EUROPEAN COMMISSION
DIRECTORATE-GENERAL
ENVIRONMENT
Directorate G - Sustainable Development and Integration
ENV.G.4 - Sustainable Production & Consumption

DIRECTIVE 2002/95/EC[1] ON THE RESTRICTION OF THE USE OF CERTAIN HAZARDOUS SUBSTANCES IN ELECTRICAL AND ELECTRONIC EQUIPMENT (ROHS).

CHECK LIST FOR REQUESTS FOR ADDITIONAL EXEMPTIONS

Industry has sent to the Commission's services a number of requests for exemptions from the requirements of the RoHS Directive that are additional to those currently covered by the study and the stakeholder consultation. In most cases these are not substantiated by scientific and technical evidence. The proposed check-list will enable the Technical Adaptation Committee (TAC) to carry out a first screening of the requests received. Proposals that successfully pass the screening process will then be considered for a possible exemption.

Article 4(1) of Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment1 provides 'that from 1 July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, PBB or PBDE.' The Annex to the Directive lists a limited number of applications of lead, mercury, cadmium and hexavalent chromium, which are exempted from the requirements of Article 4(1).

Adaptation to scientific and technical progress is provided for under Article 5 of the Directive. Pursuant to Article 5(1): "Any amendments which are necessary in order to adapt the Annex to scientific and technical progress for the following purposes shall be adopted in accordance with the procedure referred to in Article 7(2):"

Article 5(1)(b) allows the exempting of materials and components of electrical and electronic equipment from Article 4(1) if their elimination or substitution via design changes or materials and components which do not require any of the materials or substances referred to therein is technically or scientifically impracticable, or where the negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh the environmental, health and/or consumer safety benefits thereof. <u>These terms of reference mean that the TAC cannot consider exemptions for any other reason, for example a justification based on increased costs.</u>

In order to allow the TAC to consider submissions for additional exemptions, the information in Table I should be provided as a minimum requirement. The request for submissions must fulfil the criteria of Article 5(1)(b). The information provided should be supported, as far as possible, with relevant technical and scientific evidence.

[1] OJ L 37, 13.2.2003, p. 19

Commission européenne, B-1049 Bruxelles / EuropeseCommissie, B-1049 Brussel - Belgium. Telephone: (32-2) 299 11 11.
Office: BU-5 5-167. Telephone: direct line (32-2) 2960493. Fax: (32-2) 2963980.

TABLE I – CHECK LIST

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

Submitted by: Test and Measurement Coalition

The Test & Measurement Coalition includes six leading companies producing Category 9 type products: Agilent Technologies, Anritsu, Fluke Corporation, Keithley Instruments, National Instruments, and Tektronix.

Criteria	**Information:** **Please provide supporting technical and scientific evidence**
1. Please indicate the specific application for which the exemption is requested and indicate a precise and clear wording for the new exemption. Please describe the material/component of the electrical and electronic equipment that contains the hazardous substance. Please indicate the functionality of the substance in the material of the equipment. Provide a detailed description of the application which explains why the restricted substance is currently required or used. Please indicate the quantity of the hazardous substance present in the whole equipment (Kg).	Lead and cadmium in optical and filter glass in monitoring and control instruments (Category 9.) There are many category 9 applications that require the use of lead and cadmium in optical and filter glass. Optical and filter glass is formed into lenses, and other shapes for filter windows and prisms. Lead as an oxide in glass provides technological properties such as a high refractive index combined with good transmission, conductance and low stress birefringence in a very compact form factor. In addition to the well-known functionality of adding lead to glass as described in the Oeko report, the use of lead provides another characteristic critical to monitoring and control instruments (Category 9), enabling high end optical imaging systems to have stable performance across the wide operating temperature range. The addition of lead to glass allows a precise characterisation of changes to its index of refraction and dispersion with temperature. Other applications include Interferometry solutions. As a laser beam passes through the optic, (a transmissive element on a measurement path), the stability of the system depends on designed-in compensation for that optic's variations (e.g. the thermo-optic coefficient dn/dT) over a full temperature range. Gas Chromatograph Detectors also use leaded optical filter glass as the glass must not shift colour or optical quality over the range-40 ºC to +450 ºC while maintaining very low optical interference and absorption. The main use for this detector is the low level analysis of hydrogen flame colour to measure amounts of nitrogen, sulphur, and phosphorus in a chemical matrix for raw oil, natural gas, etc. in order to verify they meet EU standards. Filter glass containing cadmium is used, for example, in chromatography, microscopes and spectroscopy to create various illumination and imaging modes by optical modulators. Additional applications of optical modulators include lasers and waveguides. One useful cadmium-containing material for these applications is cadmium telluride. Despite being even more expensive than

Criteria	Information: Please provide supporting technical and scientific evidence
	silver, this material has unique characteristics, including a low absorption coefficient and high thermal runaway temperature, that are good for high-power IR laser windows and mirrors. A recent innovation utilizing this material is in a filter for remote sensing over fibre optic networks. Mixtures of cadmium selenide and cadmium sulphide deposited on glass or silicon substrates result in tuneable red, yellow, or green fluorescent material. This enables construction of highly achromatic IR retarders in interferometer applications such as holography. We have reviewed the product portfolios of the T&M Coalition members and identified the following *examples* of applications where optical and filter glass with lead and cadmium are used in Category 9 equipment: • Atomic Force Microscope (AFM) • Nanoindenters • Laser Interferometer Metrology Solutions • Laser-based Dynamic Calibration Systems • Lithography Solutions (for integrated circuit fabrication) • Photonic Bit Error Ratio Test (BERT) Solutions • Photonic Digital Communication Analyzers • Photonic Jitter Generation and Analysis Systems • Optical Modulation Analyzers • Optical Power Meters • Optical Attenuators • Optical Sources • Lightwave Component Analyzers (LCA) • Gas Chromatographs • Spectrometers “250 tons of lead-containing optical glass with a lead oxide content of approx.140 tons were processed in 2002 in the EU. The use of cadmium-containing filter glass totalled in the EU approx. 8 tons, the cadmium quantity being approx. 80 kg.” Source: Spectaris input to original exemption 13
2. Please explain why the elimination or substitution of the hazardous substance via design changes of materials and components is currently technically or scientifically impracticable.	Leaded optical filter glass cannot be replaced in all precision optical applications, including laser head lenses and beam-splitting interferometers, especially where high refractive index glass is required. In applications requiring lower refractive index, non-leaded glass is feasible and has been introduced. Interferometry solutions, as outlined above, are very complex solutions with many optical elements in the measurement path. The overall system performance is dependant on all optical elements responding consistently to changes in temperature. If an optical element constructed from a material with a different dn/dT specification is substituted into the solution the system will become unstable, drifting with temperature.

Criteria	Information: Please provide supporting technical and scientific evidence
	In some of the photonic solutions listed above, the variance between samples of even the *same* material can cause unacceptable variations in performance. This requires that the lifetime needs for the optical elements be purchased from the same lot of glass from a supplier. In these high performance solutions, substitution is impractical as the design and qualification effort required is equivalent to that for a wholly new product introduction. For these special optical systems the performance of the alternative glasses available are not identical to those with added cadmium or lead, and are not sufficient to allow substitution. Therefore lead and cadmium containing glasses are still in use, when special properties of these glasses are needed. This holds especially true for optical systems, where the highest specifications have to be met to meet the sector expectations of, for example, professional and industrial optics; scientific and technical research and development; or chemical and life science analysis.
3. Please indicate if the negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh the environmental, health and/or consumer safety benefits. If existing, please refer to relevant studies on negative impacts caused by substitution.	Optical glass and filter glass present no hazard whatsoever to instrument users and consumers, as the lead and cadmium elements are firmly incorporated in the glass matrix in the form of oxides and do not constitute any toxic potential. In addition, the lenses placed on the market have been surface-coated and antireflection-coated using layers of extremely hard-to-dissolve, strongly adhesive oxidic or fluorous compounds. This means that the user cannot possibly get into contact with the actual glass matrix.
4. Please indicate if feasible substitutes currently exist in an industrial and/or commercial (please provide reference for the substitutes). If substitutes exist on the market, please indicate why they are not used. Please indicate in which applications they are used. Please indicate what efforts are being made by your company to develop alternative techniques. Please indicate if the alternative techniques will be available by 1 July 2006 or at a later stage. If not by that date, please indicate when you expect an alternative to be available?	According to current knowledge in glass technology, there is currently no direct substitute for use in existing designs which utilize optical and filter glass containing lead and cadmium due to the high standards required in technology, medicine and science. High optical quality is absolutely vital to meet professional and industrial requirements and expectations. Due to the complexity of the properties and applications involved, a clear-cut elimination of glass types containing heavy metal is not feasible, nor is it possible to address the problem on a case-to-case basis. In addition, this approach would obstruct technological progress, as every modification and new application would entail a new approval procedure for an exemption. Technical optical suppliers have begun to provide some substitutes for leaded technical glass. One may compare Schott SF10 (leaded) to Schott N-SF10 (unleaded) as an example. These new materials are not “drop-in replacement” materials. In new designs, where the engineer and the customer have design freedom, the unleaded material is a natural choice. In older products, there are differences

Criteria	Information: Please provide supporting technical and scientific evidence
	between the leaded and unleaded material that make a "drop-in" change impractical. Looking at the specifications of SF10 and N-SF10, one sees that there are differences: • Coefficient of thermal expansion • Change of index of refraction with change in temperature (dn/dT) • Density These differences prevent a direct substitution for the reasons described in the section above. Cadmium glass substitutes have not become generally available at this time. **We therefore request that the exemption applies until 2021 for all Monitoring and Control products (aligned with typical product lifecycles and the first review of Exemptions for Category 9.)**
5. Please provide any other relevant information that would support your application for an additional exemption.	In discussing the suitability of 2011/65/EU Annex III Exemption 13(a) with R&D professionals, there is a concern to be addressed regarding the lack of definition of "white glasses." This was particularly relevant for products utilizing light outside of the visible spectrum. Not one of our professionals could point to an industry reference for "white glasses". If the addition of cadmium to glasses is restricted and only allowed under Exemption 13(b), considerable research is necessary to assess the need for potential substitutes in monitoring and control applications. The diversity of monitoring and control optical applications raises concerns regarding a potential restriction to innovation if only the existing Exemptions 13(a) and 13(b) remain available. If the exemption is not granted for Category 9 Monitoring and Control; the adaptation and redesign of the sectors portfolios would be considerably extended. This change of direction due to unavailability of this substance exemption would cause massive withdrawal of products from the EU market. This would have very serious consequences, not only for Category 9 producers, but also on client industries which are of key importance for the EU economy and competitiveness such as communication, defense, research & development, aerospace, electronic manufacture, etc. The removal of Cadmium above 0.1% for any optical glass application besides "filters" and "reflectance standards" causes significant issues as the applications within Category 9 which may not be obvious as performing a filtering function. Uses in beam-splitters are one of many examples.

Criteria	Information: Please provide supporting technical and scientific evidence
	Specificity of Category 9 Sector Professional Test & Measurement products include a wide range of sophisticated electronic instruments including electronic counters, signal generators, logic analyzers, oscilloscopes, network analyzers, spectrum analyzers, power meters, multi-meters, signal analyzers, chemical and biological analyzers, and communications test equipment. The instruments are used by laboratories (for research and compliance evaluation), universities (for technical training and education), manufacturers (for product development and manufacturing of their products), and governmental agencies for conformance verification. They are essential to the good functioning of electronic communications networks, heavy industrial processes such as steel manufacturing, the testing of vehicles for compliance with emissions standards, and the monitoring of complex systems of all types. Due to the specialized nature of the Test & Measurement subset of Category 9 products they contain a relatively high ratio of custom designed components compared to off-the-shelf components. Customers require that Test & Measurement products have greater bandwidth, speed, accuracy, and measurement precision than the products they themselves are producing. Most of these Category 9 products serve industrial monitoring applications and are produced in vastly smaller quantities compared to categories already in scope of RoHS. The entirety of Category 9 product volumes in total is representative of less than 0.25% of e-waste, of which industrial Test & Measurement is a subset. Test & Measurement instruments are designed for high reliability and are considered company capital assets – not personal use products. Customers expect to use these instruments for a minimum of ten years and for manufacturers to provide upgrades to expand instrument functionality on the basis of both number and type of measurements as well as additional analytical functionality during product life. The ERA study did not consider this exemption in detail since it was foreseen to be available for medical or monitoring and control products. No detailed impact assessment has been undertaken for Category 9 products as our sector has been out of scope prior to July 2011. Availability of the original set of RoHS Exemptions had been assumed as intimated from relevant parties including the EU Commission during the development of the RoHS Recast. Consequently, the long-term reliability of all alternatives has not been fully evaluated for our applications. Our products have long life time of 10 years on average; therefore substitutes should be tested not only for meeting reliability requirements but also for long term performance, going substantially beyond

Criteria	Information: Please provide supporting technical and scientific evidence
	the one of consumer goods applications. Any forced change would require significant data collection from the supply chain, product review, redesign and requalification. This effort and cost would be disproportionate to the benefits of short-term substitution for the limited application of these parts in the monitoring and control sector. **References**: Oeko Institute report "Adaptation to scientific and technical progress under Directive 2002/95/EC, 19 February 2009."

Additional guidelines

To support your application, it may be useful to provide, in addition, an assessment of your application from an independent expert. These should be accompanied by information that will allow the Commission and TAC to be satisfied that the consultant is independent and is qualified to assess the application.

Explain the reasons why potential alternative materials, designs or processes are unsuitable with quantitative data wherever possible. If possible, provide photographs or diagrams to illustrate claims. Sources of information should be referenced where possible.