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. 25

"Lead oxide in plasma display panels (PDP) and surface conduction electron emitter displays (SED) used in structural elements; notably in the front and rear glass dielectric layer, the bus electrode, the black stripe, the address electrode, the barrier ribs, the seal frit and frit ring as well as in print pastes"

(Excerpt from Öko-Institut Report 2007; Final Report)

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Lead and cadmium in printing inks of enamel and in silver pastes used to coat QL 165 W induction-type fluorescent lamps with silver rings in order to meet electromagnetic compatibility (EMC) requirements for the application on glasses, such as borosilicate and soda lime glasses. The use of lead in silver pastes is limited until 1 July 2010.

This wording, however, would need to be agreed upon by all relevant stakeholders. Due to time constraints, this could unfortunately not take place within the duration of the current contract.

Thus, it is strongly recommended to review this exemption in the context of the upcoming review of the RoHS Annex.

5.6 "Exemption request for use mercury in plasma displays" (set 7, request no. 2, Babcock Inc.)

5.6.1 Requested exemption

Babcock (La Mirada, U.S.) requests an exemption for the use of mercury in Babcock's DC plasma displays which it considers to belong to category 4 WEEE Directive ("consumer electronics"). This request had already been submitted to the Commission before and has been subject to an online consultation as well as to a subsequent evaluation (set 5 no. 23). In this context a final recommendation could not be given due to the fact that an additional round of questions would have been necessary though exceeding the contractor's contract duration (cf. http://ec.europa.eu/environment/waste/weee/studies_en.htm, "Adaptation to scientific and technical progress under Directive 2002/95/EC; Final report, July 2006"; section 6.40). Babcock therefore was advised by the Commission to re-submit an exemption request.

According to the applicant, other plasma display manufacturers use AC technology, which does not require use of mercury. Both types of Plasma Display Panels (PDP) are already subject to entry no. 25 of the Annex to the RoHS Directive, which exempts the use of lead in such applications from restriction of use.

The particularity of DC driven Plasma technology is that they do not use phosphors to generate visible spectrum. During the manufacturing process of DC PDPs, a small amount of mercury is added to the DC plasma display to inhibit sputtering, which is a phenomenon that reduces life of PDPs (mercury is used to coat the cathode conductor and to inhibit the cathode conductor's material being sputtered onto the anode).

According to the applicant, this functionality can be summarised as follows:

- "Mercury is hermetically sealed in the DC plasma display and is used to retard the cathode sputter onto the anode electrodes. Without the use of mercury in DC plasma display the sputtering of cathode will completely deplete the cathode material. The sputtered cathode materials deposited on the anode electrodes will also cover the pixel

glow viewing and render the pixel non-viewable. DC plasma display life expectancy without the use of mercury is only a few hours as apposed to 20.000 hours with the mercury inside."

The applicant's DC Plasma display has between 1 to 20 mg of mercury per display (large displays can even have up to 30 mg mercury). The amount of mercury depends on total cathode area. Average mercury percentage by weight is stated to be 0,0014 % in the DC plasma display or 13 mg. Percentage by weight in the homogeneous material is stated to be between 0,2 – 0,4 %. The total annual amount of mercury (Hg) in the applicant's DC plasma displays for use in the EU market is estimated to be less than 80 grams.

No exact wording has been proposed by the applicant in the context of the here evaluated submission for an exemption. However, the former request included the following wording proposal:

Exemption for mercury to be use in DC plasma displays, maximum amount not to exceed 30 mg per display.

5.6.2 Summary of justification for exemption

The applicant justifies his request for exemption with technical arguments:

- Substitution or elimination of mercury in DC plasma display is currently technically not possible. The applicant has spent 2 years (1998-1999) working with DuPont electronic division to develop mercury free DC plasma display and so far no substitution was found that enable the DC plasma to operate more than few days without observing sputtering versus typical 20.000 hours in a DC plasma display with mercury inside.
  - Substitutes that were looked at are Al, Ru and LaB_6. Criteria that were used for the trials were luminous efficacy, glow uniformity of the cathode and cathode sputtering rates. In all four materials tested cathode sputtering and non-uniform cathode glow were observed after 66 hours. LaB_6 gave the most encouraging results according to documentation of test results.
  - Substitutes could not be found although there was a high motivation to substitute mercury, since it is more expensive than substitutes. Furthermore, heaters are added to raise the operating temperature of the glass in order to increase the vapour pressure of the mercury for a better performance of the display in cold climates. Substituting mercury would thus lead to cutting costs and power consumption of the PDP.
- The applicant states that substitution of mercury in DC PDPs is comparable to the situation manufacturers of compact fluorescent lamps face. The use of mercury in such lamps is currently exempted from the restriction of use under RoHS (entry no. 1 "mercury in compact fluorescent lamps not exceeding 5 mg per lamp").

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

- The applicant has provided sound and comprehensive information about the use of mercury in DC PDPs as well as on the availability of substitutes. The only missing information is i) whether substitution will be feasible within a given timeframe, ii) whether there are other manufacturers than Babcock producing DC PDPs and iii) whether DC and AC driven PDPs provide exactly the same technical functionality or whether they each have their justification of existence due to different types of uses.
- The EEB has provided a stakeholder comment questioning the necessity of the use of mercury since mercury-free PDPs are available on the market.
- The applicant has comprehensively explained why this is true for AC PDPs and why not for his DC driven PDPs.
- As a conclusion it can be stated that i) substitution is feasible on a technological level – meaning that delivering a PDP is technically feasible without mercury – and ii) substitution is not feasible within the technology of DC driven PDPs.
- Not granting the exemption would mean that a preference is given to AC driven PDPs.
- In the context and scope of the evaluation, the contractor cannot judge whether the two technologies – be it AC or DC driven PDPs – are equivalent or whether both have their justification for certain uses.

5.6.3 Final recommendation

With a view to the above argumentation, it is recommended to grant the requested exemption for the specific technology of DC driven plasma displays since substitution is currently technically not feasible. However, the Commission is invited to consider the fact that plasma displays are available on the market in mercury-free technology. Furthermore, it is proposed to set a time limit, since research of substitutes has already been undertaken.

The proposed wording for the exemption is:

Mercury used as a cathode sputtering inhibitor in DC plasma displays with a content up to 30 mg per display until 1 July 2010.