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

Joint response from EICTA, AeA Europe, EECA EISA and JCBE, to the general and specific questionnaires

relating to exemption “6. Lead as an alloying element in steel containing up to 0.35% lead by weight, aluminium containing up to 0.4% lead by weight and as a copper alloy containing up to 4% lead by weight.”

31 March.2008

<u>Content</u>

General questionnaire

1. For which substance(s) or compound(s) should the requested exemption be valid?	Lead
2. What is the application in which the substance/compound is used for and what is its specific technical function?	Metal alloys alloyed with lead (for machining purpose): - Leaded copper in (bended) brass parts in antennas, connector contacts that are screw machined (e.g. most commercial RF coaxial connectors), connector shells or other hardware that needs milling, valves, valve guides, battery terminals, temperature sensor housing, various mountings, door locks, plug connectors, shafts, actuators, pins and fittings … - Leaded steel is used in bolts, screws, nuts, hollow screws, bleed screws, valve pins, spring guides, valve pistons, valve seats, sleeves, piston rods, magnet/pole cores, solenoid, bushings, housings, distance pieces, axles, shafts, stubs, sockets, locks, brackets, rotors, etc. - Leaded aluminium is used in bushing gears for motors and Die-Cast aluminum parts (e.g. RF Filters, chassis), and in heat sinks. In addition, galvanized steel is used in EEE cabinets and tower parts (masts, bolts, nuts, screws) for corrosion prevention. Also, lead is found as an impurity in recycled aluminium and is needed for corrosion prevention in applications where durable and cosmetically acceptable surfaces are needed to be obtained by anodization process.
3. What is the specific (technical) function of the substance/compound in this application?	Provide machinability or corrosion prevention to the materials in question Steel: - Better machinability: By the addition of lead better chip fracturing, automation of the production process, high cutting speed and federates (low cycle times), longer tool life, better surface finish and more accurate dimension control can be achieved - Free cutting steels provide optimum free-machining performance with comparatively low mechanical strength. These steels are used where there is a high requirement for machinability and their strength levels satisfy the final component mechanical requriements. If greater mechanical strength is required, a carbon or alloy steel grade may need to be specified. If machining is also required on these components, the best method of aiding machining and hence reducing financial and energy costs is the addition of lead. - Galvanizing: General (batch) galvanizing is the immersion of fabricated steel articles into a bath of molten zinc, containing a certain amount of lead, to apply a zinc coating that is metallurgically bonded to the steel. The coating is specified according to EN ISO 1461 (1999). • Lead has no beneficial (or adverse) effect on the coated product, but has important functions in the galvanizing process: ▪ Fluidity – optimal drainage reduces excess zinc on the product (eco-efficiency);

	▪ Ease of drossing – to aid recycling; ▪ Avoidance of "floating dross" during galvanizing of complex geometries which may lead to adverse surface finish; ▪ Protect kettle from uneven heat distribution from burners – preventing dangerous "run-outs" of molten zinc. • The extents to which each of these factors is important vary according to the nature of the component to be coated; the technical features of the plant (often related to the age of the plant) and the type of work that is processed by the plant (range of work). Aluminium: - Better machinability: By the addition of lead better chip fracturing, automation of the production process, high cutting speed and federates (low cycle times), longer tool life, better surface finish and more accurate dimension control can be achieved - Corrosion prevention: The surfaces of aluminium parts are usually finished anodized for functional reasons since anodizing increases corrosion resistance and wear resistance. The function of lead in the described application is the higher resistivity of leaded aluminium alloys compared to tin or bismuth containing aluminium alloys against pitting corrosion - Aluminium produced from recycled scrap metal may unintentionally contain lead. The lead may have been added to the scrap stream over years through not accurately separated wheel rims, aluminium for machining purposes, lead from batteries, and other lead-containing applications. Thus, lead is included in the scrap flow as an impurity which cannot be separated during the scrap process phase. Lead is not always necessary to attain specific properties, nor does the contained lead harm the properties of aluminium alloys as long as its quantity stays within the limits set by European standards. Therefore, it is proposed the extension to exemption for lead up to 0.4% content in aluminium alloys is to be granted. Copper - The lead that is embedded as tiny nodules in the matrix of these alloys has the function of a chip breaker and machinability enhancer. The formation of short chips, which can be removed automatically, is facilitated. Only under these circumstances the wrought products can be processed around the clock on fully-automated fast-turning lathes. Another characteristic of the lead is its function as a lubricant reducing the tool wear. - Better machinability: By the addition of lead better chip fracturing, automation of the production process, high cutting speed and federates (low cycle times), longer tool life, better surface finish and more accurate dimension control can be achieved - Better slide functionality: Lead does have a unique property as an alloying element for those parts with closely fit sliding surfaces. Lead content reduces the friction between sliding surfaces which is an important design criteria for vales, bearings, bushings, and any part which requires to surfaces to "slide" without galling or binding up. - Availability of alternative products: As an example, commercial close tolerance parts such as actuator valves are available only in "free machining" (i.e. high lead content) alloys. High reliability server

	and storage systems are critically dependent upon the availability of a number of commercial close tolerant parts. Also diverter valves and actuators for plumbing systems are made of "free machining" copper alloys and there is no current requirement for these parts to be RoHS compliant in their usual market applications. However, products that wish to implement water cooling for very high power, fast, and ultra-high reliability systems would not be able to avail themselves of the current generation of plumbing technologies if exemption 6.0 were to be eliminated. The lead content in these applications provides a low friction, high wear resistance surface with a high corrosion resistance. These leaded copper alloy parts are critical to the reliability performance for these cooling units. The current reliability performance for these leaded alloy parts can be estimated at well in excess of 5M hours MTBF (mean time between failures) which translates to better than one failure per year for every hundred installations. - The typical lead content in these copper alloys (brass) is 0.2 to 4.2% in accordance with CEN EN 12164 and 12165.
4. Please justify why this application falls under the scope of the RoHS Directive (e.g. is it a finished product?	Various steel, copper and aluminium alloys are used in various applications within EEE.
- Is it a fixed installation?	Some of these applications are used in fixed systems, but also in non-fixed installations.
- What category of the WEEE Directive does it belong to?).	It is expected that devices using this exemption have potential applications in categories 1 through 10.
5. What is the amount (in absolute number and in percentage by weight) of the substance/compound in:	
i) the homogeneous material[1]	Steel: Lead content up to 0.35% Copper: Lead content varies between 0.2 – 4.2% Aluminium: Lead content in aluminium alloys varies between 0.05 -0.35%.
ii) the application, and	Depends much on the product, can be from fractions of percentage to 100%
iii) total EU annually for RoHS relevant applications?	Steel: The total production volume of leaded steel in EU is estimated to be 1.3Mt per year. Majority of these is used in applications other than ICT equipment. Within EEE, these are mainly used in larger equipment with smaller volumes. Therefore yearly quantities are not expected to be some tons at maximum. Aluminium: In the EU currently ca. 2.7 million tons of aluminium casting alloys are annually produced from scrap. Majority of these is used in applications other than ICT equipment. Within EEE, these are mainly used in larger equipment with smaller volumes. Yearly quantities are expected to be some tens of tons at maximum. In general, aluminium consumption of the E&E industry is only 9% of the worldwide consumption. Copper: Leaded copper is used in various applications, mainly small, within ICT equipment, both small and large. As the equipment sizes and content of leaded copper is varying a lot, it is very difficult to estimate the quantities. An estimate is that yearly quantities in ICT equipment are within the tens of tones at maximum.
6. Please check and justify why the application you request an exemption for does not overlap with already existing exemptions respectively does not overlap with	This is justification for the need to extend the validity of an existing exemption

exemption requests covered by previous consultations.	
7. Please provide an unambiguous wording for the (requested) exemption.	Lead as an alloying element in steel containing up to 0.35% lead by weight, aluminium containing up to 0.4% lead by weight and as a copper alloy containing up to 4% lead by weight.
8. Please justify your contribution according to Article 5 (1) (b) RoHS Directive whereas:	
o Substitution of concerned hazardous substances via materials and components not containing these is technically or scientifically either practicable or impracticable;	Steel: - All currently identified alternatives to lead as a machinability enhancer in steel have been formally assessed without identifying any addition that effectively replaces lead in all respects (Final Report Adaptation to Scientific and Technical Progress of Annex II Directive 2000/53/EC). Lead-free alternatives may show acceptable results in single machinability test, but the overall performance of the lead-free steels is worse than that of leaded steel. If a variety of machining operations is required or if deep drilling of material is required, lead is still considered the best machinability enhancer in an industrial production. - Also, a reference is made by the steel industry to different reports investigating the machinability of lead-free steel alloys: o The University of Pittsburgh had developed a non-leaded low carbon free cutting steel (1215) containing 0.04-0.08% tin which they claimed can replace leaded free cutting steel (12L14). A range of machinability tests was undertaken with tin treated steel in order to investigate these claims (Bateson, P.H. & Reynolds, P.E., 1999). The results of these tests indicated that tin treated free-cutting steels showed less favourable results with regard to the different aspects on machinability than leaded steels. It was concluded that tin cannot replace lead in free cutting steels. o The European steelmakers and component manufacturers formed a collaborative research project funded by the European Coal & Steel Research (ECSC) to evaluate potential alternatives to lead for low carbon free cutting and carbon/alloy grades. The final report of this project summarises the results of machinability tests conducted with different lead-treated and lead-free steel alloys. These machinability tests included measurement of tool life, tool wear, surface finish, chip form, tool force and tool temperature. The steel grades selected for these tests were free-cutting steels (11SMn30), steels for hardening and tempering (C45) and case hardening steels (16MnCr5) with the following machinability enhancing additions: Lead, bismuth, increased sulphur (with and without tellurium), tin (with low and high copper), phosphorus and calcium. o The general conclusion of these tests is that leaded steels showed the best performance in tests at lower cutting speeds with high speed steel tools and in deep hole drilling. Non-leaded alternative grades generally gave poorer chip form and surface finish. It was shown that of the alternatives bismuth is able to substitute for lead under certain conditions, although the cost of the addition may make it uneconomic, particularly for large scale application. Furthermore, the hot workability of bismuth steels is reduced compared to leaded steels. Hot workability is a fundamental requirement for the steel production. o This parameter is of significance when the steel is being rolled to the required size for a

customer from a piece with a larger (as-cast) cross sectional area. The reduced hot-workability of bismuth steels effectively means that it is significantly harder for a steel roller to produce a bar with the same machining properties and surface integrity if the steel obtains its machining properties through bismuth rather than lead (Adaptation to Scientific and Technical Progress of Annex II Directive 2000/53/EC Final Report)

    - It can be expected that there would be a higher energy cost associated with bismuth as well as potentially higher rejections (waste).
    - Although the machining properties of bismuth treated steels approach those of lead treated steels for certain machining operations, in the majority of machining operations lead remains the most effective machinability additive through its combination of machining characteristics.
    - It was further concluded in the report that calcium can substitute lead in C45 steels for use at higher cutting speeds. However, calcium treated steels have higher cutting forces, poorer chip form and have their best performance limited to a narrower range of machining speeds in comparison with the leaded product. It is highly likely that a variety of machining operations are required for many EEE components, such that the more limited benefits of calcium treated grades may not be able to match the benefits of leaded grades in many instances.
    - Steels containing tin generally did not show good performance in the machinability tests and thus, was not considered as a suitable replacement for lead in steel.
- Technically, the substitutes (such as SUM22/23 (SUS)) might be available for some applications, but they are low cutting performance, and costs are too high to use for these applications.
- Research is ongoing within the industry to develop new zinc-based alloys for general galvanizing. Principal research goals are (i) more zinc-efficient coatings (thinner coatings regardless of steel type) and (ii) coatings of more consistent appearance and surface finish. These goals are accompanied with a desire to reduce the presence of hazardous substances, including lead. Due to the fact that current lead prices are higher than those of zinc, there is no economic advantage to intentionally add lead to a galvanizing bath where it is not technically required. No feasible alternatives are yet available though.

Aluminium:

- There are two theoretical options to reduce the lead content in aluminium alloys in order to achieve the 0.1% limit:
    - Removal of lead from Aluminium by metallurgical processes
    - Dilution of scrap with primary Aluminium

- Removal of lead from Aluminium by metallurgical processes

  According to the European Aluminium Association (EAA) and the Organisation of European Aluminium Refiners and Remelters (OEA) the removal of lead from aluminium by a metallurgical process is technically not yet feasible on an industrial scale. Research on the removal of lead from aluminium e.g. by melt purification is currently being conducted. The research activities are still in an early stage and have not yet produced practicable solutions for industrial applications.

Publications are available confirming that in small scale experiments it is theoretically possible to remove lead from aluminium by the electrochemical addition of sodium or potassium (Tailoka & Fray 1993; Tailoka et al. 1994). However, up-scaling this method from small scale laboratory experiments to industrial scale application was considered to be difficult, thus confirming the industry position that the research activities have not yet produced practicable solutions for industry applications.

- Dilution of scrap with primary Aluminium

  Theoretically, the lead content of scrap can be reduced by diluting the melt with primary aluminium. To reduce the lead content from 0.35% to 0.1%, it would be necessary to add 2.5 tonnes of primary aluminium to 1 tonne of recycled aluminium. Even with an average lead content of 0.2% in 55% of all aluminium casting alloys, in Europe an additional amount of ca. 1.1 million tonnes of primary metal would be necessary in order to reduce the lead content to 0.1% in aluminium casting alloys.

  According to EAA/OEA the primary metal needed for diluting is not available, because the primary aluminium industry is already running at full capacity. It would take years until additional capacities could deliver the material.

  Currently, the global aluminium production is around 200'000 tonnes lower than the demand. New primary aluminium capacities, which are in the planning phase, are needed to supply the growing global demand for aluminium (average global increase annually 3.4%). Final Report Adaptation to Scientific and Technical Progress of Annex II Directive 2000/53/EC 24
- Diluting with primary aluminium is technically possible, but is restricted by the availability of primary aluminium. From an environmental point of view the dilution of scrap with primary aluminium is not considered to be a reasonable option because the quantity of energy needed to produce primary metal is 95% higher than the amount of energy needed to produce casting alloys from scrap (Adaptation to Scientific and Technical Progress of Annex II Directive 2000/53/EC Final Report).

Copper:

- According to the copper industry, research on lead-free copper alloys has been carried out for many years without finding technical and economical equivalent alloys. Lead-free copper alloys exhibit different material characteristics and entail considerable cost increases due to higher copper contents. Users of those materials in the test period report on higher wear out of machines and tooling as well as on missing long time experience in production and usage of parts. Higher cycle times for semi-finished parts in lead-free alloys limit the production capacity which may lead to a bottleneck in supply. Lead-free alloy systems are only partially patented and not widely available on the market.
- Several tests using copper alloys with reduced lead content resulted in restrictions in the recycling process, as well as higher process costs. Some progress has been made in the alloy system Cu-Zn-Si and Cu-Zn-Mn-Si—X. Here first products are in the process of sampling and approval. Silicon brasses have a high strength and moderately high corrosion resistance (e.g. "Ecobrass").

	Chip forms are, however, less favourable than those of leaded copper alloys (Final Report Adaptation to Scientific and Technical Progress of Annex II Directive 2000/53/EC). Furthermore, the self-lubricating effect is missing resulting in a higher tool wear. To overcome the existing difficulties in the production process of semi-finished products from silicon brass, further research and development work is necessary. - According to the copper industry, among others bismuth has been considered as a potential substitute for lead in two-phase brass alloys. However, the use of bismuth significantly complicates the production of wrought alloys, i.e. rods, wires and profiles. This is due to the increased internal stress in the material caused by the expansion of bismuth during solidification. This is also the reason why these materials are far more susceptible to stress corrosion cracking. Furthermore, bismuth endangers the ability to produce so-called single-phase copper wrought alloys. These are brass alloys with a copper content of over 61% by weight. Bismuth contents down to 20 ppm already lead to premature material failure even during the production of wrought products. - Alloys containing bismuth are also more difficult to recycle, because recycling is done unmixed and so far fully developed recycling does only exist for lead containing copper alloys. - Recycling of lead in secondary copper process is possible and widely used in copper recycling plants. Lowering the lead content in copper alloys would severely increase the costs in the whole material chain in order to keep metal streams separate. It would therefore have a strong negative effect on the very well established and functioning recycling processes, which would need a complete redesign. - Wieland-Werke AG, a manufacturer of copper products, has provided data indicating that a reduction of the lead content in copper alloys from 4.2% to 2.0% results in worse machinability by 25% (expressed in drilling depth in mm after 100 rotations). Nevertheless, Wieland Werke AG considers a reduction of the maximum concentration value from 4% to 3% lead by weight in copper alloys as principally possible. - Regarding alternatives to leaded copper in connector applications, the obvious alternative is zinc die casting. This is not a feasible solution for most of existing product portfolio as it is impossible to match the tolerances, electrical, and mechanical properties of existing products using this technology. Note that many of the current product requirements are driven by industry specifications. Conceivability, if industry were starting over to address this product family with the objective of not using screw machining technology (and the associated lead containing metal), one could perhaps conceive of products that could be developed, but converting current portfolio is not feasible assuming existing product specifications.
o Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically either practicable or impracticable;	Steel: • Machining and corrosion prevention is required in certain parts and this can not be avoided by design changes Aluminium: • Close tolerance parts such as RF filters need good machining properties and this can not be overcome by design changes. Heat sinks are also required to cool hot components, which cannot be overcome by design changes. Also, the impurities from recycled aluminium can not be removed by design changes. Copper:

	• This is not a feasible solution for most of existing product portfolio as it is impossible to match the tolerances, electrical, and mechanical properties of existing products using this technology. For certain connector applications, avoiding the use of screw machining technology (and the associated lead containing metal), one could perhaps conceive of products that could be developed, but converting current portfolio is not feasible assuming existing product specifications.
o Negative environmental, health and/or consumer safety impacts caused by substitution are either likely or unlikely to outweigh environmental, health and/or consumer safety benefits thereof (If existing, please refer to relevant studies on negative or positive impacts caused by substitution).	Steel: - In addition to the technical viability, there are some important consequences of premature removal of the exemption (Final Report Adaptation to Scientific and Technical Progress of Annex II Directive 2000/53/EC): o Requirements to lower lead levels will result in reduced use of recycled zinc (remelt). Reduced values for remelt zinc will also adversely affect the economic viability of recycling of ashes and dross. o Less than optimal drainage can increase zinc use on the component beyond that which is required for its protection. o Bismuth is discussed as a possible substitute for lead; however bismuth is a co-product of lead production. There is currently no primary production of bismuth and its availability to meet the needs of all replacements for lead in industry has been questioned. o Any action to discourage use of galvanized coatings for components can lead to their replacement with alternatives with higher life cycle energy and that are not fully recyclable. Regarding the environmental relevance of lead in steel during recycling of end-of life EEE, the majority of the leaded steel parts end up in the metal scrap fraction which is sent to electric arc furnaces (EAF). There, most of the lead is extracted into the off-gas and is captured in dust filters of the off-gas cleaning system. The captured dust is then transferred together with zinc to recycling facilities where lead is won back. Recent increases in zinc prices have reinforced the economic viability of the recovery of these dusts. Aluminium o From an environmental point of view the dilution of scrap with primary aluminium is not considered to be a reasonable option because the quantity of energy needed to produce primary metal is 95% higher than the amount of energy needed to produce casting alloys from scrap (EAA Energy figures primary recycling). o The recycling rate of aluminium is >95%. Due to the fact that lead is an unwanted tramp element with negative characteristics in the finished products if exceeding certain levels, the aluminium industry has an interest to keep the lead impurities in the secondary aluminium cycle as low as possible. In effect, the presence of lead in the recycling process is not so much an environmental problem but rather a question of product quality which will require compensation by dilution with primary aluminium at least to a certain grade o EAA/OEA state that there is no risk to the environment and/or human health from aluminium with a lead content up to 0.4% by weight. It is argued that lead exists as an impurity in aluminium. Lead is present in 'solid solution' in the metallic crystal lattice or as dispersed constituents of a size smaller than 1µm. As aluminium does not corrode under normal

	conditions, the lead does not leach out when aluminium is exposed to atmosphere or neutral water during its use or in cases where it is littered in the nature after the end-of-life of a product Copper: - With an increasing lead content, the self-lubricating effect and the formation of short chips result in a reduced cutting force. A reduced cutting force in turn requires less energy during the machinability process leading to lower power consumption with increasing lead content (Adaptation to Scientific and Technical Progress of Annex II Directive 2000/53/EC Final Report). Also, the tool life time is reduced and energy consumption of the machining operations is raised if the alternative alloys are to be applied.
9. Please provide sound data/evidence on why substitution / elimination is either practicable or impracticable (e.g. what research has been done, what was the outcome, is there a timeline for possible substitutes, why is the substance and its function in the application indispensable or not, is there available economic data on the possible substitutes, where relevant, etc.).	As explained above
10. Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale for similar use.	As explained above. In general, substitutes <u>for some applications (but not all)</u> might be available if the availability would become greater higher and price would become lower.
11. Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes were available by 1 July 2006 or at a later stage.	In general, substitutes <u>for some applications (but not all)</u> might be available if the availability would become greater higher and price would become lower.
12. Please indicate if any current restrictions apply to such substitutes. If yes, please quote the exact title of the appropriate legislation/regulation.	Restricted alternatives have not been searched for. Industry is aiming at finding safe and sound alternatives.
13. Please indicate benefits / advantages and disadvantages of such substitutes.	Disadvantages: Not available in required quantities and costs too high.
14. Please state whether there are overlapping issues with other relevant legislation such as e.g. the ELV Directive that should be taken into account.	The same exemptions are needed also for ELV Directive. Many of the comments above are also referred to in the study made for the review of the need for exemptions within the scope of the ELV Directive. Under the ELV Directive, 3 exemptions deal with the same issue: - Exemption 1: "Steel for machining purposes and galvanised steel containing up to 0.35% lead by weight" Within their report on the ELV revision, Oko Institut recommended 'to continue the exemption without any changes in the wording until the next review of the ELV Directive's Annex II. This next review should include an

	exchange with stakeholders on the possibility to limit the current exemption for the use of lead up to 0,35% by weight as an alloying element in galvanised steel to low volume components of more complex geometry since all other applications are already covered by the tolerated maximum concentration value. It should be aimed at either getting a comprehensive list of applications for galvanised steel that need an exemption or restrict the scope of the current exemption by rewording the exemption specifying what exact types of galvanised steel components are included'. - Exemption 2(b): "Aluminium for machining purposes with a lead content up to 0.4% by weight" Oko Institut recommended 'to change the current wording to "Aluminium containing lead up to 0.4% by weight" under a new entry no. 2'. - Exemption 3: "Copper alloy containing up to 4% lead by weight" Under the ELV revision, Oko Institut recommended 'to continue this exemption until a full assessment has been carried out'. For these three exemptions, Oko Institut recommended the European Commission to guarantee the wording consistency of RoHS and ELV exemptions: 'in view of consistency in environmental legislation, the contractor would like to remark that the RoHS Directive's Annex also includes an exemption for the use of lead up to 4% in copper alloys (entry no. 6). Currently, the wording of both exemptions is consistent. For future reviews of exemptions under both Directives, a harmonization of the wording reflecting similar or identical technical specifications should be taken care of.'
15. If a transition period between the publication of an amended Annex is needed or seems appropriate, please state how long this period should be for the specific application concerned.	As there are no substitutes for lead as an alloying element in all applications, this question is not relevant.
16. Additional comments	

Specific questionnaire

1. Which applications falling under the scope of the RoHS Directive use these leadcontaining metals? Please give a comprehensive list of applications or an appropriate grouping of applications.	Metal alloys alloyed with lead (for machining purpose): - Leaded copper in (bended) brass parts in antennas, connector contacts that are screw machined (e.g. most commercial RF coaxial connectors), connector shells or other hardware that needs milling, valves, valve guides, battery terminals, temperature sensor housing, various mountings, door locks, plug connectors, shafts, actuators, pins and fittings … - Leaded steel is used in bolts, screws, nuts, hollow screws, bleed screws, valve pins, spring guides, valve pistons, valve seats, sleeves, piston rods, magnet/pole cores, solenoid, bushings, housings, distance pieces, axles, shafts, stubs, sockets, locks, brackets, rotors, etc. - Leaded aluminium is used in bushing gears for motors and Die-Cast aluminum parts (e.g. RF Filters, chassis), and in heat sinks. In addition, galvanized steel is used in EEE cabinets and tower parts (masts, bolts, nuts, screws) for corrosion prevention. Also, lead is found as an impurity in recycled aluminium and is needed for corrosion prevention in applications where nice and durable surfaces are needed to be obtained by anodization process.
2. What is the amount of lead in these applications? Please state the amount of lead used per application, the lead content in the homogeneous material, the annual production volume as well as the number of applications related to exemption 6 put on the EU market annually.	Please refer to general question 5.
3. The use of lead as an alloying element in steel, aluminium and copper up to a certain amount is not only exempted under the RoHS Directive, but also under the ELV Directive (Annex II). The exemption under the ELV Directive has just been evaluated. Results can be found in the final report at http://circa.europa.eu/Public/irc/env/elv/library?l=/stakeholder_consultation/evaluation_procedure/reports/final_report&vm=detailed&sb=Title. Please state which of the results and statements are also valid for applications falling under the scope of RoHS.	Please refer to general question 14.
4. Which applications falling under the scope of the RoHS Directive using these kind of lead-containing metals have **different / specific requirements** compared to the use in automotive industry?	None. Electronic products are tightly integrated within cars and other major issues (cooling related, aluminium alloys, galvanized steel) questions are also the same

	with cars.
5. Use of **lead as an alloying element in steel**: do you support the conclusion given in the above-mentioned report that there currently is no substitute for this use of lead in steel? One particularity of the use in automotive applications was that steels used in the automotive industry go through a variety of machining operations. Thus, the overall performance of steels in the various machinability tests (chip form, tool life and wear, surface finish, tool force, hot workability, deep drilling, etc.) need to be considered. Is this also valid for RoHS related applications?	Yes, this is also valid for RoHS related applications.
6. Use of **lead as an alloying element in aluminium**: do you support the conclusion given in the above-mentioned report that there should be no difference made between the intentional and unintentional use of lead in aluminium and that no substitutes are available for this use of lead in aluminium?	Yes, we support the same conclusion.
7. Use of **lead as an alloying element in copper**: the following points remained open in the above-mentioned report. Please answer them in relation to applications falling under the scope of RoHS.	
a. Leaded copper alloys are still used in a wide range of RoHS applications. For some of the applications it is not comprehensible why a **substitution to leadfree alternatives** is not possible (not safety-relevant applications). Please explain / justify / list applications for which substitution is technically not feasible and applications for which substitution is indeed feasible.	Please refer to general question 8.
b. Furthermore, it was not possible to evaluate whether or not lead-free alternatives could substitute leaded copper alloys (at least in some applications), since no **detailed data or documentation** on test results on lead-free alternatives (e.g. "Ecobrass") were provided. Please provide such data and information.	Unfortunately we do not have such information available, we are very much relying to material and component manufacturer's in this kind of issues. Hopefully they are able to provide you better data.
c. **Different statements** regarding the maximum concentration value of lead in copper alloys were submitted: One stakeholder states that a reduction of the maximum concentration value from 4% to 3% lead by weight in copper alloys is principally possible whereas in another statement it is emphasised that the concentration value of 4% lead is still justified and necessary. Please state which statement you support and provide supporting documentation.	Material and component manufacturer's have the best available information regarding this. Hopefully they are able to provide you better data.
8. Assuming the current exemption will be given an **expiry date**, what date do you think is technologically feasible for industry?	Considerable innovation is needed to eliminate the need for this exemption, so an expiry date cannot be estimated at this time.