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

Fraunhofer Institut Zuverlässigkeit und Mikrointegration

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

Results previous evaluation

Exemption No. 28

"Hexavalent chromium in corrosion preventive coatings of unpainted metal sheetings and fasteners used for corrosion protection and Electromagnetic Interference Shielding in equipment falling under category three of Directive 2002/96/EC (IT and telecommunications equipment). Exemption granted until 1 July 2007"

(Excerpt from Öko-Institut Final Report 2006; Annex 1 Monthly Report 3 and 9)

Öko-Institut e.V.

Freiburg Head Office
P.O. Box 50 02 40
79028 Freiburg, Germany
Street Address
Merzhauser Str. 173
D-79100 Freiburg
Tel. +49 (0)761 – 4 52 95-0
Fax +49 (0)761 – 4 52 95-88

Darmstadt Office
Rheinstraße 95
64295 Darmstadt, Germany
Tel. +49 (0)6151 – 81 91-0
Fax +49 (0)6151 – 81 91-33

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

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This request has been withdrawn by the applicant.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.

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

6 Requests open for recommendation

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

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

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

6.1.1 New situation

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

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

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

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

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

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

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

6.1.2 Requested exemption

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

6.1.3 Summary of justification for exemption

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

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

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

  Sets of 10 Steel coupons were treated with:

  i. Henkel Alodine 1200 (Chromate or hexavalent chromium)

  ii. MacDermid ELV Blue (Product Number: IP74330)

  iii. MacDermid PK3 Blue

  Sets of 10 Aluminium coupons were treated with:

  i. Henkel Alodine 1200 (Chromate or hexavalent chromium)

  ii. Chemetall Oxsilan Al-0500

  iii. Henkel Alodine 4595

  iv. APS Chemicals Surtec 650 (TCP-HF)

  Things to observe in the results are:

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

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

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

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

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

6.1.4 Final recommendation

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

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

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

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

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

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

6.2.1 Description of requested exemption

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

6.2.2 Summary of justification for exemption

Criteria for justification

- No long time experience on whisker formation from lead-free tin-based finishes.
- Great deal of uncertainty regarding environmental factors (e.g. high air humidity and high temperature) that might affect whisker growth.