Test & Measurement Coalition

RoHS Directive Scope Review

Contribution to Öko-Institut study on RoHS current exemptions

1 April 2008

Introduction to T&M Coalition

The Test & Measurement Coalition represents an ad-hoc grouping of companies active in producing Category 9 type products. The Coalition includes six leading companies in the sector including Agilent Technologies, Anritsu, Fluke Corporation, Keithley Instruments, National Instruments, and Tektronix. We estimate the coalition membership represents roughly 60% of the global production of industrial Test and Measurement products and other Category 9 equipment including chemical analysers.

The Test & Measurement Coalition actively participated in the consultations organised by DG Environment and DG Enterprise regarding RoHS revisions. We have also submitted detailed information to ERA about the exemptions needed for our products. We are pleased now to contribute to the Öko-Institut consultation preparing the study on current RoHS exemptions.

Summary

Category 9 is currently not in the scope of RoHS. Bringing Category 9 into scope will require significant substitution and redesign of the large number of products due to extensive use of lead solder. Assuming that drop-in replacement, compliant components were available, which is not the case for many custom parts, compliance will require re-qualification of virtually all products after new designs are assembled with lead-free solder. Qualification testing alone will have a major impact on our industry and on our customers considering the large number of products we make, even without additional practical issues to solve.

The Coalition strongly emphasises the need to maintain the following exemptions when category 9 will be brought into the scope:

a) Exemption #1 - Mercury in compact fluorescent lamps not exceeding 5mg per lamp.
b) Exemption #5 - Lead in the glass of cathode ray tubes, electronic components and fluorescent tubes.

c) Exemption #6 - Lead as an alloying element in steel containing up to 0.35% lead by weight, aluminum containing up to 0.4% lead by weight and as a copper alloy containing up to 4% lead by weight.
d) Exemption #7
   - Lead in high melting temperature type solders (i.e. lead based alloys containing 85% by weight or more lead).
   - Lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signaling, transmission as well as network management for telecommunication.
   - Lead in electronic ceramic parts (e.g. piezo-electronic devices).
e) Exemption #8 Cadmium and its compounds in electrical contacts and cadmium plating except for applications banned under Directive 91/338/EEC (1) amending Directive 76/769/EEC (2)
f) Exemption # 9 a Deca BDE in polymeric applications
g) Exemption # 11 Lead used in compliant pin connector systems
h) Exemption #13 Lead and cadmium in optical and filter glass
i) Exemption #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.
j) Exemption #15 - Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit Flip Chip packages.
k) Exemption #23 - Lead in finishes of fine pitch components other than connectors with a pitch of 0.65 mm or less with NiFe lead frames and lead in finishes of fine pitch components other than connectors with a pitch of 0.65 mm or less with copper lead frames.
l) Exemption #24 - Lead in solders for the soldering to machined through hole discoidial and planar array ceramic multilayer capacitors.
m) Pending Exemption: Lead oxide in seal frit used for making window assemblies for Argon and Krypton laser tubes

In addition, we assume no additional regulated materials are added to the EU RoHS Directive and that Maximum Concentration Values for existing RoHS substances are not reduced.

The reason for requesting the extension of the above mentioned exemptions is linked to the specific nature of our products, their design cycles and high reliability requirements:

- Redesign often presents significant technical challenges that take time to resolve – it can be 1-2 years before a new product can be released and 0.5-1 year for an enhancement. A significant amount of the time is required for environmental and safety testing of new designs.
- 15 - 20% of the components used in Test & Measurement products are custom designed for our instruments. As many of our members use around 100,000 different parts today this means redesign and testing of several thousand custom parts for each company.

- Where RoHS compliant components are available, they require extensive testing to verify their long-term reliability when used in Test & Measurements products.
- Test & Measurement products have a long product life (≈10 years on average) and frequent redesign is not common for the sector, further emphasizing the need for extended transition periods to achieve compliance with existing resources.
- Test & Measurement products are extremely complex and there are a limited number of highly qualified engineers available to work on redesign. This will divert significant resources from the development of new, innovative products.
- Material substitutes meeting our customers' reliability criteria are limited in some instances. For example a domestic household product with expected life of five years has more material options for anti-corrosion coating than a Test & Measurement product for outdoor use which customers expect to work reliably for ten years or more.
- Historically, material or component substitutions have been validated through a number of tests under extreme conditions. Testing programmes can last one or two years.
- Preliminary evaluation of several RoHS compliant substitutes in our critical applications has so far yielded less than satisfactory results.

Removal of these exemptions will result in premature withdrawal of the affected products from the EU market when professional Category 9 equipment is brought into the scope of RoHS as redesign will in most cases not be economically viable.

Forced obsolescence will have a significant impact on EU industries using Test & Measurement equipment such as communication, defence, research & development, aerospace, electronic manufactures, industries involved in design manufacturing validation and testing of electrical and electronic components and systems, network equipment manufacturers and network providers, pharmaceuticals, etc. Service, installation and maintenance in thousands of heavy to light industries depend on the availability and reliability of Category 9 equipment.

With early retirement, customers will lose access to tailor-made specialty products which provide unique solution for a unique set of customers. This will have a negative impact on the reliability of these customers' products. Proven safe products will not be available for service, installation and maintenance application in industrial venues.
Forced obsolescence will additionally have a major impact on companies who have invested in modular T&M systems, which can be continually upgraded and replaced.

Exemption 1: “Mercury in compact fluorescent lamps not exceeding 5 mg per lamp”

This exemption is currently in widespread use in the Test and Measurement sector to allow for the sale of products and systems incorporating LCD display technology. Due to the expectation for high reliability in Test and Measurement equipment, industrial display units are used. These display units generally incorporate one or two compact fluorescent lamps which do not exceed 5 mg mercury per lamp.

As downstream users of industrial display technology, test and measurement equipment producers are only able to incorporate the materials made available by display producers. At the current time, commercially viable industrial-grade LCD units using non-mercury LED backlighting are just starting to become available in some of the smaller i9isizes and form factors. It is expected that these substitutions will increase over the next three to five years, making available mercury-free displays for most if not all new designs.

It should be noted, however, that the Electromagnetic Compatibility performance of many Test and Measurement products is highly dependent on the particular display unit used. Should substitution in current designs be required, each replacement will require costly re-qualification of the product as a whole and potential scrap of any remaining stock of mercury-containing display units. This would not serve the goals of the Directive as units already on the market would be scrapped prematurely for a very minimal environmental return.

For further details, see our submission to ERA.

Exemption 5: “Lead in glass of cathode ray tubes, electronic components and fluorescent tubes”

We support the continuation of the exemption for lead in glass of electronic components as we are not aware of any alternatives for some components using these materials, e.g. surface-mount resistors, conformal coatings of semi-conductor dies, glass-bodied diodes, LCD frit seals and transformers. While many of these are common applications, some are very specialized. One custom use is in the glass capillary tube, composed of more than 20% Lead that helps deliver sample into a Mass Spectrometer (MS). The glass for this application needs to be electrically conductive to improve ion transfer into the MS. Non-leaded glass would not work for this application.

Due to the unique nature of these components, the removal of the exemptions listed above would drive design changes to the individual component and potentially design changes to the application where the component is utilized.

For more details see our submission to ERA.

Exemption 6: "Lead as an alloying element in steel containing up to 0,35% lead by weight, aluminium containing up to 0,4% by weight and as a copper alloy containing up to 4% lead by weight"

Both steel and aluminium which contain lead are used to create machined chassis parts. Steel with lead is also used to create fine-pitch screws. We support the conclusions of the ELV assessment that there is currently no substitute for lead in steel and aluminum.

Copper alloys containing lead are also used for their improved machinability. Currently leaded copper alloys are used extensively in custom parts for Test and Measurement products, such as probes, for fine tolerance, high-reliability contact points. These alloys are also used to machine precision cavities. Substitution materials, if available, would need to work under potential size constraints due to RF-domain impedance concerns. Materials being marketed as potential substitutes (e.g., Ecobrass) do not claim machinability on par with higher-lead copper alloys, which makes it likely they would promote faster machine wear and have lower manufacturability (slower machining) characteristics. We support maintaining the current exemption for lead up to 4% in copper alloys.

For more details see our submission to ERA.

Exemption 7: "(a) Lead in high melting temperature type solders (i.e. lead-based alloys containing 85% by weight or more lead), (b) lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signaling, transmission as well as network management for telecommunications, (c) lead in electronic ceramic parts (e.g., piezoelectronic devices)"

(a) The Test and Measurement industry supports at least a limited continuation of the exemption for lead in high-melting type solders due to the unique nature of the design cycles employed in the industry. It is typical practice in the industry to have custom ICs produced to meet those design criteria that cannot be achieved using off-the-shelf parts. Due to the low volumes and long product and design lifetimes typical of the test and measurement industry, custom ICs are frequently built in a single run that constitutes a lifetime supply of parts for both production and service applications. Older IC designs were built up in this fashion with high melting temperature type solders and these parts will be required to continue producing the products designed to incorporate them. Removal of the exemption will result in premature withdrawal of the affected products from the EU market when professional Category 9 equipment is brought into the scope of RoHS as redesign of the ICs to extend product life will in most cases not be economically viable. The material is also used for ceramic ball grid array (CBGA) applications where the stand-off must be maintain to control stress introduced by CTE mis-match. Potential RoHS-compliant replacements relying on technical breakthrough developments are 6 or more years away according to industry sources.

(b) Pb/In-based solders are used for soldering of high frequency connector pins to thick film gold traces in network management applications. Tests showed that tin-based solder are not suitable for this application due to the high gold dissolution rate, and there is no real replacement solder that would work in the common solder temperature range. Test and Measurement equipment manufacturers are also in some cases downstream users of servers and server storage arrays, as well as suppliers of equipment to the affected telecommunications network industry. The high reliability of a server platform or server array is an important criterion for their utility in test and measurement system designs. Though some years of lead-free solder reliability data have now been accumulated, it does not extend to the longer lifetimes needed in test and measurement applications. Until more data has been accumulated on the long-term reliability of lead-free solders in complex, “always-on” applications, we support a continuation of the exemption for lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signaling, transmission as well as network management for telecommunications.

(c) This exemption is critical for the thick film technology that is central to the circuitry business. Suppliers of thick film pastes are just at the initial phase of introducing Pb-free compatible pastes, and in some cases, no suitable replacement material has been introduced.

Due to the unique nature of these components, the removal of the exemptions listed above would drive design changes to the individual component and potentially design changes to the application where the component is utilized.

For more details see our submission to ERA.

Exemption 8: “Cadmium and its compounds in electrical contacts and cadmium plating…”

There is no supplier for switches capable of currents above 10 Amps that does not use silver cadmium oxide contact plating material. AgCdO plating on switch contacts material prevents arcing leading to fire. This application requires the cadmium exemption to be maintained to meet safety standards.

For more details see our submission to ERA.

Exemption 9 a: “Deca BDE in polymeric applications (exemption until 2010)”

Deca BDE is used in some custom cables. Due to the unique nature of these components, the removal of the exemption would drive design changes to the individual component and potentially design changes to the application where the component is utilized. Alternative flame retardant additives exist, though frequently less risk assessment data is available for these alternatives. Based on the outcome of the EU risk assessment deca BDE does not meet the criteria for restriction under RoHS so its continued use should be allowed via exemption.

Exemption 11: "Lead used in compliant pin connector systems"

This exemption is needed for making compliant pin connectors using alloys containing lead. In one case we have found a single source producer that has not found a feasible substitute to-date.

Exemption 13: "Lead and cadmium in optical and filter glass"

Gas Chromatograph Detectors and lasers use leaded Optical Filter glass as the glass must not shift color or optical quality from -40 to +450 C with very low optical interference and absorption. Trials were made last year to use filter glass of 5 different possible base materials. In all instances, either the temperature expansion capacity, opacity, or color retention to maintain the ability to filter and measure light levels that are at the minimum optical transmission were not able to perform with the same ability of leaded glass. The low level analysis of hydrogen flame color to measure amounts of Nitrogen, Sulfur, and Phosphorus in chemical matrix for raw oil, natural gas, etc. is the main use for this detector. If the leaded optical glass exemption is removed, the measurable base level of sulfur in oil & gasoline will no longer be capable of being measured to the level specified by the EU. GCs and lasers need the leaded glass for optical filters exemption if the standards for these & other applications are not impacted in the future. 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 index, non-leaded glass is feasible and has been introduced. These precision optical components are incorporated into equipment for nanotechnology, integrated circuit fabrication and positioning systems.

For more details see our submission to ERA.

Exemption 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.

Test & Measurement Coalition members are down-stream users of microprocessors. Our suppliers have indicated that suitable lead-free solder connections are not available.

For more details see our submission to ERA.

Exemption 15: “Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit Flip Chip packages”

The Test and Measurement industry supports continuation of the exemption for lead in solders to connect die to carrier due to the unique nature of the design cycles employed in the industry. It is typical practice in the industry to have custom ICs produced to meet those design criteria that cannot be achieved using off-the-shelf parts. Due to the low volumes and long product and design lifetimes typical of the test and measurement industry, custom ICs are frequently built in a single run that constitutes a lifetime supply of parts for both production and service applications. Older IC designs were built up in this fashion with lead-containing solders and these parts will be required to continue producing the products designed to incorporate them.

There are a number of flip-chip BGA packages that require the high temperature melting solder connections to prevent against re-reflow of the solder joints during Pb-free solder assembling processes. Flip chip technology allows the entire die surface to be covered with an array of bonding pads. There are currently no available substitute components for use in high reliability applications, and few, if any, alternative components or technologies available for other applications. Substitution of lead-free solders has been shown to create unacceptable early life failures due to electro migration or dielectric damage in high reliability applications.

Removal of the exemption will result in premature withdrawal of the affected products from the EU market when professional Category 9 equipment is brought into the scope of RoHS as redesign of the IC Flip Chips to extend product life will in most cases not be economically viable.

For more details see our submission to ERA.

Exemption 23: “Lead in finishes of fine pitch components other than connectors with a pitch of 0.65 mm or less with NiFe lead frames and lead in finishes of fine pitch components other than connectors with a pitch of 0.65 mm or less with copper lead frames.

Current research did not come up with a conclusion as to when a suitable replacement will be available. Until the mechanisms for whisker production are fully understood and can be reliably and generally mitigated over an extended product lifetime, we support the maintenance of an exemption for lead in the finishes in the listed fine-pitch components.

For more details see our submission to ERA.

Exemption 24 – "Lead in solders for the soldering to machined through hole discoidial and planar array ceramic multilayer capacitors"

Pb in solders for installation of discoidal through hole multilayer ceramic capacitors affects capacitive DC feeds used in the fabrication of custom hybrid microcircuit package assemblies. The high temp solder alloy contains > 85% Pb and at this juncture, there is no RoHS compliant high temperature solder alternative that meets high reliability standards. Lower temp solders are not appropriate due to incompatible solder hierarchy for hybrid microcircuit package assembly. Additionally, suppliers of EMI filters constructed using these capacitors have reported the use of InPb solders in order to achieve thermal matching with the ceramic material and avoid cracking. As downstream users of these parts we support the extension of this exemption for the use of lead.

For more details see our submission to ERA.

Exemption: "Lead oxide in seal frit used for making window assemblies for Argon and Krypton laser tubes" (Adopted October 07)

We need the exemption to be extended to cover seal frit for making assemblies for helium laser tubes. Unleaded glass frits have been tried but result in increased leakage of helium reducing the three year life of laser tubes using lead glass frit seals. As these tubes are replaced many times during the 20+ laser lifetime, the exemption could be withdrawn if the Commission defined "consumables" in respect of RoHS and provided binding ruling that laser tubes are consumables.

Test and Measurement Coalition

RoHS Scope Review of Category 8 and 9 Products

Contribution to ERA study

10 February 2006

Mercury Dossier

1. <u>Use of Mercury in test and measurement equipment</u>

1.1 General

There are several uses of mercury and its compounds in electrical and optical equipment because of its special properties including liquid metal state at room temperature and its high electromagnetic frequency of radiation compared to other metals.

- In manometers, which measure and control pressure;
- In thermometers;
- In electrical and electronic switches;
- In fluorescent lamps;
- In batteries (as mercuric dioxide); and
- In sensors

Usage has been reduced considerably in the interest of safety and the environment wherever cost-effective and technically equivalent substitutes have been found for applications of mercury. Mercury in the test and measurement (T&M) sector has been greatly reduced in the last decade and, excluding sensors, is in limited use in switches (including relays) and display lamps. The actual amount in use is small. Five major companies in the T&M sector estimate their products account for no more than 14 grams in switches and 340 grams in display lamps shipped into the EU annually.

Further information on uses of mercury including dental and other medical applications can be found at http://www.chem.unep.ch/mercury/Report/Final%20Assessment%20report.htm

A simple introduction to switches and relays is available at http://www.cougarelectronics.com/pdf/reed_relays.pdf

1.2 Technical characteristics

1.2.1 Lamps:

Mercury has the ability to enable electron/photon interaction processes at much lower energy levels compared to other metals. This property has been used in mercury lamps in education, research and in low energy fluorescent lamps for many years.

Photon energy from a mercury lamp hitting a zinc plate will release electrons from the zinc and this is a common demonstration of the photovoltaic effect due to the photon energy exceeding the work function of the zinc. Tungsten filament lamps will not show the effect independent of their brightness because the photon energy produced is proportional to the electromagnetic frequency of the light. (Mercury electromagnetic frequencies are in the violet/ultraviolet spectrum compared to the lower frequencies of filament lamps.)

Mercury lamps consume lower energy than other lamps for equivalent light output. They are used as lamps for room lighting, backlighting in liquid crystal displays (LCDs), laser printers and photocopiers. LCDs are a common display type in T&M equipment. No other commercially available backlighting technology gives equivalent brightness and contrast ratio. LCDs with lamps having 3-5 milligrams of mercury have largely replaced cathode ray tube displays in our sector. Other new mercury free display lighting possibilities have been announced but we anticipate it will be several years before a cost-effective suitable alternative becomes available. There is great commercial incentive to bring mercury free display lighting to market given the widespread usage of mercury lamps in many domestic and industrial products.

1.2.2 Switches and Relays:

Using the properties of low resistance and surface tension, mercury wetted switches and relays have been used in the past. Generally they have the disadvantage of being directional in operation and are sometimes called tilt switches. Companies in the T&M sector have replaced mercury switches with other types in the majority of applications through mercury reduction programs, however there remain some applications that require no contact bounce, high isolation, low contact resistance or long life (number of operations over expected product lifetime) where mercury switches and relays (activated by mercury switches) are still in limited use. Application requirements of switches and relays generally include:

Reliable and stable low contact resistance

High operational life
Switching frequencies sometimes into the RF region
Wide range of ambient temperature operation
Switching voltages and currents

1.2.3 Other uses:
There are no products with mercury based manometers or temperature measuring equipment in our companies. One company provides sealed elemental mercury that has no electrical power for temperature standards applications.

1.3 Trends

1.3.1 Our companies have restricted mercury to LCDs, relays and switches in electronic products. The majority of applications for switches and relays do not employ mercury-wetted types which use in the order of 10 milligrams. Equivalent types two decades ago used 20 or more times the quantity or mercury.

1.3.2 Our own reduction of mercury is in-line with reports of world usage of mercury that indicate use of mercury is an order of magnitude less than the amount of mercury used twenty years ago. Further details can be found at http://www.chem.unep.ch/mercury/Report/7.3

2. Substitutes for Mercury

Lamps

In the test and measurement sector LCDs are employed for visual text and graphical representation of measured and derived data with screen sizes much smaller than large screen TVs. Alternative plasma and LED display types are employed where the quantity of information is small and numeric in nature. Our members have no additional information on substitutes for mercury lamps in display backlights that have not been made available to ERA for their review of the first round of RoHS exemptions.

Switches

There are vast numbers of switch/relay technologies available for different applications. Most are electromechanical but there is a growing trend to use solid-state switches and relays in the guise of CMOS or FET devices:

In any electromechanical relay, contact operation relies on an energising element or switch. Depending on the design this can be a purely mechanical device or a magnetic element producing armature movement when energised. The by-product of coil energization is heat. This is not an ideal situation in relays required to offer stable low-level switching since heat generates significant thermal emf voltages across switching contacts.

Different materials and technologies are employed in the following applications:

Power switching (high voltages and currents),
RF (Radio Frequency) switching at high speed and
Low-level signal switching.

Power switches
In power switches the issue to mitigate is arcing of contacts. In most applications power switches do not require large operational life as they change state relatively infrequently (10 times/ hr) and a switch life of 10^5 operations is often more than adequate. To mitigate arching, power switches use cadmium oxide to keep contact resistance low, and may have air evacuated and subsequently sealed to operate in a vacuum, or are filled and sealed with inert gas. Gold plating is an alternative used that improves stability in gas filled relays and switches passing high currents. High voltage switches normally have tungsten or molybdenum contacts that are hard and have high melting temperatures.
Solid-state switches are unable to pass sufficient power without melting. Our companies do not use mercury in power switches and we are not aware of any available.

RF Switches
Operating any relay at radio frequencies to switch analogue or digital signals imposes current and voltage limitations due to the skin effect where current migrates from the centre of a conductor towards its outer surface as frequency increases. This results in localised heating at the surface of the conductor. In many applications at these frequencies a relay life of 10^8 operations or greater is required as it may have to operate many times per second for considerable time. Wherever possible solid-state switches are used however contact resistance is higher than equivalent electromechanical relay switches and they suffer from poor isolation.
Electromechanical RF switches with a lifetime of 10^6 operations without mercury operate at switching speeds up to 50 MHz. Wetting contacts with a small amount of mercury extends lifetime to 10^8 operations and frequency response up to 1 GHz. The quantity of mercury used is in the order of 10 milligrams. The equivalent switches twenty years ago contained 100 milligrams or more of mercury.

Low-level signal switches
For low frequency applications more choices are available to designers. Unless very low contact resistance or high isolation is required, solid-state switches are normally used for their long life in preference to electromechanical switches. In general purpose test and measurement applications wide input signal ranges are specified and where one of several signals is switched (to an analogue to digital converter for example) mercury wetted relay switches are still in use for specialist applications as they give long life and good electrical isolation in applications such as engine testing or monitoring turbo-generators.

With the new arrival of MEMS (micro-electromechanical systems) technology devices, where moving components are etched into a silicon substrate, performance of electromechanical switches is extending to the point where demanding applications like automated test equipment can be implemented to switch RF or low-level signals at internet speeds with low contact resistance and with lifetimes of 10^9 or greater operations.

Types being developed with miniaturised cantilevers have potential lifetimes of around 10^8 as they are limited by wear and oxidation of the solid metal contacts. In the mercury MEMS switches a small (1-5 milligram) slug of mercury is moved from one position to another by a fast heating element within the chip substrate. The slug of mercury sealed by glass over the substrate, is the only moving part in this type of switch. The first switch developed has a frequency response to 12 GHz and has one milligram of mercury. Development is underway to increase frequency bandwidths to 50 GHZ and beyond. Without degrading other performance parameters, these higher bandwidths can only be achieved by increasing the amount of mercury up to 5 milligrams.
Note these switches need very little power to switch and remain on. Once a signal is switched, the control signal can be removed; the switch device contacts stay latched thereby requiring less operating power compared to solid-state switches and electro-mechanical switches (which require power to maintain the on contact position).
The lifetime of a mercury MEMS is only limited by the heater; lifetimes of 10^9 or greater operations have been achieved. In portable battery operated test products, the small size of MEMS switches is an advantage as well as decreased power consumption and long life.

For the application types described above there are no working technically viable alternatives. Potential MEMS developments may eventually substitute mercury with gallium but for the moment this poses insurmountable technical difficulties. To name a few: metal liquid state occurring above room temperature (30 ^{o}C.) and poor surface tension wetting compared to mercury.

3. Impacts of substitution

3.1. Assuming no change to the current RoHS exemptions for mercury in lamps and no new exemptions approved for compliance, one member company would have to eliminate mercury switches in their products.

3.2. Environmental Impacts
As the amount of mercury in switches placed on the EU market by our members is less than 20 grams / year, substitution will have very little environmental impact particularly as thorough recycling procedures already in place for the type of industrial equipment which contain these switches, minimise environmental impact. A closed loop system for controlled take back and treatment means there is virtually no environmental impact from our sector’s products. Substituting these switches with shorter lifetime types will cause increased waste.

3.3. Economic Impact
In respect of conventional mercury wetted tilt switches and relays there is no economic impact to our members since we have recently stopped using them in products due to American legislation.

We are introducing low mercury (up to 5 mg) MEMS switches for high performance switching applications in test equipment for communications and electronic manufacture where no equivalent switches exist. In addition to recovering eight years development costs, industry would be disadvantaged if the new high-performance test equipment were banned from Europe; inevitably development and testing of high-speed communications equipment would migrate to other regions. Elimination of mercury by redesign of such products is not technically possible without degrading product life and performance.

3.4. Health Impacts

Unlike glass mercury thermometers that break easily, there is no risk to health of mercury in LCDs, relays and switches because the mercury is contained in sealed enclosures. Many LCD lamps have backlighting mercury in cartridges held firmly in display assemblies. Switches or relays are sealed components soldered on printed circuit boards. User access to these components is deliberately difficult and may void product warranty.
In addition drop, shock and vibration testing on our products has proven that no mercury is released during normal or even excessively harsh use.

4. Requests/recommendations

4.1. Exemptions

The existing RoHS exemption for mercury fluorescent lamps is essential for many test and measurement products where they are used extensively in backlights of displays. We are unable to estimate with certainty when alternative compliant displays of equal size and performance will be commercially available.

We request an additional mercury exemption for “switches or relays in monitoring and control equipment not exceeding 5 mg of mercury per switch” on the grounds that there is no substantially equivalent non-mercury alternative technology for the intended use considering all aspects of electrical performance, size, power consumption, cost and product life. In addition we propose that mercury switches used in monitoring and control equipment containing no more than 5 mg of mercury have an identification mark affixed enabling treatment operators to see the devices for removal at end of life. This controlled approach limiting use to industrial products together with removal and treatment mechanisms mitigates risk to the environment without hampering innovation. In context the innovation is the capability to test high-speed electronic products and communications network equipment where there are no technical alternatives.
This new exemption request mirrors a similar exemption granted in California for low mercury switches and relays in monitoring and control equipment since the ban enforced recently - January 2006. It is intended for limited applications where no suitable alternative exists. Our request allows new MEMS technology to address high-speed test applications where no technically equivalent alternatives are available and would drive manufacturers to adopt low or mercury-free solutions in monitoring and control equipment.

4.2. Phase-in period

Assuming exemptions for displays and switches are available when the RoHS Directive is revised, we estimate a transition phase-in period of three years from the entry into force of the revised Directive, is needed in the monitoring and control sector to conduct surveys with suppliers and update products where necessary to ensure compliance. For member companies, this period could be reduced considerably since the parts at risk have been identified by each member company and substitutes implemented where required to comply with American legislation.