# Roadmap to Compliance: The Role of Electronic Data Exchange in Supporting the European Union RoHS and WEEE Directives

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**Introduction**

The upcoming European Union RoHS and WEEE directives are driving new requirements for the management and exchange of information, both across the extended electronics manufacturing value chain, and across the product lifecycle. The Restriction of Certain Hazardous Substances in electrical and electronic equipment (RoHS) bans or severely restricts the use of certain substances in the manufacture and assembly of electronics products to be marketed in the EU. The regulation of Waste from Electrical and Electronic Equipment (WEEE) places strict requirements on the handling and disposition of electronic products at their end of life. All electronics OEMs that sell products into the EU states will have to comply or they will lose access to these markets. Information on the material composition of all components and bulk materials that go into the manufacturing of products will have to be available and shared, across multiple tiers of the supply chain, to support RoHS compliance. Information on substances of concern and the location of any hazardous substances, along with disassembly instructions, will have to be available to recyclers to support WEEE. Additional information will likely be required to support the upcoming directive on Design for Energy Using Products. Some estimates[1] place the cost of enhancing and updating IT systems to support environmental compliance for an average electronics producer at $2-$3 million over the next 3 years.

However, when asked exactly what the requirements are for IT systems to ensure compliance, most IT directors charged with providing solutions would be hard pressed to provide a detailed answer. Much of the ongoing uncertainly stems from the fact that actual enforceable requirements are left to a large degree to the individual EU states to determine as they pass the directives into their own laws. Although the EU deadline for this was August of 2004, few member states have yet done so. Even with those who have, much is still left to interpretation and further guidelines for practical application.

Meanwhile, the clock is ticking. The WEEE laws are set to go into effect August 13, 2005. Information to support recycling, including identification of substances of concern and disassembly instructions are required to be available to recyclers within 12 months of a product's release to the market. The substances banned under RoHS must not be present in electronic products (with some exemptions as defined) above established threshold values after July 1, 2006. While that may still seem like a long time off, if one considers that new product development and introduction cycles typically range from 12 to 16 months, sources of compliant components, the information to support their compliance, and IT systems to manage this information need to be established now. Given that a recent Inter-National Electronics Manufacturing Initiative (iNEMI) survey[2] indicates that while many passive components are already available in RoHS compliant forms, other components such as certain connectors, ICs, etc. will not be available until mid to late 2006, the task seems daunting. Add to this the fact that many component vendors are not changing part numbers when they switch to RoHS compliant forms, and that the demand for such parts will sky-rocket as the deadline approaches, ensuring compliance and component supply will be absolutely critical to a company's revenue from the EU in 2006.

A key element in managing compliance will be establishing liability across the multiple tiers of the supply chain. This will require an audit trail for information collected or referenced that can be legally attributed to a supplier and referenced to the part numbers (and potentially lot numbers or date codes) used in production.

Suppliers that attended a recent iNEMI workshop[3] confirmed that the number of requests that they are receiving from customers is growing exponentially. The biggest problem is that the requests are in almost as many different forms as there are customers. Some are using the Excel spreadsheet based forms developed for the auto industry (Compliance Connect), while many Japan-based producers are using the Excel form developed by JGPSSI. Others ask suppliers to log onto a company web portal and enter information there. The majority however, are sending email requests with their own customized spreadsheet. One major component vendor recently had an email request that listed 800 part numbers and requested information on 120 material/chemical substances for each. The component suppliers agree that they are rapidly approaching a point where they will be unable to respond to these requests in a reasonable time – without some standardization on format and the ability to automate the exchange of data, the problem will choke their existing resources.

There is some good news. First, clarification on how the directives will be administered is being issued by some EU states. The UK DTI is leading the way and has released draft documents that indicate how they intend to administer the regulations, as well as guidance on how producers can support compliance. These documents have also been submitted to the EU

Technical Adaptation Committee (TAC). While some of the definitions remain a little vague, it is clear that they expect producers to collect and maintain "technical documentation" that will support that they have conducted "due diligence" in insuring that their suppliers are providing compliant parts. Upon request or audit, this data is to be made available within 30 days of request, and must be retained for a period of four years.

Second, there are activities well underway to develop standard formats for material composition data reporting and exchange. The draft "Material Composition Declaration Guide", developed by EIA/EICTA/JGPSSI and commonly referred to as the Joint Industry Guide (JIG), will soon be released as an EIA/JEDEC standard. This provides guidance on the reporting requirements to meet RoHS compliance. iNEMI has been working to develop a draft Material Composition Declaration (MCD) format and data collection process that will use the JIG as a reference for reportable substances and methods. A new IPC Standard (IPC-1752) for MCD data exchange is being developed based on the iNEMI work and is being coordinated with RosettaNet (a consortium of major nformation Technology, Electronic Components, Semiconductor Manufacturing, Telecommunications and Logistics companies working to create and implement industry-wide, open e-business process standards) to establish data exchange standards as well as a form-based input mechanism. These will be validated through pilot projects over the next few months.

The goal of these efforts is to drive towards internationally accepted standards for the automated exchange of required data in order to reduce the cost and complexity of compliance, while increasing data quality and decreasing response times.

This paper will look at the different roles within the supply chain, examine the data standards activities and options for automation, then focus more specifically on the component manufacturers by offering a suggested roadmap to establish processes and tools to support compliance.

**Roles within the Supply Chain**
An effective material composition declaration strategy demands a clear understanding of what role your company plays in the electronics industry value chain. Understanding where you fit will also help in understanding the expectations of your customers and potential obligations to regulators.

For this purpose, it is useful to segment the value chain elements into three categories:
- OEM/Producer
- EMS/CM
- Component/Sub-part supplier

Each of these plays a different role, with distinct responsibilities and requirements. Of course, the roles may blur. For example EMSs/ODMs may brand and sell products themselves. Or subsystem suppliers -- such as disk drive vendors -- may sell directly to consumers. But overall the categories are still generally applicable.

*OEM/Producer*
The European Union directives define "producer" primarily in terms of branding: those companies that manufacture and sell electrical and electronic equipment under their own brand, or resell under their own brand equipment produced by other suppliers. This definition applies regardless of how the equipment is sold -- for example,.through retailers, VARs or via the Internet or mail.

*RoHS Related Requirements*
The producer is the only element in the value chain that is directly and legally responsible to EU state regulators to ensure that their products are compliant. The onus is on the producer to ensure that all of the components and materials that are used in the manufacture of their equipment are compliant, even if the actual manufacturing is performed by a third party (EMS/CM).

Currently, none of the EU states are requiring any type of formal declaration or documentation to support compliance when products are placed on the market after the

July 1, 2006 effective date, but since few EU states have yet introduced the defining legislation into their state laws, one should not rule out this possibility. The United Kingdom has developed RoHS guidance that indicates that their approach will be one of "self-declaration," whereby products placed on the U.K. market after July 1, 2006 will be assumed to be compliant. Under this system, producers would be expected to be prepared to submit technical documentation demonstrating compliance upon request of the enforcement authority. Testing procedures and standards are currently being defined that will be used to support the physical testing of products for compliance.

### EMS/CM

The electronic manufacturing service provider/contract manufacturer sector is, as usual, stuck between a rock and a hard place. Although not legally responsible to EU regulators, their OEM customers will turn to them to help ensure compliance. In some cases, OEMs are expecting their EMSs to carry out the majority of the work required to ensure RoHS compliance and are going so far as to include related clauses in their supplier contracts. Other OEMs are collecting compliance data directly from all component suppliers and requesting information from EMSs/CMs only for the materials that they add during the manufacturing process (for example, solder or adhesives). To further complicate matters, more than one EMS/CM may be included in the production process for a single product - one may perform the final assembly and test, but another may supply the assembled printed circuit board.

### RoHS Related Requirements

Customers will request technical documentation from EMSs to support their compliance due diligence. Currently, these requests take many forms, and may be at the product, part/component or bulk material level. In order for EMSs to support these requests, they will need to have access to part/component level compliance data for all parts that are used in customer's assemblies, as well as the bulk materials used during the manufacturing process.

Liability is established with the EMSs through the information that they provide and through the contractual terms of the contracts and purchase orders from their customers. The fact that there are currently no standardized formats for compliance requests/responses means that EMSs are faced with increased costs to support the mostly manual processes required.

### Component/Sub-Part Suppliers

This category spans a large range of parts, materials and suppliers -- including solder paste vendors, metal fabricators, wire and cable suppliers, PCB vendors, passive and IC component suppliers, and sub-system suppliers like disk drives. These are the building blocks that are used to create the products and for the most part are defined by the product Bill of Materials (BoM) and associated Approved Manufacturer/Vendor List. These documents define the identifying part numbers and suppliers. Some bulk materials, such as solder paste, are not typically defined on the BoM, but will need to be accounted for.

### RoHS Related Requirements

The data provided by these suppliers will form the foundation of a producer's RoHS compliance program, whether the information is provided to OEMs or EMSs. The requests for compliance data received by suppliers are even more varied than those received by the EMSs, and range from a company-level compliance declaration (covering all parts procured from that supplier) to full disclosure that accounts for 100% of the substances in each component.

The variety of formats and request types make it very difficult for suppliers to provide information in a timely manner, assuming that they have the information available in the first place. One key point is that for any procured part, the supplier will be responsible to provide compliance information for the entire content, including any sub-parts that they procure from their suppliers. The disk drive is a good example of the complexity of this. From the OEM or EMS perspective, a disk drive is a single part, identified by part number and supplier. Yet the disk drive manufacturer will have its own BoM and supplier list, and will have to manage the collection of the lower level data. As with the EMSs, liability is established with the component suppliers through the information that they provide and through the contractual terms of the contracts and purchase orders from their customers.

## MCD Data Standards and Exchange Mechanisms

The iNEMI Material Declaration project is recommending that the industry embrace 3 levels of reporting disclosure, which are cumulative, defined as follows:
1. RoHS Component Level Compliance – essentially a yes/no declaration that indicates whether a component meets RoHS compliance requirements, and allows for specification of any RoHS exemptions that are applicable.
2. JIG Material Disclosure (Levels A & B) – in addition to above, provides detail on JIG Level A and B materials, at the homogeneous level, including substance mass and ppm concentration levels.
3. JIG Material Disclosure (Levels A, B and C) – in addition to above, includes the option to add additional "materials of interest". These could include precious metals, or additional substances which may required in other jurisdictions. This can be extended to include provision for "full disclosure", where 100% of the substances must be accounted for. Obviously, this level of reporting adds considerable burden to all involved, and should only be requested where necessary.

The iNEMI Material Composition Data Exchange team is working with the newly created IPC 1752 Committee to develop a standard data model to support all three levels of disclosure, as well as to develop pdf-based forms for request-response, and supplier self-declaration. These forms are designed so that they may be completed using the free Adobe Acrobat Reader, either by manual data entry or by data upload, can be saved locally, and be submitted electronically back to the requester.

Each form will be based on an underlying XML schema, which in turn is represented by a UML model. This will enforce entries to conform to the schema requirements before the form can be submitted, thereby ensuring a higher level of data quality. XML data can be extracted by the requester upon form submission to automate the data transfer into internal systems.

The data model and XML structure are being aligned with RosettaNet 2A10 and 2A13 PIPs, and the pdf-forms correspond to the those defined under the RosettaNet Auto-Enablement program (RAE) to ensure interoperability and full support for automated B2B data exchange.

A number of solution providers are involved with these efforts, and there are now options to aid with the automated exchange and management of MCD data.

**Steps Towards Compliance for Component Manufacturers**
As previously indicated, the information from component manufacturers forms the building blocks for an understanding of product level compliance, and therefore could be considered primary data, as it typically represents the lowest level part numbers in a product BoM. It is critical for component manufacturers to understand their markets and customers requirements. Some OEMs will take advantage of exemptions for lead-in-solder (i.e. for servers and telecom equipment) – for these customers a component with Sn-Pb lead plating can still be used and be RoHS compliant within the application it is used for. This same component would be considered non-compliant in consumer electronics.

In general, component manufacturers should be prepared to provide information for the most stringent disclosure requirements. In most cases, this would be Level 3 reporting, up to and including full disclosure. If the data is established and maintained to support full disclosure, any of the lower levels of reporting can also be easily supported. At a minimum, component manufacturers should be prepared to provide information on explicit levels of JIG Level A & B substances. The suppliers to component manufacturers generally provide raw or bulk level materials- often, these materials may be in the form of proprietary chemicals, for which the suppliers may be reluctant to provide any level of detailed composition reporting. This can hinder efforts to provide full disclosure information to those customers requesting it.

The following questions will help in establishing and supporting a compliance program for component manufacturers. Once these have been answered, a company should be in good position to meet compliance requests and support their customers in ensuring product level compliance:
1. **Have you defined your Compliance Risk Management Strategy?**
    – What components are affected, in what markets, at what time?
    – What are your customer's requirements?
    – What are your liabilities?
    – How will you manage accountability and liability with your suppliers?
2. **What is your strategy for identifying changes in RoHS/Lead-free compliance?**
    – Will you change part numbers, or identify material change by lot or date code?
    – How will you communicate this strategy to your customers?
    – Will you continue to provide Sn-Pb compatible parts as well?
3. **Have you defined what substances and level of Content Disclosure you will support?**
    – Draft Material Composition Declaration Joint Industry Guide (JIG) – developed by EIA/EICTA/JGPSSI
    – Global Automotive Declarable Substance List (GADSL)
    – iNEMI Levels 1, 2 and 3
4. **Have you defined Data Formats?**
    – Excel spreadsheets (customized, JGPSSI, Compliance Connect)
    – RosettaNet 2A10/2A13 PIPs
    – IPC 1752 (Proposed): xml based MCD data format supporting multiple levels of declaration, with associated pdf-based forms
5. **How will you Transfer Data?**
    – Web portals
    – Email
    – RosettaNet RNIF, Web services…
6. **Will you support B2B exchange with Customers?**
    – Web services or RosettaNet B2B Gateways and network to support automated data exchange
7. **What do you need for MCD Tools/Applications?**
    – Provide for data input, aggregation, component level roll-up, analytics, report/declaration generation

**Conclusions**

While there are distinct differences in requirements based on the role in the supply chain, both from a regulatory perspective and from an information management perspective, there are also many common threads and common issues.

By establishing a clear methodology, your company can support customer requirements within the timelines required. The following elements should be considered:

- Ensure your company has a well defined compliance program and multi-functional team in place, with CPO and CIO visibility
- Answer the 7 questions:
    1. Have you defined your Compliance Risk Management Strategy?
    2. What is your strategy for identifying changes in RoHS/Lead-free compliance?
    3. Have you defined what substances and level of Content Disclosure you will support?
    4. Have you defined Data Formats?
    5. How will you transfer data?
    6. Will you support B2B exchange with Trading Partners?
    7. What do you need for MCD Tools/Applications?
- Analyze your product and supplier portfolio to determine risk levels
- Get involved in standards activities
- Understand that this will be an ongoing business requirement

Component and EMS companies agree that the lack of consistency in the requests they are receiving from customers, linked with the escalating frequency and shear number of requests, is rapidly creating a crisis situation. The efforts underway through the JIG, IPC, iNEMI and RosettaNet to develop material declaration standards, as well as the deployment of efficient and economical electronic data exchange technologies, will ease the burden and cost.

**References**

1. Kevin O'Marah, AMR Research, quoted in "The Art of Compliance", *Information Week*, Pages 34-38, May 17, 2004.
2. NEMI "Component Supply Chain Readiness Project" Survey Presentation, NEMI RoHS/Lead-Free Summit Meeting; co-sponsored by AeA, EIA and IPC, October 18-20, 2004, at StorageTek, Louisville, CO.
3. NEMI Material Declaration Data Exchange Workshop, August 30-31, 2004, Intel, Santa Clara, CA.

**Additional Sources of Information**

1. iNEMI: http://www.nemi.org/
2. RosettaNet: http://www.rosettanet.org/
3. IPC: http://www.ipc.org/