Submitted by the European Semiconductor Industry Association and Ramtron International Corporation

Stakeholder Questionnaire –

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

- EU COMMISSION CHECKLIST - EXEMPTIONS FROM THE REQUIREMENTS OF ARTICLE 4(1) OF DIRECTIVE 2002/95/EC FOR SPECIFIC APPLICATIONS OF LEAD, MERCURY, CADMIUM, HEXAVALENT CHROMIUM.

Öko-Institut & IZM
General questionnaire-
- The following questions can be used in two different ways:

1. To support an exemption request (the applicant's exemption request which is posted on the consultation website should already contain answers to these questions) or to argue why an exemption request is not justified.

2. To support an existing exemption or taken as a basis for requesting an amendment or the discontinuation of an existing exemption

Existing Exemption- This issue relates to the existing exemption 7c "Lead in electronic ceramic parts (e.g. piezoelectronic devices)"

- **For which substance(s) or compound(s) should the existing/requested exemption be valid?**

Lead in PZT (lead-zirconate-titanate)

- **What is the application in which the substance/compound is used for and what is its specific technical function?**

Lead in PZT (lead-zirconate-titanate) based dielectric ceramic materials for capacitors being part of integrated circuits (ICs) or discrete semiconductors

- **What is the specific (technical) function of the substance/compound in this application?**

PZT material has the highest known dielectric constant (εr = 1000 – 1200) that can be used as a planar metal/insulator/metal (MIM) capacitor with a breakdown voltage > 100V. Thin film integrated capacitors are different from normal passive component capacitors. The dielectric constant in semiconductors for the PZT based applications, will only work with lead in them. No alternative to PZT is currently known for thin films and ferroelectric RAM (F-RAM) memories that achieve the same high permittivity, the same high breakdown field and still meets the specifications on temperature stability of 20% for -25 to +85 degree Celsius Only thin films ceramics based on PZT offer breakdown voltages, permittivity and temperature stability to realize silicon integrated capacitors.

- **Please justify why this application falls under the scope of the RoHS Directive (e.g. is it a finished product? is it a fixed installation? What category of the WEEE Directive does it belong to?).**

This issue relates to exemption 7c of the RoHS Directive "Lead in electronic ceramic parts (e.g. piezoelectronic devices)"

- **What is the amount (in absolute number and in percentage by weight) of the substance/compound in: i) the homogeneous material1, ii) the application and iii) total EU annually for RoHS relevant applications?**

Within the dielectric circuit element of the capacitor, the level of lead content is very low. The amount of lead introduced into the EU per year is in the order of 25-30kg for this rohs application. Lead in PZT in this case is present in trace amounts only.

- **Please provide an unambiguous wording for the (requested) exemption.**

Lead in PZT (lead-zirconate-titanate) based dielectric ceramic materials for capacitors being part of integrated circuits (ICs) or discrete semiconductors

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;
o Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically either practicable or impracticable;
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)

- **Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale for similar use.**

No feasible substitutes exist. Trench capacitors have a breakdown of only < 30V, no MIM is possible Other potential alternatives such as Barium-Strontium-Titanat (BST) have only half the dielectric constant and result in much larger devices and won't meet the size dimensions of applications. Performance characteristics with alternatives are severely degraded. These potential alternative techniques (trench- or BST-capacitors) are not able to fulfil the electric requirements that are needed for such applications, a high breakdown voltage and low internal resistance at low leakage currents and high capacitance values.New materials without Pb will have to be invented.

March 2010