Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

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

Monthly Report 3
- final version -

Freiburg, 21 November 2005

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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 the second monthly report final recommendations could be given for some of the requests from set 1[1]. This report covers the remaining open requests of set 1 (see Table 1 below). Furthermore, an overview of the scope of set 2 is given in Table 2 below. After the third consultation round had ended on 28 October 2005, the requests and corresponding documents were subject of a first screening (see Annex 2: Overview documents set 2).

Table 1: Overview status quo requests set 1

No	Title of group	Current status
1	Lead in tin whisker resistant coatings for fine pitch applications	Final recommendation possible for request 1_a and 1_d (see section 5.2 and 5.5). Request 1_b is close to final recommendation; minor clarifications still necessary (see section 5.3). Request 1_c has been withdrawn (see section 5.4).
2	Lead bound in glass, crystal glass, lead crystal or full lead crystal in general	Final recommendation possible for requests (see section 5.6 and 5.7).
3	Chromium (also in oxidation state (VI)) and Cadmium as colouring batch addition each form up to a content of 2 % in glass, crystal glass, lead crystal or full lead crystal used as decorative and / or functional part of electric or electronic equipment	
4	Solders containing lead and/or cadmium for specific applications	Request 4_a is close to final recommendation (see section 5.8). Final recommendation for request 4_b has already been given in the second monthly report. Request 4_c has been withdrawn by the applicant (see section 5.9).

[1] For a detailed description of the scope of set 1 please refer to the first monthly report.

No	Title of group	Current status
5	Hexavalent chromium (CR VI) passivation coatings	Final recommendation possible (see section 5.10).
6	Lead in lead oxide glass plasma display panels and other technology large-sized flat display panels	Close to final recommendation; because of overlapping issues scheduled for next report. Meeting with industry has taken place (see section 5.11).
7	Lead in connectors, flexible printed circuits, flexible flat cables	The request has been withdrawn by the applicant (see section 5.12).
8	Lead oxide in lead glass, bonding materials of magnetic heads and magnetic heads	The request has been withdrawn by the applicant (see section 5.13).
9	Cadmium as doping material in avalanche photodiodes (APDs) for the optical fiber communication systems	The request has been withdrawn by the applicant (see section 5.14).
10	Lead in optical isolators	Final recommendation possible (see section 5.15).
11	Lead in sheath heater of Microwaves	The request has been withdrawn by the applicant (see section 5.16).
12	Cadmium pigments except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to the restriction on the marketing and use of certain substances	Final recommendation given in second monthly report.
13	High Intensity Discharge (HID) lamps for professional U.V. applications, containing lead halide as radiant agent	Final recommendation given in second monthly report.
14	Discharge lamps for special purposes containing lead as activator in the fluorescent powder (1% lead by weight or less)	Final recommendation given in second monthly report.
15	Discharge lamps containing lead in the form of an amalgam	Final recommendation given in second monthly report.
16	Mercury free flat panel lamp	Final recommendation given in second monthly report.
17	Special purposes Black Light Blue (BLB) lamps, containing lead in the glass envelope	Close to final recommendation. Need for clarification.
18	Low melting point alloys containing lead	Final recommendation given in second monthly report.
19	Galvanised steel containing up to 0.35% lead by weight and aluminium with an unintended lead content up to 0.4% lead by weight in electrical and electronic equipment	Final recommendation given in second monthly report.

No	Title of group	Current status
20	Lead in solder and hexavalent chromium in surface treatment, in parts recovered from production printers and copying equipment, sold, rented or leased or otherwise returned from professional users other than private households, originally put on the market before 1 July 2006, and reused for the same purpose within the original manufacturer's closed loop system until 1 July 2011. ….	Final recommendation given in second monthly report.
21	Cadmium sulphide photocells	The request has been withdrawn by one of the applicants; need for clarification concerning other applicants

Table 2: Overview requests set 2 to be reviewed

No.	Title	Applicant
1	Mercury in switches	Pickering
2	Special ICs having tin-lead solder plating on leads used in professional equipment	Thomson
3	Specific modular units including tin-lead solder being used in special professional equipment	Thomson
4	Solders containing lead and /or cadmium for specific applications where local temperature is higher than 150 deg C and which need to work properly more than 500 hours	Schlumberger
5	Lead in solder for printed circuit boards for emergency lighting products	LIF
6	Hexavalent chromium (Cr-VI) in chromate conversion coatings as surface treatment	Circuit Foil
7	Lead in gas sensors	Dräger
8	PbO (Lead in Seal Frit) used for making BLU (Back Light Unit Lamp) for LCD televisions	Samsung
9	Cadmium in opto-electronic components	TESLA
10	Non-consumer mechanical power transmission systems including speed reducers and mechanical couplings which rely on electrical/electronic components for safe control and operation	FALK
11	Electrical and electronic components contained in heating ventilating and air conditioning building systems, commercial refrigeration systems and transport refrigeration systems	Carrier
12	Cadmium-bearing copper alloys	Symbol
13	Electrical/electronic components contained mobile and stationary air compressors and vacuum systems, compressed air contaminant removal systems and pneumatic contractor’s air tools	Sullair

No.	Title	Applicant
14	Electrical/electronic equipmentthat are: used in transport -aviation, aerospace, road, maritime, rail; installed in to the fabric of buildings – elevators, escalators, moving walks, dumb waiters, and heating, cooling and ventilation systems, and fire and security systems; used in the energy generation and transmission; used in mining and mineral processing; used for non-consumer mechanical power transmission systems; industrial process pumps and compressors; used in industrial refrigeration; and used in military applications	United Technologies
15	Lead alloys as electrical/mechanical solder for transducers used in high-powered professional and commercial loudspeakers	Meyer Sound
16	Cadmium oxide	INMET
17	Solder tin of the thermo fuse with a defined low melting point	Stannol
18	Lead in lead oxide glass used in plasma display panel (PDP)	KEA
19	Lead in solder on small PCB and tinned legs of primary components	e2v
20	Use of the not lead free component NEC V25 in the Memor 2000	Datalogic
21	Lead used in shielding of radiation for Non Medical X-ray equipment	l3com
22	Lead based solders sealed or captured within heat-shrinkable components and devices.	SEIP

4 Results

After having met representatives from industry associations and after having gathered more necessary information it was possible to give final recommendations for nearly all requests from set 1.

Only a few requests remain open. This is partly due to overlapping issues with requests from set 2 (e.g. request 6 set 1 with request 19 and request 9 set 2). Where this is the case the consultants decided not to give a final recommendation without having taken both requests into account so as to avoid conflictive results. Nevertheless, final recommendations for these requests are scheduled for one of the next monthly reports.

Some requests are also very complex and need a more thorough assessment than others. For these some more investigations and discussion with applicants and other parties are necessary. These requests will though be dealt with as soon as possible.

As in the first two monthly reports an overview of the evaluation of each of the 33 requests for exemption is given in the checklists annexed to this report. Furthermore a detailed description of the requests ready for final recommendation is also given 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 (see section 5).

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

5 Status of remaining requests set 1

5.1 General remark

The authors would like to reiterate the following general remark on the use of gold as a substitute for lead in soldering applications: there are hints that the use of gold as a substitute for lead could result in considerably higher environmental impacts. These impacts cannot be assessed since no detailed data or information on this issue was provided by applicants or by any other party. Sound final recommendations would require a deeper investigation into the environmental impacts of gold-for-lead substitutions. From the authors' point of view it should be the common objective of industry and the European Commission to acquire a sound understanding of this problem with consideration to substitution questions as raised in this exemption request. It is therefore suggested that public authorities together with industry commission a study on the environmental and safety effects of gold as a substitute for lead in order to allow publicly available information on this issue.

The following requests could be evaluated with a view to final recommendation.

5.2 Lead in tin-lead finishes of separable fine pitch (<1mm) connectors – FCI (request No. 1_a)

5.2.1 Description of requested exemption

Substance

Lead

Function

Mitigation of whisker growth

Specific application

Tin-lead (90/10) finishes of separable fine pitch connectors

Precise wording

Lead in tin-lead finishes of fine pitch connectors with a pitch smaller than 1 mm

5.2.2 Summary of justification for exemption

Criteria for justification

The preferred lead-free alternative is pure tin - either matte or bright. It is susceptible to whisker formation. Mitigating practices can normally minimize the risk in soldering applications. However, in contact applications, when pure tin is scraped, it generates whiskers in 2 days. Elimination of lead is currently technically impracticable because all the mitigations known are employed prior to actual use. It's the actual use (mating) that generates the whiskers. Consumer goods are failing in field use because of whiskers due to the elimination of lead from the tin-lead finish alloy. Fine pitch applications, due to the narrow spaces between the pins, are at high risk for failures due to whiskering.

Technically, contact surfaces such as gold or palladium are a viable substitute, but are a 100 times more expensive than the tin lead finishes. They are too expensive for the consumer goods market. The total cost of shift to gold plating is indicated with less than around 50 Mio. Euro.

Next to the cost increase, the move to gold plating types is often very difficult to implement in assembly operations. The majority of these connectors are solder to board, using reflow of wave solder processes. The small dimensions of the terminals often do not allow selective plating. As such terminals are plated all-over with the same type of plating. This implies that also the solder terminals will be plated with gold. The solderability of gold is less then for Sn-based plating and as such reliability issues can be created. Besides this, there are no other reasons why gold type plating could not be used as an alternative for Sn based plating. Gold is an excellent plating to provide very reliable interconnects.

The exemption request covers around 7.000 t (metric) of lead used in this type of fine pitch connectors in Europe.

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

The applicant himself mentions gold as a technically viable alternative. The cited cost reasons cannot be taken into account in this review process. As JEITA and JBCE have withdrawn their similar or identical exemption requests accepting gold as a viable substitute the cited problems with gold plating can be considered to be able to be overcome.

5.2.3 Final recommendation

This exemption should not be granted since no argument in line with article 5 (1) b against the available substitute could be provided by the applicant.

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

5.3.1 Description of requested exemption

Substance

Lead in tin-lead finishes with less than 20 mass-% of lead

Function

Mitigation of whisker growth

Specific application

Finishes on fine pitch components with a pitch of less than 0.65 mm

Precise wording

Lead in tin-lead finishes with less than 20% Pb on fine pitch components with a pitch of 0.65 mm or less

5.3.2 Summary of justification for exemption

Criteria for justification

- No long time experience on whisker formation from lead-free finishes
- Whisker mitigation techniques applied by component manufacturers said to be not effective to prevent whiskers
- Nickel-palladium (Ni/Pd) and nickel-palladium-gold (Ni/Pd/Au) technically viable substitutes, but expensive and capacity of suppliers insufficient to cope with demand until July 2006

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

- Even if whisker growth can be observed on whisker mitigated finishes, it is contentious whether the testing conditions, under which these whiskers occurred, are relevant for real-life conditions. More detailed information was not made available in the first questioning round.
- The growth of whiskers does not necessarily imply a real-life reliability problem. Again, the details, backgrounds and conditions have to be cleared, under which the said whisker growths occurred on whisker mitigated surfaces.
- The applicant, without more detailed information, argues with capacity problems for gold containing surfaces on fine pitch components.

- Assuming the capacity problem exists, the use of fine pitch components with whisker mitigated surfaces could mitigate it if they are not inappropriate from the beginning for the use on fine pitch components. These issues and backgrounds of the findings cited by the applicant on whisker formation on whisker mitigated lead-free surfaces needs to be checked.

5.3.3 Final recommendation

A final recommendation is not yet possible due to the necessity for more clarification with the applicant.

5.4 Solder -Lead- plating used on the portion which external stress is impressed – JBCE (request No. 1_c)

This request has been withdrawn by the applicant. The justification given is: the companies concerned will use gold as a short term substitute and in the meantime research on other viable alternatives.

5.5 Lead in tin whisker resistant coatings of Flexible Printed Circuits (FPC), Flexible Flat Cables (FFC) and their connectors – Sony (request No. 1_d)

5.5.1 Description of requested exemption

Substance

Lead

Function

Mitigation of whiskers on finishes of FFC, FPC and their connectors

Specific application

Flexible flat cables, flexible printed wiring boards and their connectors

Precise wording

Lead in tin whisker resistant coatings of Flexible Printed Circuits (FPC), Flexible Flat Cables (FFC) and their connectors with distance between pins <= 500µm

5.5.2 Summary of justification for exemption

Criteria for justification

Lead is necessary to prevent the growth of tin whiskers in particular on components where external stress aggravates the whiskering problem. Respective tests simulating the external pressure result in whisker growth on lead-free plated connectors. The observed length of 500 µm of the whiskers at the growth saturation point by far exceeds the 20 to 40 µm length of whiskers on SnPb-plated connectors under identical conditions. The conclusion is that the use of lead in finishes of FFC, FPC and their connectors is indispensable.

The applicant mentions NiPdAu and NiAu as technical alternatives. There is, however, no experience and they are commercially not available to the necessary extent, as the applicant maintains.
Additionally, the applicant brings forward that the use of gold and palladium containing finishes is impossible as the increased cost is not acceptable for many applications.

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

The applicant himself mentions technically viable alternatives. The cited cost reasons cannot be taken into account in this review process. As JEITA and JBCE have withdrawn their similar or identical exemption requests accepting gold as a viable substitute, the availability of the substitutes on a commercial scale should not be a blocking stone on the way to lead-free finishes on this type of applications.

5.5.3 Final recommendation

This exemption should not be granted.

From the technical point of view, viable substitutes are available for the finishes of FFC, FPC and their connectors, even if there are no long-term experiences for these alternatives. JBCE and JEITA withdrew their identical exemption requests accepting gold as a viable substitute.

5.6 Lead bound in glass, crystal glass, lead crystal or full lead crystal; Cr (VI) and Cd as colouring batch addition in glass, crystal glass, lead crystal or full lead crystal - CPIV/Swarovski (request No. 2 and No. 3)

5.6.1 Requested exemption

The Standing Committee of the European Glass Industries (CPIV) together with the company Swarovski requests an exemption for

1. *“Lead bound in glass, crystal glass, lead crystal in general,*

2. *Chromium (also in oxidation state VI) and Cadmium as colouring batch addition each form up to a content of 2% in glass, crystal glass, lead crystal or full lead crystal,*

used as decorative and/or functional part of electric or electronic equipment."

Full lead crystal glass is used in pure (colourless) or coloured form for decorative and/or functional purposes, e.g. lamps, chandeliers, decoration of mobile covers, watches etc. Lead, cadmium and chromium VI are bonded in the silicate matrix of glass. Depending on the mass of the article the amount of lead, cadmium and chromium VI varies from several milligrams (glass jewellery) to some 100 grams (chandeliers). Full lead crystal consists at least of 28% lead calculated as lead oxide (therefore > 30% lead oxide). Coloured glass (red or green) may contain up to 2% cadmium (red) or chromium (green). In absolute numbers it is estimated that about 145 t/a of lead, 0,275 t/a of Cadmium and 0,025 t/a of Chromium VI are put on the European market with products affected by the RoHS Directive.

The function of the substances in the above mentioned applications are as follows:

- Lead: decorative/optical aspects (e.g. brilliancy, high light transmission, sharp colour transition etc.) and processing aspects (e.g. thermal, mechanical and refinement properties)
- Cadmium: decorative/optical purposes (i.e. very special and pure red colours with unique light absorption)
- Chromium VI: decorative/optical purposes (green colours)

5.6.2 Summary of justification for exemption

The applicant argues that no substitute is available that would replace the substances lead, cadmium and/or chromium VI in all their properties: it is stated that no substitute has the same optical/decorative and processing properties. Substitution of the substances would lead to a loss of the characteristic optical properties. Furthermore, the applicant argues that substituting lead would lead to a need for redesigning of processes and production installations.

A critical review of the information provided by the applicant and by other parties leads to the following results:

- Lead-free substitutes seem to exist for crystal glass even though they might only fulfil some of the properties lead crystal has.
- It is not clear why lead-free substitutes cannot be used for the specific applications from a technical/scientific point of view. There is no apparent need for the applications to contain lead in view of their technical functionality
- The argument of the need to redesign production processes does not mean that a redesign is impossible. At least no founded argument has been brought forward by the applicant supporting the impossibility of redesigning production processes.

- The negative environmental and health effects of substitutes are not clearly stated: "The environmental and health consequences of the use of some […] metal oxides, like BaO, are still a matter of discussion and of possible concern"[2].
- As the use of cadmium and chromium VI appears to be only of decorative/optical nature, there is no argument against a redesign of the applications without adding these substances and thus eliminating their use.
- The high amount of lead used in the mentioned applications compared to other applications in electrical and electronic equipment raises the need to give the applications discussed here a particularly close look.
- The above listed results reflect the view of the consultant which is that in our understanding there is no necessity to use lead, cadmium and/or chromium VI for the technical functionality of the evaluated applications[3].

5.6.3 Final recommendation

Due to the above mentioned results of the critical review of the request for exemption the final recommendation is not to grant an exemption for the use of lead, cadmium and chromium VI in (lead) crystal glass.

5.7 Lead bound in glass, crystal glass, lead crystal or full lead crystal - ESGA/Schott Duran (only request No. 2)

5.7.1 Requested exemption

The European Special Glass Association (ESGA) has requested an exemption for the use of lead and cadmium in enamels on borosilicate glass. The substances are contained in inks printed on borosilicate glass in certain electrical and electronic equipment (for the major part on jugs for coffee makers). The ink is used to print scales, warnings and logos on the glass.

The ink being considered a homogenous material contains between 37% and 48% PbO by weight and up to 11% CdO by weight. For the overall European market this leads to an annual consumption of 32,7 kg Pb and 2,6 kg Cd.

The lead in the ink is responsible for lowering the melting point, thus positively influencing the fusion with the glass matrix, and improving chemical resistance. As part of customer specification and consumer safety, the readability of markings has to be guaranteed for 400

[2] TNO report „Properties of lead crystal versus unleaded glass formulations (IMC-RAP-05-12372/rie), June 2005

[3] E.g. chandeliers, watches, mobile phones etc. do all work even if they are decorated with lead free crystals or non red/green crystals.

dish-washer-cycles. Cadmium together with the lead gives the enamel a good resistance against acids and alkalis as they are used in domestic cleansers Cadmium is thus also necessary to guarantee long-lasting markings.

The request for exemption is required for “lead and cadmium in printing inks for the application of enamels on borosilicate glass”.

5.7.2 Summary of justification for exemption

The applicant argues that there is no substitute for lead and/or cadmium in the ink for printing markings on borosilicate glass. There are lead-free alternatives available but these cannot guarantee the resistance to acids or alkalis. Since the relevant application is used for products that are regularly cleaned in dish-washers the applicant states that no lead-free alternative can be used. Concerning the low melting point function of lead the applicant states that there is no alternative lead-free ink that can be used on borosilicate glass.

In order to clarify potential substitutes the following questions were raised:

- Is it possible to mark the glass with etching/engraving instead of printing?
- Is it possible to use another kind of glass, which would not need lead to lower the melting point of the ink?
- Is it possible to eliminate the marking on the glass completely?

A critical review of the arguments put forward by the applicant as well as of the answers given to the questions above have lead to the following results:

- It is technically possible to substitute marked glass by non-marked glass. However, marking seems to be necessary for the functionality of the application and/or consumer safety in some cases.
- Marking the glass with etching/engraving does not seem to be technically feasible due to cracks and not sufficient resistance to acids and alkalis.
- Substituting the borosilicate glass by another kind of glass which would not require a low-melting point ink does not seem to be feasible since the glass has to meet specific characteristics (e.g. resistance to heat, fast changes between hot and cold filling) which are not met by other glass types.
- There is the theoretical possibility to use lead-free printing inks using other heavy metals such as bismuth. Trials carried out by the applicant do not seem to have lead to useful results and – again according to the applicant – it is only in the long-term (> 10 years) that a workable substitute could be developed.

5.7.3 Final recommendation

Due to the fact that the amount of lead and cadmium used in the application on borosilicate glass is relatively low compared to other applications and that substitutes fulfilling the criteria

for durability of the marking do not seem to exist we recommend granting the exemption using the following wording: “lead and cadmium in printing inks for the application of enamels on borosilicate glass”.

However, since there is an existing option through a change in design for a part of the concerned applications, we also recommend requiring from the applicant to specify the applications for which marking on the borosilicate glass is absolutely necessary for its technical functionality. In case another exemption should be requested after four years it should be limited to those applications. Furthermore, in order to ensure research of lead and cadmium free alternative enamels for the application on borosilicate glass it should be made clear that the exemption granted is only valid for a limited period of time!

5.8 Solders containing lead for specific applications – Syfer (request No. 4_a)

5.8.1 Description of requested exemption

The original wording provided by the applicant is: “Solders used for soldering to machined through hole discoidal and planar array ceramic multi layer capacitors”.

Substance

Lead

Function of the Solder

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

Specific application

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

Precise wording

The proposed, more precise, wording for this exemption is: “Use of lead in solders containing 50 to 60 percent of indium for the soldering to machined through hole discoidal and planar array ceramic multi layer capacitors for EMC discrete filters, filter assemblies and filtered connectors“.

5.8.2 Summary of justification for exemption

Criteria for Justification

Alternative, lead-free solders cause cracking of the ceramic bodies after the soldering process due to thermal mismatch (CTE). The copper alloy pin is mentioned as a main reason for the CTE. Alternative pin materials have been tested, but are not viable substitutes. The alternatives doe not provide suitable resistivity to allow sufficient current flow without excessive temperature rise.

The use of high-melting SnPb solders with more than 85 % of lead is a viable substitute. As this substitute would increase the amount of lead used in this application as well as the energy consumption and would require new soldering equipment, this alternative is not considered to be in the spirit of the RoHS Directive.

Alternatives therefore do not exist and an exemption is required for this use of lead.

Critical Review on Data and Information (given by applicant or other parties)

The above mentioned arguments presented in the exemption request are plausible. However, after further inquiries with the requesting company, there is a hint that for some applications in filtered connectors mechanical contact 'spring clips' could be an alternative. It is under investigation with the applicant, for which applications this alternative exactly is suitable.

Additionally, a further alternative came up which some of the applicant’s competitors might consider to use. The applicant, however, claims to have evidence that this alternative is not viable. The applicant considers this information a competitive edge over his competitors and therefore wants it to remain confidential. It was pointed out to the applicant that confidential information cannot be the base of a final recommendation about his request. The applicant was asked to reconsider the confidentiality of this information and, in case he will give it up, give evidence of why the respective alternative is not viable. There is no answer yet, and the final recommendation will be postponed until the answer is provided or, if the deadline for an answer is over, be decided based on the available information.

5.8.3 Final recommendation

A final recommendation is not yet possible due to the maintained confidentiality of the applicant’s arguments against existing alternatives. As mentioned above a final recommendation will either be given on the basis of publicly available information or – after a definite period of time – on the basis of the information available to the consultants.

5.9 Solders containing lead and / or cadmium in the thermal element of thermal cutoffs – JBCE (request No. 4_c)

This request has been withdrawn by the applicant. The justification given is: the companies concerned will adapt the functionality of the products concerned and will redesign it for the European market.

5.10 Hexavalent chromium (CRVI) passivation coatings – HP (request No. 5)

5.10.1 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

5.10.2 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.

5.10.3 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.
- The exact wording recommended thus being:

  “Hexavalent chromium in passivation coatings until 1 July 2007“

5.11 Lead in lead oxide glass plasma display panels and other technology large-sized flat display panels – JBCE/JEITA (request No. 6)

This request has great similarities with request No. 19 of set 2 (“Lead in lead oxide glass used in plasma display panel (PDP)”). Due to this overlapping of requests a final recommendation can only be given after having considered both requests in parallel.

A meeting with industry has already taken place concerning request No. 19 of set 2. The evaluation of this request will take place consequently thus leading to a consistent recommendation for both requests. Therefore no final recommendation for request No. 6 from set 1 is given at this stage.

5.12 Lead in connectors, flexible printed circuits, flexible flat cables – JBCE (request No. 7)

This request has been withdrawn by the applicant. The justification given is: The companies concerned will use gold as a short term substitute and in the meantime research on other viable alternatives.

5.13 Lead oxide in lead glass, bonding materials of magnetic heads and magnetic heads – JEITA (request No. 8)

This request has been withdrawn by the applicant. The justification given is: JEITA had handed in a comment on this issue during first stakeholder consultation but somehow claims not to have to have commented the requests of the second stakeholder consultation. This is the reason given for not supplying any additional information possible substitutes to the consultants. JEITA has consequently withdrawn its request for exemption.

5.14 Cadmium as doping material in avalanche photodiodes (APDs) for the optical fibre communication systems – JBCE/JEITA (request No. 9)

This request has been withdrawn by the applicant. The justification given is: due to the published maximum concentration values for cadmium, both JBCE and JEITA have decided to withdraw their requests since the quantity of cadmium contained in APDs is clearly lower then the level defined in the maximum concentration values.

5.15 Lead in optical isolators – JEITA/Sumitomo (request No. 10)

5.15.1 Requested exemption

JEITA (Japan Electronics & Infomation Technology Industries Association) on behalf of NEC Corporation and Murata Manufacturing Co., Ltd and SUMITOMO METAL MINING CO.,LTD. request an exemption for lead in optical isolators.

The function of optical isolators consists in the reduction of reflection noise in several optic communication systems (transceiver, transmitter and receiver, optical amplifier). For this purpose rare earth iron garnet (RIG) are used because od their magneto-optical effect.

The garnet crystal is grown by the so called LPE (liquid phase epitaxial) method which uses lead oxide as flux material. In doing so lead is slightly included in a crystal as an impurity.

The total annual quantity of RIG used for optical isolators in the EU is specified to be 6.000 g. Starting from a typical Pb content of 0,3 to 1,0 % the total amount of Pb in this applications accounts for less then 100 g per year. According to the applicant in a dissolution test using Dutch serial batch test Pb has not been detected.

5.15.2 Summary of justification for exemption

The applicants justify their request for exemption with technical reasons:

- There are several solution growth techniques for RIG available but only LPE technique leads to RIG with all the specification required for optical isolator.

- The specifications for RIG will not be achieved using alternative lead-free flux materials.

Furthermore the applicants discuss the application of VCSEL (Vertical Cavity Surface Emitting Laser) for fibre optic communication system because this system can be used without optical isolator. However, the transmission distances are restricted at 1.300 nm to 20 km (compared to transmission distances of more than 40 km using DFB laser with optical isolator).

5.15.3 Final recommendation

This exemption request should be granted according to Article 5 (1) b, as no alternative production techniques are existent providing the needed quality of RIG used as optical isolators and substitution on a system level (VCSEL instead of DFB laser) is restricted to short distance transmission. Furthermore RIG as optical isolator is used only for signal transmission in professional applications; the annual amount of Pb compared to other applications is nearly negligible.

We suggest the following wording:

Pb as impurity in RIG Faraday rotators used for fibre optic communication systems.

5.16 Lead in sheath heater of Microwaves – JBCE (request No. 11)

This request has been withdrawn by the applicant. The justification given is: it is foreseeable that alternative technologies will be available in the near future. No detail is given though on the nature of these substitutes. The issue is raised on the open question regarding sufficient supply of the substitutes.

6 Further proceeding

The focus for the forthcoming work will lie on the closure of final recommendations of requests from set 1. At the same time, requests from set 2 will undergo a first completeness check, followed by a contact to the applicant and/or other parties in order to clarify open questions.

Annex 1: Revised checklist requests set 1

(See file ChecklistReport3.pdf)

Annex 2: Overview documents set 2

(See file Document management.pdf)