

# RoHS/WEEE Directives

## Contents, Testing Requirements

G.A.MIRJI

Shiva Analyticals (India) Ltd

[www.shivatec-india.com](http://www.shivatec-india.com)

[mirji@shivatec-india.com](mailto:mirji@shivatec-india.com)



**WEEE - Waste Electrical and Electronic Equipment**  
**RoHS - Restriction on Hazardous Substances**



# Background to Directives

- Minimise resource depletion
- Minimise air, water and ground pollution
- Improve reuse, recycling and recovery
- Emphasis on producer responsibility

# Objectives

- To protect the environment
- To prevent human health problems due to exposure to hazardous substances
- To provide a common EU framework so as not to distort competition or create unnecessary barriers to trade.

**RESTRICT THE USE OF SCIENTIFICALLY KNOWN HAZARDOUS SUBSTANCES WHERE SAFER ALTERNATIVES ARE AVAILABLE.**

# RoHS Directive

- **Restriction of the use of certain Hazardous Substances in electrical and electronic equipment put on the market after 1st July 2006**
  - **lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl and polybrominated diphenyl ethers**

# Scope

- Large household appliances
- Small household appliances
- IT and telecomms equipment
- Consumer equipment
- Lighting equipment
- Electrical and electronic tools (except large-scale stationary industrial tools)
- Toys, leisure and sports equipment
- Medical devices
- Monitoring and control instruments
- Automatic dispensers



## RoHS - Restriction on Hazardous Substances



### Who is impacted?

Ultimately, anyone who builds, markets or imports electrical or electronic equipment (or components) into the European Union must ensure that the product complies with the RoHS directive, regardless of where it was originally produced.



### Who is exempt from RoHS?

**Military, Aerospace and network infrastructure equipment for switching, signaling, transmission as well as network management for telecommunication; Pb (lead) used in Servers, Storage and Storage array systems** [exemption granted until 2010]. ... It should be recognized that existing exemptions may be short lived, and should not be relied upon as part of your overall conversion strategy

# Key Elements – ROHS

- From July 2006 new electrical and electronic equipment put on the market cannot contain more than the maximum permitted concentration in values of
  - Lead
  - Mercury
  - Cadmium
  - Hexavalent Chromium
  - Polybrominated Biphenyls (PBB)
  - Polybrominated diphenyl ether (PBDE)
  - There are some exemptions
  - Put on the market means manufactured or imported

# The following are outside the scope of the Directive or exempted

- **Spare parts** for EEE put on the market before 1 July 2006
- Where electricity is **not** the primary energy source for the appliance.
- Equipment **specifically** designed to be installed in, airplanes, boats or other means of transport
- Batteries and ink cartridges

## Maximum Concentration Values

- **0.1% by weight in “homogeneous materials” for lead, mercury, hexavalent chromium, polybrominated biphenyls and polybrominated diphenyl ethers**
- **0.01% by weight for cadmium**
- **Homogeneous material means a unit that cannot be mechanically disjointed in single materials**

# WEEE Directive

**Encourages design and production of equipment that takes into account:**

- **Repair, upgrade, disassembly, re-use and recycling**
- **6 million tonnes of WEEE annually throughout Europe**
  - **Around 85 million electrical and electronic items**
- **Benefits of improved treatment of waste:**
  - **Reduced risk to human health and environment**
  - **Reduction air pollution and water toxicity**
  - **Help divert waste from landfill**

# Key Elements - WEEE

- Encourage the design and production of equipment which take into account dismantling and recovery
- Separate collection of WEEE through recovery systems
- Treatment of WEEE according to best practice
- Imposition of recovery and recycling by weight

# Industry Implications of Environmental Directives

- ✓ Manufacturing processes must ensure process capability for product compliance
- ✓ Product designs and component selections must comply with legislation
- ✓ Product designs and associated materials and components must be compatible with the emerging manufacturing processes and metallurgy so that product performance and reliability objectives are maintained
- ✓ Component conversions must be completed to comply with legislation and corresponding manufacturing processes (Suppliers) .....

**ALL OF THESE ELEMENTS MUST BE ADDRESSED FOR YOUR PRODUCT TO BE COMPLIANT**



# The banned substances

- **Pb** (lead)
- **Hg** (mercury)
- **Cd** (cadmium)
- **Cr<sup>VI</sup>** (hexavalent chromium)
- **PBB** (polybrominated biphenyls)
- **PBDE** (polybrominated biphenyl ethers)

Except when used in one of the applications listed in the Directive's annex OR if used within permissible concentration levels.

## Testing for RoHs - PBBs

- MonoBr PBB : 3 - Bromobiphenyl
- DiBR PBB : 4,4' - dibromobiphenyl
- TriBr PBB : 2,4,6- Tribromobiphenyl
- TetraBR PBB : 2,2',4,5' - Tetrabromobiphenyl
- PentaBr PBBs : 2,2',4,5',6- Pentabromobiphenyl
- HexaBr PBB : 2,2',4,4',5,5'-Hexabromobiphenyl
- OctaBr PBB : Octabromobiphenyl
- caBr PBB : Decabromobiphenyl

# Testing for RoHs - PBDEs

- MonoBr PBDE : 3 - Bromodiphenyl ether
- DiBR PBDE : 4,4' - dibromodiphenyl ether
- TriBr PBDE : 3,3',4- Tribromodiphenyl ether
- TetraBR PBDE : 3,3',4,4' - Tetrabromodiphenyl ether
- PentaBr PBDE : 3,3',4,4',5- Pentabromodiphenyl ether
- HexaBr PBDE : 2,2',3,3',4,4' -Hexabromodiphenyl ether
- HeptaBr PBDE : 2,2',3,4,4',5,6- Heptabromodiphenyl ether
- OctaBr PBDE : 2,2',3,4,4',5,5',6- Octabromodiphenyl ether
- DecaBr PBDE : Decabromoediphenyl ether

## What is the difference between lead-free and RoHS compliant?

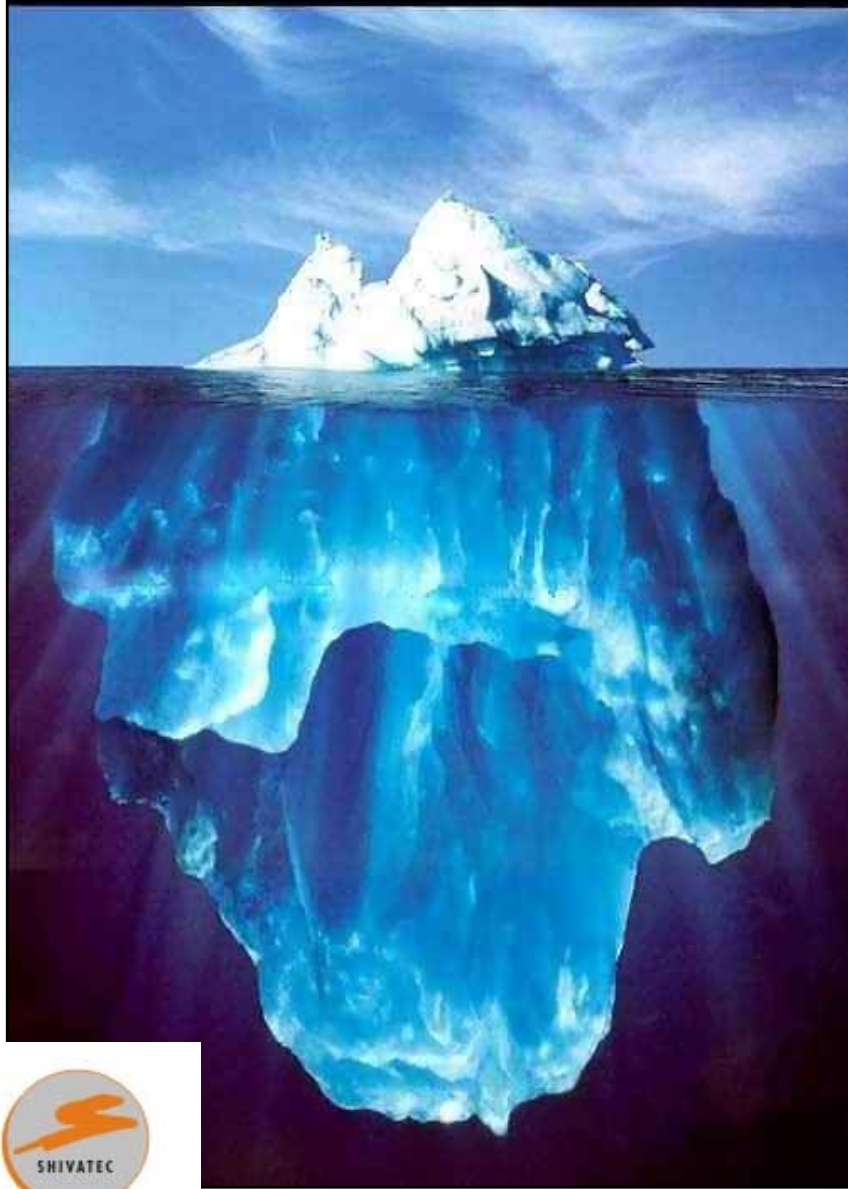
While lead (**Pb**) is the most widely used RoHS specific hazardous substance in electrical and electronic equipment (EEE),

the term "lead-free" is often wrongly adopted to refer to all of the substances specified in the Restriction of Hazardous Substances (RoHS) Directive.

However, RoHS restricts a total of six substances - lead, mercury, cadmium, hexavalent chromium, PBB and PBDE.

To be truly "RoHS compliant" with the WEEE – RoHS legislation, the presence of each of these substances must be reduced below their proposed maximum concentration values (MCV)..

## Lead-free: *not* equal to compliance



### Lead-free: just the tip of the iceberg

Lead-free solder assembly: many companies are doing this today

### RoHS/WEEE Compliance

- Includes all other banned substances
- Certificate of Compliance
  - Grant, track and manage
- New part numbers assigned
- Changes to incoming inspection
- High temperature survivability
- Moisture Sensitivity Concerns
- Material Declaration and Tracking
- Product Labelling
- Registration with European Authorities
- Tracking product distribution
- Take back and recycling
  - Business to Business
  - Business to customer
- Proving Legislative Compliance

## **RoHS - Restriction on Hazardous Substances**

RoHS compliance **impacts all components suppliers** that provide **Tin-Lead (Sn-Pb)** finish components. Most component suppliers will need to transition away from **Tin-Lead (Sn-Pb)** finish components to **Lead-Free (Pb-free)** alternate.

### **Component Terminal Transition**



95% **Tin (Sn)** / 5% **Lead (Pb)**

- 100% **Tin (Sn)** - or -
- **Tin (Sn)** / **Bismuth (Bi)** - or -
- 96% **Sn** / 3% **Ag** / 1% **Cu** - or -
- 99% **Sn** / 1% **Cu** - or -
- 100% **Gold (Au)**

## Soldering Process Changes as Result of RoHS:

### Legacy Tin-Lead (Sn-Pb) soldering:

- Widely based upon "Sn63" solder alloy
- Liquidus temperature of **+183°C**
- Reflow soldering with component exposure peaks from **+210°C ~ +230°C**

### Pb – Free Soldering:

- Many Pb-Free solder alloys are available [LINK]
- "**SAC**" (Sn-Ag-Cu) Tin –Silver - Copper Solder Alloy
- Liquidus temperature of **+217°C** ... **30°C** higher than Sn63
- Reflow soldering with component exposure peaks at **+240°C ~ +260°C**

# RoHS-Myths & Facts

<b>RoHS/WEEE only concerns companies who sell/operate in Europe...</b>	<p>30% of Electronics Revenue is generated in Europe. RoHS/WEEE important to China as well (export \$60B of electronics to Europe annually). Also dumping ground syndrome.</p> <p>Similar legislation is surfacing in other geographies (China, Taiwan, some U.S. states).</p>
<b>I don't have lead in my products</b>	You may have the other five banned substances in your products.
<b>I don't have <i>any</i> of the banned substances in my components</b>	Will the components you do use withstand lead-free processing (30 degree higher temperature)?
<b>My company can replace <i>non-compliant</i> parts /solder with <i>compliant</i> parts/solder</b>	It's not that simple: 30 degree higher processing temperature
<b>This is just an issue for my engineering team, they are smart people and will handle it</b>	What are they currently doing? Are they aware of all your suppliers' roadmaps? SCM, logistics, operations, finance will also be impacted.

# Am I affected?

- The RoHS Directive applies both to domestically (EU) produced and imported EEE.

## **You are affected if you:**

- Produce EEE which is exported to the EU
- Produce components for inclusion in EEE which is manufactured in or exported to the EU
- Resell EEE in the EU under your own brand that has been manufactured by someone else
- Are a professional exporter/importer of EEE into the EU

# **Steps to consider**

**For the product to comply with the RoHS Directive.**

- Contact suppliers - do their materials, parts, components etc contain any of the 6 restricted substances?**
- Is there any doubt about the presence of a restricted substance?**
- Some suppliers will not change their part numbers so separation of stock will be required**
- Keep supplier declaration and analysis documentation in a technical file....current recommendation for 4 years**
- Some customers may ask about RoHS compliance and expect a material declaration or certificate of conformity**

# Key dates

- **August 13th 2005**
  - **Producer responsibility for new products and historic WEEE. New equipment must include WEEE logo**
  - **Made in UK, sold in France = UK manufacturer is Producer**
  - **Imported into UK, sold in France = UK importer is Producer**
- **July 1st 2006**
  - **“Ban” on six substances commences**
- **December 31st 2006**
  - **Producers must meet recovery and recycling targets**

## RoHS - Restriction on Hazardous Substances

In **addition to unique RoHS part numbers**, all RoHS compliant material will have a packaging identification of RoHS compliance or Pb-Free.

Possible Packaging Identification Symbols:



- \* Shiva Group was established in USA in 1990
- \* Shiva Technologies Inc was established in Syracuse, USA in 1990
- \* Shiva Technologies Europe was established in Toulouse, Europe in 1995
- \* Shiva Analyticals India Ltd was established in Bangalore, India in 1997
- \* Indo US MIMTec Pvt Ltd, an Associate Co. of Shiva Group was established in Bangalore, India in 1998



# Equipments used for RoHs evaluation

S.NO.	EQUIPMENT	MODEL / ACCURACY
1	INDUCTIVELY COUPLED PLASMA SPECTROMETER –MS	VG ELEMENTAL MASS Perkin Elmer
2	ICP-OES	Varian
3	GC /MS, GC-FID/ECD/TCD/NPD	Agilent/HP
4	AAS	Shimadzu
5	HPLC	Shimadzu
6	FTIR	Nicolet