



ENVIRONMENTAL and HEALTH NGOs¹ COMMENTS ON THE INTERIM REPORT ON THE REVIEW OF DIRECTIVE 2002/95/EC (ROHS) CATEGORIES 8 & 9, MAINLY ON MERCURY

17th May 2006

The Environmental and Health NGOs believe that categories 8 and 9 should be included in the scope of the RoHS directive with the restrictions of the relevant (RoHS) substances applying as soon as possible and at the latest by the date the revised directive is adopted (estimated by 2008). Time limited exemptions should only be granted if alternatives are not available.

Considering our focus on *mercury* – through the Zero Mercury Campaign Project - we would argue that especially the use of mercury should be restricted for category 8 and 9 products of the WEEE directive for the following reasons:

1. The main relevant uses of mercury are in switches, thermostats, level sensors, cadmium mercury telluride semiconductors, lighting and reference electrodes.
2. Mercury is not mentioned as material of concern related to reliability of substitute materials and safety implications (chapter 8, page 58) for virtually all of these uses.
3. In chapter 9.3 (page 122) in reference to the impact for manufacturers of thermostats, smoke detectors etc (where mercury is mainly used out of the 6 ROHS substances) if these were to be included in the ROHS directive, it is mentioned that ROHS compliant products are available now or as early as 2006; it is unclear therefore why it is proposed by the consultant that action should actually be taken by 2012(!). However, such delays are inconsistent with EU's mercury strategy to minimize mercury use as soon as possible.
4. In the analysis on impacts to manufacturers of specific products, no references are made on problems in replacing mercury but mainly with respect to lead in lead soldering and hexavalent chromium. (page 118-125);
5. The arguments used on costs and innovation (page 125), no specific references are made that eliminating mercury would actually create costs increases or prevent innovation. Especially for mercury and in view of the EU strategy on mercury, where it the EU objective to eliminate mercury use is declared, it is well expected, that manufacturers will try to find appropriate substitutes, therefore it cannot be said that innovation will be hampered from the restriction in the use of mercury.
6. As explained in our submitted comments, there can be no question regarding the practicability of marketing non-mercury thermostats/switches since there are many models manufactured and sold today. Moreover, the non-mercury thermostats generally are equal to or better than mercury thermostats in function and performance.
7. The information presented in our submitted comments is largely derived from reports and government actions in the United States of America. However, given similar experiences in the Nordic countries with mercury product bans, and the EU presence¹ of the leading US manufacturers, there is no reason to believe the situation in Europe is markedly different. Indeed, at least one prior EU report indicates European mercury consumption for electrical control equipment may be underestimated given comparable demand in the United States, suggesting the US and European markets are quite similar absent RoHS Directive or comparable mandates in the United States.²

¹ E.g. <http://europe.hbc.honeywell.com/> and <http://www.invensyscontrolseurope.com/lwwcm/connect/Invensys+Controls+Europe/Home>

² Maxson, Mercury Flows in Europe and the World: The Impact of Decommissioned Chlor-Alkali Plants, prepared for the European Commission, February 2004, p. 39.

With respect to all of the ROHS substances, despite our limited capacity, at least for the moment, to comment more specifically on each of the remaining substances covered by the directive, the following points should be considered, before decisions are taken.

Scope

1. The fact that 'small' quantities of RoHS substances are used in these categories cannot be used as an argument- what is a 'relatively small' quantity when dealing with a hazardous substance?
2. From the analysis of the consultant it is clear that the scope of what is included under category 9 it is confusing and with many interpretations. Nevertheless we would like to point out that to our view a control or monitoring device such as a thermostat or heating regulator directed at ambient room temperature, fixed on a wall, should not be considered part of the building per se; the construction company would have to buy it from the market before installing it, therefore it could be considered that it is a finished product. Moreover, replacement thermostats are routinely purchased from Heating, Ventilation and Cooling wholesalers and contractors typically operating as independent contractors.
3. On the other hand, a thermostat which is part of a large industrial stationary tool is typically an integral part of that production equipment, which means that this thermostat was on the market and it should therefore fall under category 9. In either case, mercury thermostats no longer warrant an exclusion from RoHS, whether properly within Category 9 or not.
4. Reduction in the use of hazardous substances is not only restricted to products covered by RoHS. Confusion from grey areas of scope is not a reason to exclude entire categories; To the contrary, it is a reason to review the RoHS as soon as possible to resolve areas of uncertainties and narrow the existing exclusions where possible to do so.

Competitiveness

5. Many of the claims in the report relate to difficulties of manufacturers making an immediate change to RoHS compliant technology. Such a point merely illustrates that most manufacturers have not taken the anticipated demands of RoHS seriously. If category 8 and 9 products required long-term re-design, then responsible manufacturers should have allowed such time, and should have started earlier.
6. Table 63 outlines one of the main concerns over providing continued exemptions for category 8 and 9 i.e. that many manufacturers have already moved towards RoHS production and it would be unfair to reward those who have not with an exemption.
7. Many SME's are also involved with the manufacture of products currently within the scope of RoHS. No exemption is provided for them and consideration of this fact in category 8 and 9 would be discriminatory.
8. SME's are involved in ALL sectors of the electronics industry and in ALL cases need assistance in implementing changes required by RoHS. Assistance is available from MS expert networks, projects and EU part-funded projects such as 'LEADOUT'³

International Aspects

9. It is claimed that EU manufacturers would be disadvantaged since competitors outside of the EU have not been forced to modify products. RoHS equivalent regulation is being introduced in other significant markets (California⁴, China⁵, Korea⁶) and it is well know that

³ LEADOUT: Low Cost Lead-Free Soldering Technology to Improve Competitiveness of European SMEs, has as its objective to: Provide support to European SMEs to implement a Soldering Technology objectives: Developing low cost lead free soldering processes to enable SMEs to meet the requirements of new EU directives (WEEE and RoHS); Establishment of process quality standards to assist SMEs to rapidly convert to lead-free soldering, reducing defect rates, improving product reliability and increase European Competitiveness; Improve Health and Safety awareness and Pollution Prevention http://www.dvs-hg.de/fv/neu/Leadout/Documents/20051223Project_Presentation.pdf

⁴ <http://www.dtsc.ca.gov/HazardousWaste/EWaste/>

⁵ <http://www.chinarohs.com/>

⁶ Korea issued its RoHS/WEEE/ELV-like legislation called "The Act for Resource Recycling of Electrical/Electronic Products and Automobiles" to the World Trade Organization (WTO) on March 30, 2006.

http://www.europeanleadfree.net/pooled/articles/BF_NEWSART/view.asp?Q=BF_NEWSART_195645

the Japanese⁷ market has been moving away from the use of hazardous substances in all electronic equipment for many years and been extremely sensitive to standards coming out of Europe of the US.

10. Page 52 discusses the US restrictions of mercury that have already affected the electronics business. This is in contradiction to the reports earlier claims that only the EU market is affected by RoHS type regulation. Similarly in section 9.1.3 it is stated that Japanese customers nonetheless expect use of hazardous substances to be reduced. Therefore it cannot be claimed that the EU market will be disadvantaged since no other regions are demanding RoHS products.

Innovation

11. Pressure from legislation and peers in the market has already driven many manufacturers to change technologies avoiding the 6 ROHS substances even though their products are not until now in the scope of the directive. (page 114)
12. Section 9.6 states that 'researchers do not normally restrict their choice of materials for new development'. This is questionable – researchers would rather assess the availability of potential materials that may be included in new developments. It would be surprising to imagine that any responsible researcher would go ahead with the development of a product dependant on a substance which cannot be used in the market.
13. With respect to the transition to ROHS compliant substance; there are many ways in which engineers can develop a rapid knowledge of RoHS production; seminars, conferences, consultants, industry association events, webcasts, web training etc. RoHS will encourage knowledge development and therefore innovation.

Costs

14. It is claimed that re-design costs would accelerate product withdrawal from the market. The situation could be interpreted in alternative ways, for example, it could offer an opportunity for increased profit from RoHS compliant product and/or stimulation of innovation which would also encourage other developments in e.g. other features would make the product lighter , smaller, more energy efficient, etc, as it is the general trend with electronics.
15. The quoted costs of turnover seem to rather speculative. The report mentions that "The costs that would be incurred by category 8 and 9 producers is not yet known...." P.24, if it cannot be proven it should then not be considered as a reasonable argument. However, electronics prices have consistently declined in recent years – and there has been not overall increase that would otherwise have been observed.
16. Comments on potential costs are mentioned in the report; however, there is also evidence to suggest that moving to environmentally friendly 'green' products provides a cost saving. The report does not make any consideration of such cost benefits.⁸

On the potential exemption for the use of Mercury Cadmium Telluride (MCT)

To our knowledge it seems that such IR sensors are not the preferred choice of many scientific laboratories. It has been pointed out that germanium and other mercury free alternatives exist, like amorphous chalcogenides. We would also like to point out that the catalogue of the leaders in the IR Spectroscopy field, as well as other Analytical, Life Science and Optics process related questions – such as, Bruker Optics, www.brukeroptics.com, should be checked. In the Guide for Infrared Spectroscopy, p.6. "Detectors" it is shown that even commercial detectors exist to

Design Chain Associates, LLC ("DCA") has reviewed Korea's RoHS-like (and WEEE/ELV-like) proposed legislation, discussed it with the Korean Ministry of Environment (MoE), and written a detailed 5 page analysis. In addition they have included their recommendations for what should be commented on, and what impacted manufacturers should be doing now in order to prepare for when this law is put in to effect, the target date for which is July 1, 2007. They are selling this report, along with an unofficial English translation of the law, see <http://www.korearohs.com/buykorearohs1.html> for more information and how to obtain these documents.

⁷<http://www.jeita.or.jp/index.htm>, <http://uk.farnell.com/jsp/bspoke/bspoke8.jsp?bspokepage=farnell/en/rohs/rohs/facts.jsp>

⁸ See for example

<http://www.cypress.com/portal/server.pt?space=CommunityPage&control=SetCommunity&CommunityID=208&PageID=218&DirectoryID=713730>, Quist's presentation, "Attacking the Myth that Green Manufacturing is More Expensive," should be considered.

replace all MCT detectivity range. The alternatives mentioned as commercial are InGaAs D424, Te InAs 423, SiB D320.

Alternatives to MCT need to further be discussed as well as its need for most of the actual uses.

Furthermore, progress in research under the European Research Area (<http://ec.europa.eu/research/fp6/projects.cfm?p=3&pmenu=off>) needs to be investigated and referred to in the report to be sure that all available information is taken into account.

Further to our comments submitted mainly on mercury as well as the ones referring to all of the RoHS substances, and considering our limited capacity, we would also want to draw your attention to the following points concerning **lead** as a first reaction; the issues brought up need to be further checked before decisions are being taken at EU level. More time will be needed from our side if we were to provide more details.

Solder reliability

- None of the potential failure modes of concern mentioned in the summary (thermal fatigue, tin whiskers and vibration) and in table 10 are new, unknown, unexpected or not broadly understood – such failures occur with tin-lead solder technology. None of the failure modes described are specific to category 8 and 9 products. Panasonic has been making lead-free products since 1998⁹. The issue of safety reliability is brought up as a special issue for these categories; considering however that lead-free products already exist¹⁰, would that imply that no-one in any other product sector makes reliability predictions for their products?
- Section 12.3.1 suggests an exemption for lead in solder. This exemption is not justified or proven and if given would be discriminatory towards manufacturers of other product types included within the scope of RoHS. The report is not very clear on this aspect. It suggests that the service conditions of categories 8 and 9 products are very different to all other product types due to e.g. more different temperature range seen, vibration or corrosion in medical fluids. On the other hand it claims that the behaviour of category 3 products is the same. Both cannot be true. The category 3 exemption for servers and telecom equipment is justified more by the type of large complex board generally found in that product (i.e. a processing consideration since Pb-free solder is more difficult to use on large boards). The service conditions of category 3 product are not extreme – they are generally installed in air conditioned dedicated server rooms and similar that maintains temperature close to room temp. The reports comparison with category 3 is therefore questionable – issues of production of large complex boards (3) are compared with the claims that category 8 and 9 product is used in more severe use conditions and may therefore be more susceptible to thermal fatigue.
- The report leaves the impression that manufacturers should not be expected to innovate in their product materials since the full effects of a change on reliability cannot be absolutely precisely predicted. However, in practice, manufacturers are constantly making changes and adapting product design to new technology and materials.
- Page 28 describes a failure of a heart pacemaker allegedly from tin whiskering. This occurrence is referenced to 1986 and therefore bears no relevance to current technology. Tin whiskering has been the subject of very significant research in the past 10 years and plating technologies in use now have been developed to reduce tin whiskering to an acceptable level. In fact, this example shows that the tin whisker phenomena was not unknown before the implementation of the RoHS Directive, and, that due to the stimulus of this regulation, technical development and innovation has occurred that has *increased* understanding and improved reliability of plating technology.

⁹ Keynote: Environmental Activities of Matsushita Electric Industrial and Development of Advanced Lead-Free Solder Technology, Kenichiro Suetsugu, Ph.D., Matsushita Electric Industrial Co. Ltd., at the IPC/Soldertec 2006
http://www.ipc.org/calendar/2006/LFConf_0406/LFConf_Malmo_0406.htm#Agenda, http://www.omron.com/ir/pdfs/ar05/ar05_10.pdf
¹⁰ http://www.tel.com/NR/rdonlyres/26B75F31-A942-42C8-9AB7-F69C3C928103/0/ar2004f_e.pdf

- Page 52 notes that ‘many manufacturers are already using lead-free solder in new models although not changing existing design’. This confirms that lead-free solder can be used in standard production of category 8 and 9 product. The report claims in a later section that this would not be possible due to difficulty in reliability prediction. This ‘problem’ has obviously been overcome and can therefore be discounted. The question here remains as above, how are companies managing to do that, if the issue of unknown lifetime prediction is as important as suggested?
- Furthermore we need to consider that whether or not categories 8 and 9 will be specifically covered by other countries’ regulations, these countries do cover different products to the EU and that makes it more difficult to get Pb components etc – this is another reason why EU industry will change. In many cases industry will be forced to change whether they can calculate reliability or not since they will have no choice; Pb-free components or no components.
- Some issues mentioned in the report should be highlighted more: Table 63 outlines one of the main concerns over providing continued exemptions for category 8 and 9 i.e. that many manufacturers have already moved towards RoHS production and it would be unfair to reward those who have not with an exemption.
- The conclusions on page 186 state that ‘several aspects of lead-free technology are not yet fully understood’. This is a rather surprising statement considering that continuous research has been carried out on an international basis for more than 20 years, and lead-free has been used in high volume production for around 10 years.
- In addition there are currently at least 5 projects taking place, funded under the 6th RFP on lead free soldering; these should further be looked at. http://icadc.cordis.lu/fep-cgi/srchidadb?CALLER=FP6_PROJ&USR_SORT=EN_QVD+CHAR+DESC&QZ_WEBSR_CH=Soldering&QM_EP_CY_D=
- The report makes no consideration of the potential reliability benefits available from lead-free technology and the improved process understanding that arises from a renewed focus on product innovation.
- From the selected data presented by the author in table 11 it could be concluded that lead-free solder can provide a more significant improvement in low strain fatigue than the potential decreased performance in high strain fatigue i.e. advantages can outweigh disadvantages.
- Page 60 summarises conclusions on thermal fatigue. It is true that whether lead-free solders perform better or worse than tin-lead depends on use conditions. It must be underlined however that lead-free solder can produce reliability *increases*. The doubts that the authors raise are mainly related to the prediction of reliability – but this factor can clearly be discounted since a) manufacturers are making category 8 and 9 products NOW with lead-free solder b) extensive data is available from other market sectors that can be applied, and c) many research projects have addressed the differences in reliability modelling required for the different solder types.
- It is possible to make a choice between more ductile lead-free solders (e.g. tin-copper) and more creep resistant lead-free solders (e.g. tin-silver-copper) depending on the electronic application being manufactured. This provides a *greater* range of reliability options than is available with tin-lead solders only.
- Section 8.1.5 on thermal fatigue could maybe be looked at further (5 literature references). Detailed information on this subject and several text books are available from respected authors who have *direct* involvement in reliability test and development.¹¹
- It is stated that most failures are not caused by thermal fatigue failure but by other factors - generally badly made joints or similar manufacturing problems; could we then question that the issues surrounding reliability prediction are not that important - since getting the manufacturing process right is more important than trying to predict reliability of solder joints themselves ? What is exactly meant - that manufacturing problems cause failure or that fatigue causes failure, and which is most significant?

¹¹ e.g. Lead-free Solder Interconnect Reliability (Hardcover), by Dongkai Shangguan (Editor) <http://www.amazon.com/gp/product/0871708167/104-6702358-8375134?v=glance&n=283155>

- Slower rates of temperature change produce only moderate differences between lead or lead-free alloys. Only rapid changes in temperature produce significant differences (positive and negative). These do not seem to have been addressed in the report through a discussion of typical service conditions for category 8 and 9 product. It may be assumed, without in depth study, that the service conditions of typical medical and industrial control products would not experience rapid temperature change – therefore differences in solder performance may not be significant.
- Section 10.25 suggests various forms of exemption for lead solder ‘until the reliability of lead-free solders is fully understood and no longer a concern’. By definition, the reliability of ANY solder will never be fully understood as the boundaries of technological development are for ever being pushed further. The reliability of tin-lead solder is not fully understood and concerns exist there – some of those concerns can be reduced by the use of lead-free alternatives.

Whiskers

- Page 28 describes a failure of a heart pacemaker allegedly from tin whiskering. This occurrence is referenced to 1986 and therefore bears no relevance to current technology. Tin whiskering has been the subject of very significant research in the past 10 years and plating technologies in use now have been developed to reduce tin whiskering to an acceptable level. In fact, this example shows that the tin whisker phenomena was not unknown before the implementation of the RoHS Directive, and, that due to the stimulus of this regulation, technical development and innovation has occurred that has *increased* understanding and improved reliability of plating technology.
- Section 8.2 discusses tin whiskering. The key sentence is ‘Whiskers are a problem only if they are of sufficient length to cause a short circuit’....Since the extensive research on development of whisker resistant coatings over the past 10 years the reliability expected from tin coatings is *higher* than before. No issues on whiskering seem to be specific to category 8 and 9 products.
- Section 8.2.2 discusses accelerated tests for whiskering. It is claimed that standard tests are not available – this is not correct. Internationally accepted standards on whisker testing and whisker acceptability in different product classes have been published and are generally available.¹²
- The conclusion in section 8.2.3 on whisker risk minimisation is that whiskers *are not a concern* except in very high frequency circuits i.e. the risk factors are limited and understood. Conclusion 5 in section 13.2 confirms that ‘Research has shown how whiskers can be avoided; so the risk is low where these recommendations are followed’.
- Table 3 (page 41) discusses component coatings. This implies that the only reason that lead is used in such coatings is to reduce whiskering – this is not the case. Lead is contained in component coatings since it matches the tin-lead used as solder in the past ensuring good wettability (the key technical requirement).

Reliability under vibration conditions

- Table 13 summarising vibration data generally shows ‘no failures’ for lead-free solder tests. It can be anticipated that vibration failure is not a significant issue for lead-free solders.

Other general

- In table 3 e.g. that no suitable non-toxic alternatives for lead as a machining additive can be considered, and that steel is the main alternative for lead counterweights, is questionable. There are various high density lead-free materials available that have been developed for the ammunition

¹² JEDEC standards are used by the components industry, JESD22A121.01 (Revision of JESD22A121, May 2005), JESD201 MARCH 2006, JP002 MARCH 2006, <http://www.jedec.org/download/default.cfm> (search for whiskers)

market, examples of non-lead weights for fishing, wheel balancing; alternatives can be zinc, steel, tin, polymer-tungsten, bronze-tungsten.¹³

Note

The Environmental and Health NGOs, submitted comments to the consultant carrying out the report on the 13th January 2006, mainly referring to mercury and concerning the inclusion of thermostats in the scope of the RoHS directive.¹⁴

Further to these comments, and considering the links between tilt-mercury switches and thermostats, the Environmental and Health NGOs response to the 3rd Stakeholder consultation on Adaptation to scientific and technical progress under Directive 2002/95/EC for the purpose of a possible amendment of the annex, should also be considered (annex 3), including references related to the non-need of mercury use in thermostats.

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¹ Environmental NGOS include

The **European Environmental Bureau (EEB)**, www.eeb.org, is a federation of more than 140 environmental citizens' organisations based in all EU Member States and most Accession Countries, as well as in a few neighbouring countries. These organisations range from local and national, to European and international. The aim of the EEB is to protect and improve the environment of Europe and to enable the citizens of Europe to play their part in achieving that goal.

European Public Health Alliance Environment Network (EEN), <http://www.env-health.org/> is an international non-governmental organisation advocating environmental protection as a means to improving health and well-being. Member groups and organisations represent health, environment, women, health professionals and others. The group has a diverse membership of 41 member groups (6 international organisations, 11 European networks and 24 national/local organizations) including non-governmental organisations, professional bodies representative of doctors, nurses and other healthcare workers, academic institutions and other not-for-profit organisations.

Health Care Without Harm Europe (HCWH), www.noharm.org, is an international coalition of hospitals and health care systems, medical and nursing professionals, community groups, health-affected constituencies, labour unions, environmental and religious organisations. HCWH is dedicated to transforming the health care industry worldwide, without compromising patient safety or care, so that it is ecologically sustainable and no longer a source of harm to public health and the environment. HCWH input only pertains to the mercury comments.

The Natural Resources Defense Council is a private, U.S. not-for-profit environmental organization that uses science, law, and the support of more than 1 million members and activists nationwide to protect the planet's wildlife and wild places, and to ensure a safe and healthy environment for all living things.

The **Ban Mercury Working Group**, www.ban.org/Ban-Hg-Wg/, is an international coalition of 28 public interest non-governmental organisations from around the world formed initially in 2002 by 2 US based NGOs, the Basel Action Network (www.ban.org) and the Mercury Policy Project (www.Mercurypolicy.org). working to end pollution from the toxic metal -- Mercury. The Ban Hg-Wg input only pertains to the mercury comments.

¹³ E.g. <http://www.leadfreewheels.org/>, http://www.cws-scf.ec.gc.ca/publications/papers/88/chap4_e.cfm, <http://www.thomasnet.com/heading.html?cov=JN&what=Lead&heading=43570407&searchpos=9&cid=10022007&navsec=products>

¹⁴ http://www.zeromercury.org/EU_developments/060113_ENV&H_NGOsEUTHERMOSTATinRoHS.pdf and http://www.zeromercury.org/EU_developments/060113_ANNEX_1_%20MAINE_DEP_DENIALOFEXEMPTIONREQUEST.pdf http://www.zeromercury.org/EU_developments/060113_ANNEX_2_MAINE_BEP_DENIALOFEXEMPTIONREQUEST.pdf http://www.zeromercury.org/EU_developments/060113_ANNEX_3_051027FINALNGOResponse3rdConsultationROHS.pdf