Status of EU RoHS Exemptions

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ABSTRACT
In this article the EU (European Union) RoHS (restriction of the use of certain hazardous substances in electrical and electronic equipment) exemptions will be updated. Emphasis is placed on the exemptions proposed by the electronic industry and the exemptions granted by the EU Commissioner.

INTRODUCTION
In the past two years, there have been many articles written on the EU RoHS exemptions. Most of them, however, are not only misstated but misleading. Eventhough some of them are correctly reported, they didn't present a complete picture of the exemptions. In this study, all the exemptions proposed by the electronic industry are reported, all the official exemptions granted by the EU Commissioner are stated, and all the exemptions voted "YES" by the EU TAC (Technical Adaptation Committee) but not officially published in the OJ (Official Journal) of the EU are presented.

EU RoHS
Since February 13, 2003, the RoHS has been a law in EU [1]. RoHS bans lead (Pb), mercury (Hg), cadmium (Cd), hexavalent chromium (Cr^{6+}), PBBs (polybrominated biphenyls), and PBDEs (polybrominated diphenys ethers). The implementation date is July 1, 2006. That means, starting from that date, all EEE (electrical and electronic equipment), except those with exemptions [1, 2, 3, 4], cannot be put on the market in the EU if they contain those six banned materials. The categories of EEE covered by the EU RoHS are [5]:

1. Large Household Appliances
2. Small Household Appliances
3. IT and Telecommunications Equipment
4. Consumer Equipment
5. Lighting Equipment
6. Electrical and Electronic Tools (with the exception of large-scale stationary industrial tools)
7. Toys, Leisure and Sports Equipment
8. Medical Devices (with the exception of all implanted and infected products) [Not covered by RoHS]
9. Monitoring and Control Instruments [Not covered by RoHS]
10. Automatic Dispensers

It should be pointed out that, as of today, categories 8 and 9 are not covered by the RoHS. Many people misunderstood and thought these products are exempted. Actually, they are

not even covered by the RoHS which means they don't have to obey the RoHS at all. Since September 2005, the EU Commissioner has hired a consultant to look into these two categories of products. If the EU Commissioner decides to propose inclusion of these 2 categories it would not expect to put proposals to the Parliament and Council (according to the Comitology rules) before the end of 2007. Thus, we would not expect to see any new measures come into force before 2010, which is the earliest date if all the voting/ruling passed!

For the time being, China published their own RoHS on February 28, 2006 and the implementation date is March 1, 2007.

What is the definition of X-free, e.g., Pb-free? The maximum concentration value (MCV) of those six banned materials permitted in the "homogeneous materials" of an EEE has been published in the Official Journal of EU and become a law on August 18, 2005 [6]. It stated: "for the purposes of Article 5(1)(a), a MCV of 0.1% by weight in homogeneous materials for lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) and of 0.01% by weight in homogeneous materials for cadmium shall be tolerated". In plain language, for example, lead-free is defined as the content of lead in all the (individual) homogeneous materials of an EEE is less than 0.1wt%.

What is a homogeneous material? According to EU Commission's guidance in respect to homogeneous materials is as follows [7] –

(1) 'Homogeneous material" means a material that cannot be mechanically disjointed into different materials.
(2) The term 'homogeneous' means "of uniform composition throughout". Examples of "homogeneous materials" are individual types of plastics, ceramics, glass, metals, alloys, paper, board, resins, and coatings.
(3) The term "mechanically disjointed" means that the materials can, in principle, be separated by mechanical actions such as unscrewing, cutting, crushing, grinding, and abrasive processes.

Some EU Commission examples of the application of this guidance are [7]:

(1) A plastic cover is a 'homogeneous material' if it consisted exclusively of one type of plastic that was not coated with or has attached to it or inside it any other kinds of materials. In this case, the MCV of the RoHS Directive would apply to the plastic.
(2) An electric cable that consisted of metal wires surrounded by non-metallic insulation materials is an example of a 'non-homogenous material' because the different materials could be separated by mechanical processed. In this case the MCV of the RoHS Directive would apply to each of the separated materials individually.
(3) A semi-conductor package contains many homogenous materials, which include the plastic molding material, the tin-electroplating coatings on the lead frame, the lead frame alloy and gold-bonding wires.

What is the TAC? There are 25 members of the TAC. Each one of them represents her/his own Member State (country). They have the utmost power because their role is to provide technical changes and exemptions as well as the interpretation of the EU RoHS. They reported to the EU Commissioner. All of them receive the same information from the Commissioner, but don't have the same voting power. The vote from some Member States (e.g., United Kingdom and Germany) will carry more weight than the others (e.g., Greece and Ireland).

How a law is published in EU RoHS? Figure 1 shows a very simple flow chart indicating how a law of EU RoHS is published. It can be seen that after the TAC's YES vote on an item, the EU Commissioner will consult with the Parliament and Council. If the Parliament agrees, then the Commissioner will sign it and publish in the Official Journal of EU and it becomes a law.

EU EXEMPTION PROPOSALS

As of today, there are 5 different batches of exemption proposals and they are listed in the following.

1st Batch Exemption Proposals (Submitted by Industry before July 5, 2004)

1. Mercury in straight fluorescent lamps for special purposes
2. Lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signaling, transmission as well as network management for telecommunications
3. Lead in glass for light bulbs
4. Lead used in compliant-pin VHDM (Very High Density Medium) connector systems.
5. Lead as a coating material for a thermal conduction module c-ring
6. Lead and cadmium in optical and filter glass
7. Lead in solders consisting of more than two elements for the connection between the pins and the package of microprocessors with a lead content of more than 80% in proportion and less than 85% in weight
8. Lead in high melting temperature type solders (i.e., tin-lead solder alloys containing more than 85% lead by weight or more lead)
9. Lead in solders to complete a viable electrical connection internal to certain Integrated Circuit Packages (Flip Chips)

2nd Batch Exemption Proposals (Requests Fast-Tracked by TAC)

1. Lead in lead-bronze bearing shells and bushes
2. Deca-BDE in polymeric applications

3rd Batch Exemption Proposals (Submitted by Industry on February 2005)

1. Lead in tin whisker resistant coatings for fine pitch applications
2. Lead bound in glass, crystal glass, lead crystal or full lead crystal in general 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

3. Solders containing lead and/or cadmium for specific applications
4. Hexavalent chromium (CrVI) passivation coatings
5. Lead in lead oxide glass plasma display panels
6. Lead in connectors, flexible printed circuits, flexible flat cables
7. Lead oxide in lead glass, bonding materials of magnetic heads and magnetic heads
8. Cadmium as doping material in avalanche photodiodes (APDs) for the optical fiber communication systems
9. Lead in optical isolators
10. Lead in sheath heater of Microwaves
11. 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
12. High Intensity Discharge (HID) lamps for professional U.V. applications, containing lead halide as radiant agent
13. Discharge lamps for special purposes containing lead as activator in the fluorescent powder (1% lead by weight or less)
14. Discharge lamps containing lead in the form of an amalgam
15. Mercury free flat panel lamp
16. Special purposes Black Light Blue (BLB) lamps, containing lead in the glass envelope
17. Low melting point alloys containing lead
18. 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
19. Cadmium in sulphide photocells

4th Batch Exemption Proposals (Submitted by Industry on October 2005)

1. Linear incandescent lamp
2. Mercury in switches
3. Special ICs having tin-lead solder plating on leads used in professional equipment
4. Specific modular units including tin-lead solder being used in special professional equipment
5. 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
6. Lead in solder for printed circuit boards for emergency lighting products
7. Hexavalent chromium (CrVI) in chromate conversion coatings as surface treatment
8. Lead in gas sensors

9. Concerning PbO (Lead in Seal Frit) used for making BLU (Back Light Unit) Lam
10. Cadmium in opto-electronic components
11. Non-consumer mechanical power transmission systems including speed reducers and mechanical couplings which rely on electrical/electronic components for safe control and operation
12. Electrical and electronic components contained in heating ventilating and air conditioning building systems, commercial refrigeration systems and transport refrigeration systems
13. Cadmium-bearing copper alloys
14. Electrical/electronic components contained mobile and stationary air compressors and vacuum systems, compressed air contaminant removal systems and pneumatic contractor's air tools
15. Electrical/electronic equipment that 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
16. Lead alloys as electrical/mechanical solder for transducers used in high-powered professional and commercial loudspeakers
17. Cadmium oxide
18. Solder tin of the thermo fuse with a defined low melting point
19. Lead in lead oxide glass used in plasma display panel (PDP)
20. Lead in solder on small PCB and tinned legs of primary components
21. Use of the not lead free component NEC V25 in the Memor 2000
22. Lead used in shielding of radiation for Non Medical X-ray equipment
23. Lead based solders sealed or captured within heat-shrinkable components and devices

5th Batch Exemption Proposals (Submitted by Industry on February 10, 2006)

1. On-Semi MCR265-10 SCR
2. Components NEC V55
3. The use of lead in solder applications for electronic components of musical instruments having an average lifespan in excess of 10 years
4. Lead solder alloy in Surge protective devices (SPDs)
5. Inventory of Special ICs having tin-lead solder on/in leads/balls, used in specialist/professional equipment
6. Lead alloys as electrical/mechanical solder for transducers used in high-powered professional and commercial loudspeakers
7. Solder containing lead for applications where the local temperature exceeds 150 C and reliable operation for a minimum of 30,000 hours is required

8. Tin-lead solder in the manufacture of professional audio equipment;
9. Specific modular units including tin-lead solder being used in special professional equipment
10. Lead in electronic vacuum tubes
11. Lead in aluminum used in gas valves for domestic cooking appliances
12. Cadmium and its compounds in electrical contacts except for applications of one-shot operation function such as thermal links and cadmium plating except for the applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to the restriction on the marketing and use of certain dangerous substances and preparations."
13. Lead in solder of parts recovered from gaming/amusement machines put on the market before 1/07/06 and reused for the same purpose within a manufacturer's closed loop until July 2014
14. Lead in solders in components and assemblies used in non-consumer products, provided that: - such components and assemblies were purchased or are subject to a proven last-time buy contract placed before 1 July, 2006; and - such components and assemblies are used in models of EEE that were already available on the market before 1 July 2006
15. Cadmium plating as defined in Directive 91/338/EEC except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations."

EU RoHS EXEMPTIONS PUBLISHED IN THE OFFICIAL JOURNAL OF EU

The TAC use consultants such as ERA (in UK) and Oko-Institu (in Germany) to help them to review the proposed exemptions so they can intelligently cast their votes. As of June 26, 2006, the EU Commissioner granted 20 exemptions and they are shown in the following. (OJ stands for Official Journal)

1. Mercury in compact fluorescent lamps not exceeding 5mg per lamp (OJ of EU 2/13/2003)
2. Mercury in straight fluorescent lamps for general purposes not exceeding: (OJ of EU 2/13/2003)
   - Halophosphate (10mg)
   - Triphosphate with normal lifetime (5mg)
   - Triphosphate with long lifetime (8mg)
3. Mercury in straight fluorescent lamps for special purposes (OJ of EU 2/13/2003)
4. Mercury in other lamps not specifically mentioned in this Annex (OJ of EU 2/13/2003)
5. Lead in glass of cathode ray tubes, electronic components and fluorescent tubes (OJ of EU 2/13/2003)
6. Lead as an alloying element in steel containing up to 0.35% lead by weight, aluminium up to 0.4% lead by weight and as copper alloy containing up to 4% lead by weight (OJ of EU 2/13/2003)
7. –Lead in high melting temperature type solders (i.e., lead-based alloys containing 85% by weight or more lead (OJ of EU 10/25/2005)

–Lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signaling, transmission as well as network management for telecommunications (OJ of EU 10/25/05)

–Lead in electronic ceramic parts (e.g., piezoelectronic devices) (OJ of EU 10/25/05)

8. Cadmium and its compounds in electrical contacts and cadmium plating except for applications banned under Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations (OJ of EU 10/25/2005)
9. Hexavalent chromium as an anti-corrosion of the carbon steel cooling system in adsorption refrigerators (OJ of EU 2/13/2003)
   – 9a. DecaBDE in polymeric application (OJ of EU 10/15/2005)
   – 9b. Lead in lead-bronze bearing shells and bushes (OJ of EU 10/15/2005)
10. Within the procedure referred to in Article 7(2), the Commission shall evaluate the applications for: (OJ of EU 2/13/2003)
    – DecaBDE,
    – mercury in straight fluorescent lamps for special purpose,
    – lead in solder for servers, storage and storage array systems, network infrastructure equipment for switching, signaling, transmission as well as network management for telecommunications (with a view to setting a specific time limit for this exemption), and
    – light bulbs
    as a matter of priority in order to establish as soon as possible whether these items are to be amended accordingly.
11. Lead used in compliant pin connector systems (OJ of EU 10/25/05)
12. Lead as a coating material for the thermal conduction module c-ring (OJ of EU 10/25/05)
13. Lead and cadmium in optical and filter glass (OJ of EU 10/25/05)
14. Lead in solders consisting of more than two elements for the connection between the pins and the package of microprocessors with a lead content of more than 80% and less than 85% by weight (OJ of EU 10/25/05)
15. Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit Flip Chip packages (OJ of EU 10/25/05)
16. Lead in linear incandescent lamps with silicate coated tubes (OJ of EU 4/28/06)
17. Lead halide as radiant agent in High Intensity Discharge (HID) lamps used for professional reprography applications (OJ of EU 4/28/06)
18. Lead as activator in the fluorescent powder (1% lead by weight or less) of discharge lamps when used as sun tanning lamps containing phosphors such as BSP (BaSi2O5:Pb) as well as when used a specialty lamps for diazo-printing reprography, lithography, insect traps, photochemical and curing processes containing phosphors such as SMS ((Sr,Ba)2MgSi2O7:Pb) (OJ of EU 4/28/06)
19. Lead with PbBiSn-Hg and PbInSn-Hg in specific compositions as main amalgam and with PbSn-Hg as auxiliary amalgam in very compact Energy Saving Lamps (ESL) (OJ of EU 4/28/06)
20. Lead oxide in glass used for bonding front and rear substrates of flat fluorescent lamps used for Liquid Crystal Displays (LCD) (OJ of EU 4/28/06)

Six New Exemptions Voted YES by TAC on June 22, 2006 (Waiting to be signed by the EU Commissioner)

21. Lead and cadmium in printing inks for the application enamels on borosilicate glass
22. Lead in finishes of fine pitch components other than connectors with a pitch of 0.65mm or less with NiFe lead frames and lead in finishes of fine pitch components other than connectors with a pitch of 0.65mm or less with copper lead-frames
23. Lead in solders for the soldering to machined through hole discoidal and planar array ceramic multilayer capacitors
24. 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
25. Lead oxide in the glass envelope of Black Light Blue (BLB) lamps
26. Lead alloys as solder for transducers used in high-powered (designated to operate for several hours at acoustic power levels of 125dB SPL and above) loudspeakers

Two New Exemptions Voted YES by TAC on June 26, 2006 (Waiting to be signed by the EU Commissioner)

27. 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). Exemption granted until 1 July 2007
28. Lead bound in crystal glass as defined in Annex I (Categories 1, 2, 3, and 4) of Council Directive 69/493/EEC OJ L 326, 29.12.1969, p. 36. Directive as last amended by 2003 Act of Accession

It should be noted that the above 8 exemptions are not granted by the EU Commissioner yet. Usually it will take 6 months, due to the comitology and other rules, to be published in the OJ of the EU. Exemption No. 22 is very important for high-end and high-reliability products because of the tin-whisker issues [8, 9].

SUMMARY

As of today, 20 exemptions of the EU RoHS have been published in the OJ of the EU. Eight exemptions have been voted “yes” by the TAC and are waiting for the signature of the EU Commissioner. Forty exemptions are still outstanding, which the TAC members and their consultants are working very hard now.

On February 15, 2005 during the TAC meeting, some Member States expressed concern about the numbers of exemption that are being proposed as they feel these detract from the original aim and objectives of the Directive and undermine enforcement.

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Development of EU RoHS Law