answers 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 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; questions sent out to applicant & stakeholders; some answers pending.
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 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 section 5); Questions sent out to applicant & stakeholders; some answers 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; questions sent out to applicant & stakeholders; answers pending. Meeting scheduled.

4 Results

Five requests from set 2 still remain open for final recommendation (please refer to 7th monthly report). This is mostly due to missing information by the applicant or to contradictory information available to the consultant. As soon as this situation can be clarified, final recommendations will be given. The applicants were informed that a delay in our evaluation leads to a delay in the whole decision procedure.

In one case (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 section 5).

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

As can be seen in Table 1 half of set 3 requests are concerned by the so-called LTB issue. LTB is relevant for companies mostly producing specialised custom designed ICs or specialised printed circuit boards assemblies in relatively small amounts. Most of the products are also b2b products and these products mostly have a very long lifetime - especially in comparison with consumer products and are subject to long design cycles. In cases were a component used in those products is not being produced anymore, these

companies might take or have taken a so-called last time buy; meaning that they order an considerable amount of the respective component in order to be able to secure continuous production.

Should this component not be RoHS compliant, a large stock might exist which – according to current legislation – cannot be used for producing new equipment to be put on the market after 1 July 2006. This is the reason why some companies have requested an exemption for those LTB components in order to be able to use their stock products within new products put on the market after 1 July 2006.

One stakeholder has described the typical LTB situation as follows:

"When confronted with such an offer, equipment manufacturers usually look at several options:

1. seek an alternative supplier for the component;
2. redesign the equipment using other components or
3. do a "lifetime" or "last time buy".

An LTB is, however, rarely (if ever) the preferred option since future sales are hard to predict and stocking components for long periods is both burdensome and expensive."

In order to be able to carry out a proper evaluation, all concerned requests need to be looked at together. In view of consistency it needs to be checked whether

- the specific LTB contract was justified against the schedule of RoHS implementation (i.e. whether at the moment of LTB there really was no RoHS compliant alternative available on the market and whether redesign in view of RoHS compliance was not a viable alternative to LTB);
- using LTB components would lead to non RoHS compliant products put on the market for a longer period (i.e. how long can a phase-out period be acceptable?);
- the exemption request is justified or whether the applicant is merely aiming at a sell of stocks;
- the exemption relates to a specific component in a specific application for a specific time frame or whether a "general exemption" is targeted.

An evaluation with the above described questions presents a certain challenge since it appears difficult to be put into practice. Furthermore, this might only be the tip of the iceberg, since this issue specially affects SMEs facing a hard resource problem: for small companies it is sometimes nearly impossible to generate the effort in order to start a necessary redesign process in view of RoHS compliance. The problem often not only depends on hardware but also on the specific corresponding software.

An overview of all requests concerned by the LTB issue was given the 7th monthly report.

In view of the above-described situation the consultants have decided to proceed as follows:

- Give a recommendation applying Article 5 (1) (b) in a narrow sense, trying to evaluate whether the available data and information allow a conclusion on technical or scientific feasibility. Where this is not possible – due to lack of information or uncertainty[1] – give a negative recommendation since proof could not be delivered by the applicant.
- Evaluate the request taking involved amounts of concerned restricted substance into account.
- Evaluate the request against the background of the general LTB situation and practicability of RoHS compliance.
- Evaluate the request in a broader overall environmental perspective, i.e. taking environmental aspects into account that go beyond the criteria named in Article 5 (1) (b) and not taking possible technical or scientific feasibility into account. This also implies evaluating the request against the overall objectives of environmental legislation.
- Furthermore evaluate the request according to other, e.g. economic criteria.

After having evaluated the first answers given by applicants and other interested parties, it can be stated that it seems very difficult to gather enough information from the applicant in order to be able to decide whether e.g. a re-design was started early enough. In order to do a sound evaluation of the requests it would be necessary to do a detailed case-by-case enquiry including site visits, insight of relevant documentation, evaluation of documentation delivered by suppliers etc. This clearly is not feasible within the mandate given to the consultants in the framework of this evaluation work. Nor does it appear to be feasible by a public authority.

The consultants thus recommend finding a general agreement on how to decide on these LTB issues. Questions which will arise in this context are e.g.:

- How can misuse be identified respectively avoided?
- What would be the criteria according to which an exemption can be restricted to certain specific applications?

In this report three requests belonging to the overall LTB issue have been evaluated in a first step (see sections 6.3 to 6.5) on the basis of extensive information made available by the applicants. For the other LTB requests information is not yet complete or missing. These will thus be evaluated at a later stage. Final recommendations will be given when a general agreement on the evaluation criteria of LTB issues has been found.

[1] Especially technical specifications of the assembly in order to evaluate whether substitution at product or system level is possible.

6 Requests open for recommendation

The following section contains draft final recommendations for requests from set 2 and set 3.

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

6.1.1 Description of requested exemption

The applicant asks an exemption for lead and cadmium in low melting solders, which he uses in thermofuses of linear power transformers. The performance of these power transformers ranges 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

6.1.2 Summary of justification for exemption

6.1.2.1 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 reproducible 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.

6.1.2.2 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.

6.1.3 Final recommendation

An external expert stated that design changes facilitate the use of RoHS compliant thermo fuses. The applicant was given the chance to react to this external expertise but did not yet give his statement. A final recommendation thus is not yet possible.

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

6.2.1 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*"

6.2.2 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.

6.2.3 Final recommendation

Based on the information given by Tyco Electronics RoHS compliant alternatives seem to be feasible. Thus, a recommendation to reject this request is likely, but a statement by the applicant is awaited to support the recommendation further.

The applicant announced to provide new evidence on this case shortly, and that also Tyco will comment once again on their alternatives, explaining probably difficulties they face with their leadfree devices. Hence, the final recommendation is postponed until end of April to take this expected input into account.

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

6.3.1 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 10k 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*" but did not receive an answer or statement from the applicant.

6.3.2 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.
- 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, SW-to-SW[2] alternative to NEC V55 does not exist - neither in NEC's microprocessors offer nor in other microprocessor producers' offer.
- 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 evidence has been brought forward by the applicant concerning the announced NEC last buy in September 2002.
- The applicant has not explained why last buy orders were taken in the course of the year 2003 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 could not be met.
- The applicant has not brought forward any 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.

[2] Acronym used by the applicant in his reply. Applicant has been asked to provide explanation on meaning of this acronym.

- 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.

6.3.3 Final recommendation

At this point of evaluation a final recommendation according to Article 5 (1) (b) cannot be given since the applicant has not provided sufficient information/evidence on a certain number of points. The applicant has been be given another possibility to better support his argumentation. If no further evidence can be provided, a final recommendation will be taken on the basis of the available information. 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 section 5).

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).

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

6.4.1 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 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*".

6.4.2 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 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.

- 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.
- 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 – according to an own statement – in the process of converting its soldering operations to lead-free in anticipation of RoHS compliance deadlines.
- 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 products which are within the scope of RoHS are not specified by the applicant. It can thus not be concluded whether the exemption request is actually formally apt for evaluation.
- The applicant could not make clear why he has started re-design at a late stage when RoHS was already in force and why last time buy orders were taken by that time knowing that the applicant would have to comply with the RoHS Directive by 1 July 2006. It can

thus not be evaluated whether an earlier re-design could have allowed customer-adapted phase-out of non-RoHS compliant components.

- 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.

6.4.3 Final recommendation

At this point of evaluation a final recommendation according to Article 5 (1) (b) cannot be given since the applicant has not provided sufficient information/evidence on a certain number of points. The applicant has been be given another possibility to better support his argumentation. If no further evidence can be provided, a final recommendation will be taken on the basis of the available information. 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 section 5).

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).

6.5 Lead in customer designed or single source integrated circuits (exemption request set 2-3, Thomson) and in customer designed modular units (exemption request set 2-4 Thomson) for use in professional broadcast equipment

The applicant had submitted two requests. They are evaluated together, as the applicant's argumentation line is almost identical for both requests.

6.5.1 Description of requested exemption

The applicant requests an exemption for lead used as constituent in finishes of application-specific custom designed or single source integrated circuits (ICs), and lead in *tin-lead solder*

in custom designed modular units: power supplies, display modules less than 50 cm², non-standard connectors, in otherwise lead-free professional broadcast equipment.

The amount of lead involved in the ICs is around 1,4 kg worldwide and around 600 g in Europe. The amount of lead in the modular units is around 2,5 kg worldwide and less than 1 kg in Europe. The total amount of lead exempted would thus be around 4 kg worldwide, and less than 2 kg in Europe.

The wordings as proposed by the applicant in the original exemption request:

"Lead in tin-lead finish on leads (connecting elements) of custom designed or single source Integrated Circuits used in otherwise lead-free boards of professional broadcast equipment. The development of these ICs was completed before 19/8/05. The exemption is granted until 31/12/2009."

and

"Lead in tin-lead solder in custom designed modular units: power supplies, display modules less than 100 cm², non-standard connectors, in otherwise lead-free professional broadcast equipment. The development of these modular units was completed before 19/8/05. The exemption is granted until 31/12/2009."

The share of lead in these solders is around 40 %. The modular units comprise power supplies, display modules of less than 50 cm² size and either custom LCD or LED based, and non-standard connectors.

In both applications, the lead is a constituent of the tin-lead solder (~40% of Pb) and finishes. All these components and modules are used in professional broadcasting equipment.

6.5.2 Summary of justification for exemption

The applicant's arguments are complex. They are therefore summed up in different categories.

Long product commercial life time

- Product development times can vary from 6 months to 3+ years, with an average of around 2 years.
- Once the physical product is in production, it is very common to continue development of new features by means of software enhancements for 5-10+ years. Example: Customers install professional TV broadcasting equipment with the expectation of being able to keep it in service for at least 10 and often up to 20 years. They also

expect to be able to upgrade the system by means of new hardware or software for a large portion of the service life of the product.

- The re-design circles of these products can be up to 5 years

Specific conditions of the supply chain

- The majority of assemblies in products manufactured are lead-free, but a few modular components are not available lead-free. The manufacturer may use tin-lead for soldering components within these modular components. These modules must be purchased as a lifetime buy since there are no alternate manufacturers due to technology changes and low production volume. The only solution for the equipment integrator will be to redesign the system to replace the affected modular functions. The assemblies that include these modules will be otherwise totally lead-free (solder, finish, any). The modules will be added by hand using lead-free solder or other means of compliant connections. The modules themselves may include a small amount of Sn-Pb solder, typically 0,1 gram and no more than one gram. The dsplay modules are typically custom designed LED segmented character displays or similar LCD units. To restart the development at sub-contractors requires new tooling and set up of new production processes but is not viable doe to the low volume of the production. The modules are customer specific and produced in small quantities, often in one production run. Some of modules are no longer available after some years, making it impossible to shift them to lead-free versions. This forces users to buy big stocks at once for the supply of the coming years, and sometimes make a last-time-buy to sustain future production over the commercial product life time.

- Products sold in very low volume only, and few of the special ICs will be used: one or two in some of the boards. ICs are customer specific and produced in small quantities, often in one production run. Some of the ICs are no longer available after some years, making it impossible to shift them to lead-free versions. Users are forced to buy big stocks at once for the supply of the coming years, and sometimes make a last-time-buy to sustain future production over the commercial product life time. Over the year 2004, the applicant made a last order for the current generation of products that will provide continued supply of these components for the remaining commercial life of these products that should end by the end of 2007. Suppliers continue advising the applicant to make last order on additional components for which there is no technically viable replacement. The applicant intends to place the last order by end of March 2006.
  The redesign of non-compliant IC's suitable for use in a next generation product typically requires 24-36 months. Integration in a product typically requires 6-12 months after the availability of samples of the new IC. In 2003, the applicant started developing and initiate component classification for RoHS compliance. Many component

manufacturers were not aware of the RoHS directive and very few components were classified. Even in 2005, still manufacturers were encountered whose components are not compliant. In some cases lead-free components are not currently available, and until they are, prototyping or manufacturing is not possible. There are also components as referenced in this exemption request that will never be RoHS compliant so that this exemption is required. Fully RoHS compliant designs are in process for the next generation of equipment due to be released within the next 2-4 years.

- The applicant argues that a major problem on the way to RoHS compliance has been that there was a lack of clarity in the directive. Until last year many component vendors (our suppliers) could not tell whether or not their parts were compliant or not, let alone announce plans for RoHS compliant replacement parts, or be able to provide sample parts to prove the transparency of these new parts when run through new lead free assembly processes. In other cases, manufacturers outside Europe were either not aware of the ROHS Directive, or misunderstood the requirements applying to their components. Once the requirements were clarified, the flow of information in the supply chain sped up significantly, but even today there are shortages of RoHS compliant parts to build fully compliant designs. For many of our suppliers the process has been extremely difficult, mainly due to the significant changes and verification required for each component:

Legislative RoHS schedule versus long product life times

- There is a discrepancy between the way the RoHS legislation has been set and the long cycles of the specific professional products industries. By contrast, it's comparatively easy for consumer products using standard components in high volumes and having a commercial cycle of 6 to 12 months to manage their transition according to the timing imposed by RoHS, however it is quite unrealistic for special professional products.
- The discussions on important details of the RoHS Directive implementation made the situation difficult for a long-term business like the TV broadcasting equipment business.

Economic impacts

- The existing resources for developing new products are inevitably limited and it's impossible to redesign all these products in a couple of years. This is even more critical considering the number of SMEs active in this field in EU.
- Re-design and re-engineering of the equipment just for RoHS compliance of these ICs is too expensive.

Environmental impacts

- Discarding such ICs and modules will generate unnecessary waste as it will just happen sooner rather than later. It would generate more waste since a number of other components or assemblies involved in the same product will be also need to be discarded.
- These types of very specific professional equipment are commonly offered for sale on the used equipment market after their first service life (often several times).
- Finally, at the product's end-of-life it will be taken-back under the WEEE directive. At that time it will be carefully disassembled, ICs and valuable components are recovered, tested and reused or recycled. So, in the end, no RoHS controlled substances are expected to enter the environment as waste.
- Another environmental aspect of the case is the fact the alternate solutions for soldering are not exempt of environmental problems. Comparative Life Cycle Analysis are showing the environmental benefit of the standard alternate solutions (like Sn-Ag-Cu) is not always obvious. This further reduces the relative impact of the expected exemption. The recovery approach as described above is in fact a much more effective measure.

6.5.3 Critical review of justification and arguments

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

The applicant, manufacturer of professional broadcasting equipment, requests this exemption in order to

- be able to repair equipment put on the market before the RoHS deadline July 2006 AND equipment put on the market after the deadline July 2006, if the exemption is granted. The use of non-RoHS-compliant components for the repair of equipment put on the market before July 1, 2006, is already exempted. However, this is not the case for equipment put on the market after the deadline.
- be able to upgrade customers' exitisting equipment with new modules and functions as long as they want to use this equipment. This requires software and also hardware upgrades. If these upgrades are impossible, the equipment will have to be scrapped, or customers and in consequence the manufacturers will have severe disadvantages. The applicant says that
  - the low volume of specific components makes a RoHS-compliant component redesign impracticable for existing products.
  - the long-term product re-design cycles of up to 3 years, the long commercial life time of 5 to 10 years and more make re-design not viable in order to be in line with the RoHS deadline.

According to the Commissions FAQ document[3], the upgrade, like the repair, of equipment put on the market before July 2006 is possible with components that are not RoHS compliant: *"The use of non-RoHS compliant material in electrical and electronic equipment (EEE) products put on the market before 1 July 2006 for the purposes of capacity expansion and/or upgrade is allowed in principle provided that the EEE is not put on the market as a new product. If after the capacity expansion and/or upgrade the EEE is put on the market as a new product it should comply with the RoHS directive. However, if after capacity expansion and/or upgrade the EEE is put on the market as a reused product, the ROHS Directive does not apply."*
The requested exemption is therefore not required to upgrade products put on the market before July 1, 2006.

- be allowed to put new non-RoHS compliant products on the market after the deadline July 2006. The aplicant claims he has to make long-time and last-buy-orders and now wants to use up all these components in production until the next generation of re-designed equipment is available for the market. Additionally, products are designed for long commercial life times of 5 to 10 years and more. Being RoHS-compliant would thus interrupt the commercial life of products designed for these long commercial lifes. In this sense, compliance is not a problem for consumer electronics with short re-design cycles according to the applicant.
  Technically, the ICs in the focus can be produced RoHS compliantly. Some of the component suppliers do not want to change the existing components in order to be RoHS compliant, according to the applicant. On the other hand, the applicant says that the component and module suppliers would produce RoHS compliant components, if he himself or his suppliers had redesigned the components for a new product generation. RoHS compliance thus becomes a question of a timely re-design of the components and modules considered in the exemption request.
  The applicant, like any other producer of EEE, must be expected to align and coordinate his component and product redesign in order to be ready for the deadline July 2006. Underlying redesign times of customer specific ICs of up to 36 months and integration times into the PWB of up to 12 months, the total redesign time of up to 48 months hampers achieving RoHS compliance of such components. In 2002, component manufacturers could not yet offer RoHS compliant components. So there is an issue of technical impracticability of RoHS compliance for such components.
- The applicant claims that details of the RoHS directive, in particular the definition of the threshold value for the banned substances, has only be inserted into the legislation in

[3] http://europa.eu.int/comm/environment/waste/pdf/faq_weee.pdf

August and Oct. 2005 (2005/618/EC, 2005/717/EC and 2005/747/EC). He claims that before he did not have enough legal security in order to start the re-design of the customer specific or single source ICs. The applicant mentions the consumer electronics industry with its short product and redesign cycles, which make it easy to comply with the RoHS Directive, in opposite to his own business conditions. However, it must be severely doubted that the consumer electronics industry would have been able to comply if they had started the redesign of their products or complex parts thereof in August 2005. The argument with this deadline is therefore not acceptable.

The applicant says that he could not start the redesign in time due to the limited availability of RoHS compliant components, the lack of clear transition deadlines of components to RoHS conform versions, and the lacking awareness of component manufacturers outside the EU. However, these are generally observed problems in the transition process and each producer of EEE has to handle it. This may be a more complex task considering the longer design cycles and the discontinuous production of these components. The applicant will have to show that his own design cycles and the alignment with the component manufacturers and suppliers made it impracticable to finish the redesign in line with the RoHS requirements.
Meanwhile, the applicant himself has reduced the deadline for his exemption requests to the end of 2007. It remains unclear, why the applicant asks for an exemption for the display modules of up to 100 cm^2 in his proposed exemption wording, while in the exemption request he says that these displays are smaller than 50 cm^2.

- Environmental Aspects
  - The applicant stresses the fact that the components are available and should be used. If the exemption is not granted, they become waste prematurely causing environmental burdens. This burden, however, can be reduced as the components can be used for upgrades and repair, and for products brought on the market outside the geographical scope of the RoHS Directive. Furtheron, the environmental burden does not arise from the use of substitutes, but from logistical imbalances. Here as well, any other manufacturer may experience similar problems, although they may be more severe due to the low volumes of components involved and the single order policy of the component manufacturers.
    The applicant says that this equipment will be taken back at end-of-life and will be disassembled, re-used and recycled. If this happens, it certainly reduces the environmental impact of lead. It must be stated, however, that the RoHS Directive does not allow an exemption just because the possible impact of the banned substances is mitigated, but clearly makes provisions for the substitution as long as the substitutes themselves do not cause more adverse impacts than the materials or

technologies, which they substitute. A reduced environmental impact of the RoHS-banned substances thus does not justify an exemption under the criteria of article 5 (1) (b) of the RoHS directive as long as it is not clear that the substitutes do not cause more adverse impacts than using the banned substances.

6.5.4 Final recommendation

A final recommendation is not yet possible, but it can be outlined based on the information available.

The consultants sent several questions to the applicant in several rounds. The applicant still owes the answers to two important questions. The applicant was asked:

- Please show how your design cycles are linked to the offers of the component suppliers. How far in advance could you start the redesign of your products, before the component manufacturers offered RoHS-compliant products?
- Please provide a list that allows an unequivocal identification of the ICs and modules you want to have exempted including a written confirmation from each manufacturer that these components and modules will not be available in RoHS compliant versions in time for the RoHS deadline.

The exemption is not necessary to repair and upgrade existing equipment put on the market before July 1, 2006. The RoHS directive in this case does allow the use of components that are not RoHS conform.

The use of these non-compliant components and modules for new equipment after July 1, 2006, is not in line with article 5 (1) (b) of the RoHS directive. There are no technical or scientific reasons for this exemption. All items can be produced RoHS compliantly.

Problems arise with the specific conditions of the professional broadcasting equipment business. Low volumes of components and modules and the resulting single source and single and last buy conditions, combined with long redesign cycles may result in the situation that the timely redesign of all equipment in line with the deadline of the RoHS directive may become technically impractical.

In case the applicant can plausibly show this and provides the required list of components and modules, the exemption could be granted for these ICs and modules.

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

6.6.1 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 tin 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. 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 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.

6.6.2 Summary of justification for the exemption

6.6.2.1 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 total shipments and amount of lead contained in finished assemblies is very small (please refer to item 1 above for specific amounts). 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

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.

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.

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

The following questions arise from the applicant's information:

1. The amount of lead you indicate only refers to your products or to all products sold in the EU?
2. Selective and/or manual soldering are the normal ways to solder temperature-sensitive components after the wave or reflow process. Please explain in detail why this is not a viable option for you to facilitate the use of lead-free solders.
3. ASIC manufacturers produce RoHS compliant components if the products and ASICS are redesigned for a new product generation. Why did you not start the redesign of products including single source and/or customer specific components in order to be ready for the RoHS deadline with new, RoHS compliant products?

Any exemption must be as application specific as possible in order to avoid misuse and to allow proper monitoring and control. We therefore propose the rewording of the exemption as follows:

Use of lead in tin-lead solders for the attachment of customer specific and single source components, as specified in an attachment, in the manufacturing of professional audio equipment to printed wiring boards until *deadline x*.

4. Please specify and justify an appropriate deadline including adequate evidence that the exemption will be necessary until then.
5. In case selective soldering or other means are not appropriate, please provide a list of all components, which you want to solder to the PWB with SnPb solders after the deadline. The listing 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 manufacturers that they will not offer RoHS compliant versions of these components

6.6.3 Final recommendation

Due to the fact that the above mentioned additional information is not available a final recommendation is not yet possible.

7 Further proceeding

The focus for the forthcoming work will lie on the closure of final recommendations of requests from set 2.

As described above the focus of the further evaluation work for set 3 will lie on the extensive and thorough analysis of the LTB issue in order to give consistent recommendations. Nevertheless, there might be need for a common agreement with the Commission on the way forward with a view on the discussion in section 5.

Regarding request 12 and 15 a meeting with applicants and stakeholders having commented on these two requests will be scheduled soon in order to get to a consistent view concerning possible changes in the already existing exemption no. 8 in the RoHS Annex.