Analytical Protocol For Motorola Product Content

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Transition to Lead-free Assembly Forum
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Testing standards for Materials Content Data

4 PM	Introduction	Bob Pfahl
4:05	Overview of Motorola's Approach to Testing	Steve Scheifers
4:30	Review of EMT Testing Capabilities	Keith Gray
4:40	Discuss & Develop Action Plan	All
5:00	Adjourn	

Outline

- Regulatory areas of common concern
- Reasons to have qualified assay procedures
- Key aspects of assay technologies
- Anatomy of an assay
- Qualification methods
- Compliance testing methods
- Summary

Regulatory Product Compliance Certification
Common Areas of Concern

- **Recycling and Reuse**
  - Controlled Substance Location and Concentration
  - Percentage of Recoverable and Recyclable Product
  - Lifecycle Analysis of Environmental Impacts
- **Low Pb versus No Pb Components**
  - Lead or Surface Finish
  - Solder Materials
  - Ceramics/glasses
  - PVC Cable Stabilizers
- **Corrosion Protection and Dyes**
  - Cr(VI)
  - Cd
  - Azo Dyes
- **Other Hazardous Substances**
  - Halogenated Dioxins and Furans
  - Hg
  - Asbestos
  - Chlorofluorocarbons and halons
  - Ethylene Glycol Monomethyl Ether and its acetate
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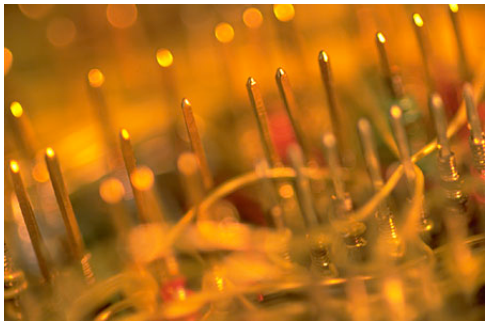
  - PBBs and PBDEs (PBDOs)
  - PCB's and PCT's



Assays' Rationale

Motorola's environmental stewardship and good corporate citizenship means that we will:

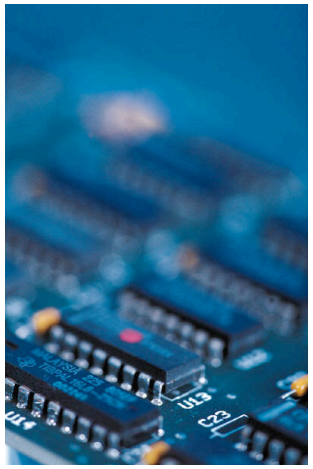
- Assure regulatory compliance for customers and products (e.g. P-65, RoHS, WEEE, ELV, etc.)
- Check engineering calculations
- Provide missing information for engineering calculations of product content
- Check supplier information
- Provide suppliers with methodologies to help them complete Motorola's material declaration

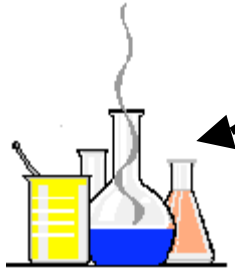
Key Aspects Of Assay Technology

- Assays must be scientifically valid
  - **Recognized by government regulation, e.g. EPA Method 3050b**
  - **Statistically validated**
  - **Performed by accredited lab**
- Assays must be traceable to recognized material standards such as those from NIST
- Assays must be qualified to prove viability for the application
- Assays can help to answer many legal questions about product content directly (e.g. prohibited metal content)
- Assays can indicate areas for further testing (elemental assays for Cr, Cl, and Br may suggest further testing for Cr(VI) or halogenated flame retardants)
- Assays cannot easily address manufacturing and product component variation

Anatomy Of An Assay

- Sample Preparation
  - **Collection and handling**
  - **Storage**
  - **Reduction – e.g. grinding, cutting**
- Sample Reduction
  - **Sampling of reduced product**
  - **Introduce NIST traceable control standards and blanks**
  - **Digestion method and technique, e.g. nitric acid/microwave**
  - **Filter and diluting**
- Sample Analysis
  - **Instrument type/detection technique, e.g. ICP/MS**
  - **Dilutions to bring sample within calibration range or eliminate interference**





Example Qualification Method

- Anticipate and bracket analytes concentration range
- Use NIST traceable chemical standards to test lab and instrument performance
- Determine limits of detection and quantitation
- Determine potential for false positives
- Determine linearity and reproducibility
- Calibrate assay
- Use actual product samples to test reproducibility
- Can be used to compare lab to lab performance

Example Regulatory Compliance Testing

Elements and Compounds	Standard Test Methods
Lead Pb Cadmium Cd	•EDXRF for PWBs and Plastics or •EPA Method 3050b followed with ICP/AES or ICP/MS
Mercury Hg	•EDXRF Screening •EPA Method 3050b followed by GF-AA, cold vapor FIA or AA
Chromium VI [Cr(VI)]	•EPA Method 3060A followed with UV/VIS detection
PBB and PBDE	•EDXRF Bromine Flame Retardant Screening •Bromine quantization - bomb digestion or equivalent followed by ion chromatography with conductivity detection •Species test for extractable brominated flame retardant ccompounds needed

Summary

- Assays provide vital information about product content
  - **Assays needed assure regulatory compliance**
  - **Assays check validity of calculations, validate supplier data, and help to provide unknown product content data**
- Assays are an integral part of long term E-Waste management

- NEMI task?
  - **The electronics industry needs qualified assays**
  - **Standardized and widely recognized (scientifically valid industry standard) testing is highly desirable**