

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

Contract

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1 Background and Objectives

Article 4 (1) of Directive 2002/95/EC on the restriction of the use of certain hazardous sub-stances 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 Commission has received (and is still receiving) additional requests for applications to be exempted from the requirements of the Directive from industry. These requests need to be evaluated in order to assess whether they 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 contract consists in a clear assessment of whether the requests for exemptions are justified in line with the requirements listed in Article 5 (1) (b) and in a subsequent recommendation on whether or not to grant the exemption – including a precise wording. These recommendations as well as the description of the proceeding will be included in monthly reports between October 2006 and October 2007.

2 General Procedure

For details on the general procedure please refer to monthly report 1.

3 Scope

On 10 November 2006 the sixth stakeholder consultation round was launched by the Commission and closed on 10 January 2007 (set 6). A seventh stakeholder consultation round was launched on 15 June 2007 and will close on 10 August 2007 (set 7). The requests open for comments of these two consultation rounds represent the scope of this eighth monthly report and of the current and forthcoming evaluation.

Concerning set 6 some stakeholder comments have been posted on the consultation website concerning requests 1, 7, 15, 18, 22 and 23 as well as one general comment. Since for set 7 the consultation has been launched just before issuing this report, no comments have yet been posted on the consultation website.

Table 1 and Table 2 below give an overview over the corresponding sets of requests for exemption and their current status.

Table 1: Overview status of requests set 6

No.	Title	Applicant	Status
1a	Lead used for shielding of x-radiation emissions for CRT	VDC Display Systems	WITHDRAWAL 11/12/06
1b	Hazardous materials and lead in solders in components and assemblies used in non-consumer products	VDC Display Systems	WITHDRAWAL 11/12/06
1c	Electronic equipment where reliability, durability and longevity of the equipment is paramount	VDC Display Systems	WITHDRAWAL 11/12/06
2	Lead as soldering alloy in high performance communication electronic board and hexavalent chromium (Cr-VI)	Clarity SAS	WITHDRAWAL 18/12/06
3	GemCore 410 EMV	Gemplus	Recommendation given in monthly report 6
4	SAVBIT solder	Roband Electronics PLC	Final clarification with applicant in progress.
5	Sn-Pb soldering used in Ground-based Aeronautical Communication Equipment Manufacturing	Telerad	Recommendation possible (cf. section 5.1)
6	Transducers used in professional loudspeaker systems, using tin-lead solder	Gemini Sound products Corp.	Recommendation given in monthly report 5.

No.	Title	Applicant	Status
7	Tin-lead solder in the manufacture of professional audio equipment	Gemini Sound products Corp.	Recommendation given in monthly report 5.
8	Inventory of special ICS having tin-lead solder on/in leads/balls, used in specialist/professional equipment	Gemini Sound products Corp.	WITHDRAWAL 02/01/07
9	Crystal Stones within the battery operated watch	Zeon Ltd.	WITHDRAWAL 10/01/07
10	EEE used for the broadcast and homeland security sector	Tieline Technology	WITHDRAWAL 26/2/07
11a	AM186ES-V40 containing lead in used in the leads over plating and AM79C961AKC containing lead in used in the leads over plating	Digigram	Recommendation given in monthly report 6
11b	Audio board manufacturing process	Digigram	Withdrawal probable. Final clarification with applicant in progress.
12	Cadmium sulphide or cadmium selenide in polymer based thin film transistor	Silk Displays Inc.	Scope issue clarified – evaluation to be finalised by monthly report 9
13	Lead used in the soldering for surface finishing at the electric pole terminal on the electronic parts	ICOM Incorporated	Recommendation given in monthly report 7.
14	Cadmium contained in the cadmium oxide of a thick film ceramic substrate	ICOM Incorporated	WITHDRAWAL 15/06/07
15	All electronics assemblies using lead in solder	RoHSUSA Inc	Final recommendation given in monthly report 3.
16	Lead in electric overblankets for Hot Spot detection	Beurer / Especialidades Eléctricas Daga S.A.	Final recommendation given in monthly report 5.
17	MPC10 used in automatic vending machines to achieve the payment by card	Sagem monetel	Recommendation given in monthly report 7
18	Hexavalent Chrome Cr-VI when used as a passivate	Amphenol Limited	Recommendation given in monthly report 7

No.	Title	Applicant	Status
19	Lead contained in circuit boards, obsolete and non-compliant Intel 80c188/86 EA\XL microprocessors, Analog Devices ADMC300 DSP, and NEC uPD7101 DART and hexavalent chromium	NBS Technologies Inc.	Clarification on inclusion into RoHS scope still in process with applicant.
20	Component used in the manufacture of electric blankets and heating pads	Thermocable (Flexible Elements) Limited	Final recommendation given in monthly report 5.
21	Request to delete exemption for "Lead as impurity in RIG (rare earth iron garnet) Faraday rotators used for fibre optic communications systems	Integrated Photonics	Recommendation given in monthly report 6
22	Lead in Trimmer Potentiometer elements	Tokyo Denshi Ltd.	Questions sent out 7/5/2007. Answers received 14/06/2007. Evaluation and further clarification in progress.
23	Cadmium in opto-electronic components	Marshall Amplification plc	Questions sent out 7/5/2007. Answers not yet received. Evaluation and clarification with stakeholders in progress. Overlapping with set 7 no. 4.

Table 2: Overview status of requests set 7

No.	Title	Applicant	Overlapping
1a	Extension of Exemption #21 as listed in Annex 1 of 2002/95/EC	ELCF	Overlapping with former request (set 1 no. 2b; cf. monthly report 3 of former contract)
1b	Lead in silver rings on the exterior lamp surface of induction-type fluorescent lamps	ELCF	Overlapping with former requests (set 1 no. 13 – 17; cf. monthly report 2 and 4 of former contract)
2	Use of mercury in plasma displays	Babcock	Overlapping with former request (set 4 no. 23) and exemption in force (entry no. 24)
3	Cadmium in photocells for accurate control of lighting equipment	Silonex	Overlapping with former request (set 1 no. 21; cf. monthly report 5 of former contract)

No.	Title	Applicant	Overlapping
4	3 year grace period on the use of cadmium-based photoresistors used in professional audio equipment, for the purpose of investigating suitable alternatives and redesigning audio products accordingly	Sound Devices	Overlapping with former requests (set 4 no. 5 and set 6 no. 23; cf. final report of former contract and forthcoming monthly report)
5	RELOCK FUSE, Model X-09, High Security Electronic lock	Kaba	Overlapping with former request (set 3 no. 12; cf. monthly report 9 and final report of former contract)
6	Lead in glass housing of high voltage diodes	Vishay	Overlapping with former request (set 1 no. 2b; cf. monthly report 3 of former contract)
7	Cadmium and cadmium oxide in thick film pastes used on beryllium oxide substrates	Apex	Overlapping with former request (set 4 no. 1; cf. final report of former contract)

4 Results

Questions have been sent out to all applicants of set 6. Due to sometimes complex technical issues evaluation of the remaining open requests is not yet finalised. 6 requests remain open for recommendation but will be finalised by monthly report 9; except for one (no. 23) which is overlapping with request no. 4 of set 7. Evaluation of these two requests will be done in parallel in order to ensure a consistent recommendation. One more withdrawal was handed in (no. 14) making it 8 in total.

Concerning the newly launched consultation on set 7, no questions have been sent out to applicants yet. Requests have in a first step been analysed with regard to overlapping issues. As a result it came out, that most of the requests have a direct link to former requests and will thus be evaluated in that light.

5 Recommendations

5.1 Use of lead in solders for ground-based aeronautical communication equipment - Telerad (set 6 request no. 5)

5.1.1 Description of requested exemption

The applicant is specialised in the manufacturing of high-tech radio communication systems used in ground-based aeronautical communications (both civil and military). The applicant manufactures and markets products designed by its own research and development laboratories.

The applicant requests an exemption for lead, which he uses for Sn62Pb37Ag2 solders in its equipment involved in the control, the supervision and the safety of flights. The effective quantity of lead used for brazing in the applicant's premises is lower than 2 kg per year in Europe.

The proposed wording of the requested exemption is as follows:

Use of lead in solders applied in ground based aeronautical communication equipment

5.1.2 Justification for exemption as submitted by applicant and stakeholders

The applicant says that his products have life spans up to several decades, running 24 hours a day in very hard environmental conditions. The applicant uses an eutectic solder alloy composed of 62 % tin, 36 % lead and 2 % silver for a lot of surface mounted devices (SMD) and thru-hole components. This solder, according to the applicant, has proved its reliability for more than 70 years.

The applicant puts forward that current studies he is aware of do not guarantee the reliability of the solder based on lead-free alloys, especially at medium and long term, for the following reasons:

1. The presence of whiskers can generate electric shortcuts, especially on high density pin integrated circuits like "fine pitch",
2. Low temperature alloys can be damaged (tin pest)
3. Fillet lifting can occur,
4. The increase in brazing temperature decreases the reliability of components and printed circuit boards,
5. The wetting of component connections is significantly lower.

The applicant reasons that he has spent a lot of time to get a better understanding on lead-free solders and realised that there are a lot of issues which have not been solved by the industry so far. For these reasons, he argues, the airborne applications have been exempted from the RoHS Directive. As the applicant's equipment is supposed to communicate with airborne radios, he says that, as lead-free solders would degrade the reliability of his equipment and therefore affect the reliability of the air-ground communications, his products should be allowed the continued use of lead in solders.

Some old electronic components that the applicant still uses are not RoHS-compliant and remain irreplaceable without a complete re-design and re-qualification of the concerned equipment (CE marking and approval by the relevant authorities). The applicant says that the small quantity of products sold and their diversity would make it impossible to amortise the costs.

Moreover, the applicant reasons that it is usually mandatory to guarantee the supply of additional equipment 15 to 20 years after the contract has been awarded. This represents quite a stringent constraint.

Additionally, the applicant says that communication equipment in airplanes is not within the scope of the RoHS Directive for safety reasons, due to the lack of reliability of lead-free solders. As his equipment is supposed to communicate with the respective equipment in airplanes, he says that for safety reasons his ground-based aeronautical communication equipment must be allowed to continue the use of lead in solders as well.

In view of these considerations, the applicant claims that without the requested exemption he has no solution to carry on manufacturing his products at the same level of safety as it currently is for both civil and military flights.

In summary the applicant's arguments are as follows:

- Technical arguments (long-term reliability of lead-free solders)
- Last time buy issues (components produced in small quantities where a re-design is not feasible)
- Long-term uninterrupted supply of additional equipment

5.1.3 Critical review of information as submitted by applicant and stakeholders

Clarification of scope

Aeronautical ground-based communication equipment might be considered as aeronautical equipment, which is not within the scope of the RoHS Directive. The applicant was sent the Commission's FAQ-document with some additional hints and was asked to clarify this question. The applicant decided to keep up his exemption request. The applicant's products are therefore assumed to fall under category 3 (information and communication equipment) of the WEEE Directive, which is within the scope of the RoHS Directive.

Technical arguments (reliability of lead-free solders)

The applicant argues that the long-term reliability of lead-free soldered electrical and electronic devices is unproven. Admittedly, there is a lack of experience concerning the long-term-reliability of lead-free solder joints. There is, however, no proof that these solder joints cannot suffice the medium- and long-term reliability requirements. Thus, there is a certain risk, but no proof that the substitution of lead is technically or scientifically unpractical in long-term reliability applications.

The applicant maintains that whiskers are a reliability constraint in lead-free solder joints. The existing exemption no. 23 in the RoHS Directive for the use of lead-containing finishes on fine pitch component pins with pitches of 0.65 mm and less meets the concerns about whisker risks in fine pitch applications. The applicant did not submit evidences that whiskers are a general reliability risk or a risk in fine pitch applications with pitches of more than 0.65 mm. The existing exemption must be considered as sufficient to exclude the risk of whiskers and a general exemption for the use of lead to prevent whiskers is not justified.

Fillet lifting and different wetting behaviour are well-known issues in the context of lead-free soldering. The proper adaptation and optimisation of the printed wiring board designs, the soldering temperatures and the soldering profiles in the manufacturing phase, however, can reliably solve these problems or mitigate them to a manageable degree. There is no evidence that lead-free soldering is scientifically or technically impracticable for long-term reliability applications because of these issues.

The applicant says that tin-pest occurs in lead-free solders and that he cannot use them as this would put in danger the reliability of his products. He did, however, not submit any evidence that this effect actually makes the use of lead-free solders technically impracticable for the long-term reliability of lead-free solder joints.

The temperature compatibility of electrical and electronic components is a general issue related to lead-free soldering as well. The components must be qualified for the higher soldering temperatures in lead-free soldering in order to guarantee their reliability. Component manufacturers offer such components on the market meanwhile. There is no reason to generally assume that the higher soldering temperatures result in an insufficient reliability of the components. In case specific components cannot be processed with higher soldering temperatures and alternatives are not available, the applicant should ask for an exemption in particular for such components.

Upgrades and Repair of Equipment

The applicant states that he has to provide additional equipment 15 or 20 years after the first delivery. The RoHS Directive allows the use of non-RoHS compliant components for repairs and upgrades of equipment that was brought to the market before 1 July 2006. Repair and upgrade obligations for this equipment thus cannot be a reason for a generally continued use of lead in solders and finishes in this context.

Equipment brought to the market after the deadline 1 July 2006 must be RoHS-compliant. The long-term supply for repair and upgrade of such equipment will thus have to take place with RoHS compliant components. Manufacturers have to adapt their supply strategy accordingly.

Last time buy issues

The applicant points out that he has to use some non-RoHS compliant components as their replacement would require the re-design of his equipment, which would be too expensive. Article 5 (1) (b) does not indicate economical impacts as a reason for an exemption.

Safety issues

The applicant stated that his communication equipment is only used in ground-based aeronautical communication for both civil and military uses. It is comprehensible that this area is safety sensitive. Explicit military applications as well as aeronautic applications have been excluded from the scope of the RoHS Directive. However, the applicant considers his equipment to fall under the scope of the Directive since it is ground-based. It is also comprehensible that ground-based equipment that is needed for the safe functioning of either military or aeronautical equipment should have the same level of safety.

The critical review of safety issues is therefore twofold:

1. The argument that lead-free solders are technically not practicable in the applicant's equipment and that they per se endanger a safe functionality is not justifiable
2. Safe functioning of aeronautic equipment is crucial and it is justifiable to ensure that via equipment with maximum known reliability.

The second point cannot be evaluated. Full in-depth information and knowledge on the remaining risks when using lead-free solders in long-term reliability applications compared to lead-containing solders is not available. Although there is no evidence that lead-free solder joints cannot suffice the long-term requirements of ground-based aeronautical communication equipment, there is a certain risk of failures due to the missing long-term-experiences with lead-free solder joints, which might have safety implications...

Safety issues could be taken into account through an exclusion of the equipment from the RoHS Directive, arguing that it belongs either to the category of military equipment or to

aeronautical equipment, as long as it is specifically produced for these application sectors (see the Commissions FAQ-document). The applicant had assured that his equipment is only used in military and aeronautical ground-based communication.

If the above exclusion from the scope of the RoHS Directive is not feasible, the applicant's technical arguments do not allow an exemption based on article 5 (1) (b) of the RoHS Directive.

5.1.4 Final recommendation

Concluding on the above mentioned arguments, it is recommended not to grant this exemption. The applicant's technical arguments are not in line with the requirements for an exemption according to Article 5 (1) (b) of the RoHS Directive. The argument of safety critical issues cannot be evaluated.

5.2 Cadmium contained in the cadmium oxide of a thick film ceramic substrate – ICOM (set 6 request no. 14)

The applicant produces communication equipment for professional, amateur, marine, avionics and other uses (<http://www.icom.co.jp/world/index.html>). He asked to exempt cadmium used as cadmium oxide in a thick film on aluminium oxide ceramic substrates.

5.2.1 Description of requested exemption

Cadmium is used as cadmium oxide in thickfilm ceramic boards in the applicant's products. Cadmium allows the integration of homogenised gold and copper in the paste. If this integration is not homogeneous, the gold or copper content does not satisfy the electrical properties.

The use of cadmium oxide from April 2006 to March 2007 was 576 mg in the applicant's products. The cadmium content in the thickfilm paste is clearly above 0.01 %, which would be the threshold limit for the maximum allowed content in the homogeneous material (thickfilm paste).

The applicant cannot provide data on the total use of cadmium worldwide or in Europe in this application.

The proposed wording of the applicant is:

Cadmium as cadmium oxide in thick film pastes for use on aluminium oxide ceramics

5.2.2 Justification for exemption as submitted by applicant and stakeholders

The applicant in the beginning of the exemption request evaluation already said that appropriate RoHS compliant thickfilm pastes have been available for a while. The applicant was about to develop new products, but he argued that he needed one or two years to

qualify the paste for his applications in order to guarantee the necessary paste characteristics and product reliability. The applicant also had put forward that the production cost of the ceramic board will be three to four times higher with the RoHS-compliant thickfilm paste.

5.2.3 Critical review of information as submitted by applicant and stakeholders

The contractor asked the applicant about the details of the time plan for RoHS compliance: when the RoHS compliant thickfilm paste had been available, when he had started his efforts to achieve RoHS compliance etc. After this first round of questions, the applicant stated that his efforts to apply the RoHS-compliant thickfilm paste in his products meanwhile are successful. On 15 June 2007, he confirmed that his exemption request therefore has become obsolete and officially withdrew it via e-mail notification.

5.2.4 Final recommendation

The exemption request has become obsolete. The applicant stated that he has a RoHS compliant solution and officially withdrew his exemption request.

6 Further proceeding

The next step will be to finalise open requests of set 6. Furthermore, questions will be sent out to applicants of set 7 and a first clarification and evaluation will take place.

The next monthly report is scheduled for 24 July 2007.