

Gaining Competitive Advantage Through Design for Environmental Compliance

a PLM Whitepaper
Prepared by ENOVIA MatrixOne

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Why and How a Data Management Solution will Help Your Company Comply with WEEE, RoHS, ELV, REACH and Other Emerging Global Legislation

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• Introduction	4
• Achieving the Four Critical Compliance Functions During <i>Design for Environmental Compliance</i>	5
Collection and Integration	6
Analysis	6
Reporting	7
• How MatrixOne Materials Compliance Central Can Help	8
Collection and Integration	8
Analysis	8
Reporting	9
• Conclusion	10

Introduction

In recent years, companies, particularly those in the Automotive and Electronics markets, have been faced with an onslaught of new regulatory pressures. The most notable of these has been the material compliance requirements presented by the WEEE, RoHS and ELV directives from Europe, and the equally challenging initiatives that have emerged and are still emerging in California, China and Korea. While the existing European directives have created the need for companies to manage a new set of product data, the newest requirements from around the globe are furthering the case for effective and cost efficient methods for managing product compliance information. These regulations are aimed at reducing the amount of hazardous materials contained in new products and ensuring that these materials are recyclable at the end of their product lifecycle. Under these new regulations, manufacturers must implement processes to collect, integrate, analyze and report detailed materials and substance data related to all new products.

The risk of non-compliance for Automotive and Electronics companies is quite significant. According to an AMR Research report by Eric Karofsky, *RoHS and WEEE: It's an Executive Problem*, "Not meeting these two directives could cost companies millions. They must be taken seriously and be an executive level priority." In the report, AMR notes the experience of a major consumer Electronics company which lost \$110 million in sales revenues, resulting from a ban placed on the sale of its new highly anticipated product. The government of The Netherlands claimed that the product exceeded cadmium content limits set by its regulatory agency and banned the sale of this new product.

While compliance with WEEE, RoHS and ELV is a major issue facing Original Equipment Manufacturers (OEMs) in both the Automotive and Electronics industry, it equally impacts the Tier 1 suppliers who provide parts, assemblies and systems to the OEMs. This is a result of compliance verification and audit reporting requirements mandated by the regulations. Each requires OEMs and/or their suppliers to certify in writing to the governments concerned that their products meet all regulatory requirements and do not exceed

threshold levels of identified banned substances (i.e. Lead, Mercury, Cadmium, Hexavalent Chromium, and certain Brominated Flame Retardants). New RoHS requirements in China, which took effect on March 1, 2007, mandate that companies selling "Electronic Information Products" (EIPs) on the Chinese consumer market provide labeling in their product documentation that shows within the product structure breakdown where levels of the previously stated Substances-of-Concern (SoCs) exceed the threshold value of 1000 ppm (0.1%), or 100 ppm (0.01%) for Cadmium substances.

Additional and even more complex environmental enhancement initiatives are emerging from Europe. The REACH (Registration, Evaluation and Authorization of CHemicals) Directive, which goes into effect on July 1, 2007, will make a fundamental change in ensuring environmentally-safe products by shifting the burden of proof away from "countries proving that certain chemical substances are hazardous" to "chemical manufacturers proving that all of their chemical substance products are safe." More than 15,000 of the most toxic and/or highest-volume chemical substances will be required to undergo a complex & detailed registration process over the next 10 years as part of the REACH Directive. While the REACH Directive has very little direct impact upon Discrete Products (the exception being if a product will release to the environment a chemical substance during its normal and expected lifetime use), it does have the potential to cause significant supply chain disruption in the event that a Level "n" Supplier is no longer able to use or obtain a specific chemical substance due to the substance not having been properly registered with the REACH authorities.

Providing such certification and ensuring compliance means that both OEMs and their suppliers must achieve a high level of knowledge regarding the specific materials and substances that make up each and every part and component of the products that they sell—a potentially daunting task for companies that sell diverse and complex products, each of which may consist of thousands of parts, materials and substances. However, achieving such product data knowledge can positively affect a company's competitive positioning and help the company realize benefits in the following ways:

- Certify to government agencies that products fall within new regulatory guidelines
- Enable assessment of current products to make the most cost-effective “end-of-life versus re-design” decisions
- Certify to customers that parts and assemblies conform to new and emerging guidelines
- Avoid fines triggered by non-compliance
- Avoid public relations miscues and negative customer perceptions that could last for years as the result of unsafe products reaching the market
- Maintain “preferred vendor” status with customers
- Win customers away from suppliers with lesser compliance reporting capabilities
- Avoid costly recycling and disassembly fees arising from high levels of banned substances within products at end-of-life

To gain a complete understanding of the material and substance composition of their products, companies must recognize that they must perform four critical functions related to all purchased parts and sub-assemblies found in new products:

- **Collection** of material compliance requirements from Customers and Markets
- **Integration** of material and substance data from Suppliers
- **Analysis** of material and substance data readiness
- **Reporting** of material and substance data compliance to Customers, Auditors or Legal Entities

It is of paramount importance for companies to perform these four functions early in the new product design process so that costly product revisions, new design considerations or retrofits, new manufacturing techniques and time-to-market delays are not incurred during efforts to achieve compliance. Until recently, companies had no simple mechanism for incorporating these functions into the early

product design process, leaving them to report on material and substance data *after* products had been released to market. Even in the Automotive market, where an industry standard repository of part substance data called IMDS exists, OEMs and Tier 1 suppliers could only manually input product structure (Bill-of-Materials or BOMs) or collect part substance data. They had no internal data management tool for efficiently handling the complex and company-wide need for handling material compliance data through the entire Product Lifecycle. As a result, some automotive companies had to cobble together manually-intensive operations for collecting, integrating, analyzing and reporting material substance data. Those that could not handle the four functions in an expedient manner were faced with the decision to either risk delivering non-compliant products to market or incur lofty expenses involved in manually managing part material and substance data. Some companies even incurred new product introduction delays as they awaited results from their manual compliance information management processes.

Today, leading Automotive and High Tech OEMs, as well as Tier 1 and lower level suppliers, are adopting a new method of achieving regulatory compliance without sacrificing time-to-market or the four critical functions for material and substance data management. Through their adoption of a “Design for Environmental Compliance” methodology, these companies are able to integrate part material and substance data into every phase of their new product development process, enabling them to achieve compliance with WEEE, ELV, EU RoHS, China RoHS and emerging directives, and at the same time streamline new product development. Not only do they realize the benefits of compliance, they also are able to respond to customer requirements faster than their competition.

Achieving the Four Critical Compliance Functions During *Design for Environmental Compliance*

As previously stated, product compliance data management requires collection, integration, analysis and reporting of part material and substance data. That does not change in Design for Environmental Compliance, except that it all happens much earlier—throughout the product development process—and in a more automated fashion. What enables

this unity between compliance data and the early design process is the integration of Product Lifecycle Management (PLM) technology with compliance data management solutions. Essentially, this enables companies to expand the scope of the product data managed within PLM to include material compliance data.

Having their compliance data integrated with their PLM systems, companies are able to view Customer or Market requirements, engineering bill-of-materials (EBOM) data, manufacturing BOM data (MBOM), and part material and substance data related to all product data—all in a single system. This allows rapid response to customer demands while at the same time understanding the overall functional, environmental and cost impact that various product configurations will have when designing for environmental compliance—whether in Europe, China, California, South Korea or anywhere in the world. Thus, trade-offs and issues can be discussed at the earliest stages of product development, increasing customer satisfaction and streamlining NPI and compliance efforts.

Solutions that integrate PLM and materials compliance data management should achieve the following in regards to the four critical functions for materials compliance.

Collection and Integration

Beginning with the collection of Customer or Market compliance requirements at the early design stage means that companies must understand the breadth and complexity of the specific chemical substance restrictions that will make up the various “Compliance Definitions” that will be used to measure a product’s compliance. Although, the MBOM is of most concern from a regulatory point of view, the EBOM also needs to be appended with material and substance data to facilitate Design for Environmental Compliance. This will enable design engineers to work easily with and quickly reference vendor substance data. In addition, data from a multitude of suppliers must all exist in the same format and reside within a single, unified system for all stakeholders to view, with views based on varying levels of rights-based rules.

In order to obtain accurate existing BOM data, the system must be able to automatically import data from enterprise product systems, particularly the ERP system, where the MBOM is normally stored.

Because supplying materials and substance data represents a cost center activity for Tier 2 and lower-level suppliers, Tier 1 suppliers and OEMs need to make the data provisioning process for

Tier ‘n’ suppliers as simple as possible. Best-in-class solutions provide simple Web-based, Excel-based or PDF-based forms that are pre-populated enough to virtually walk suppliers through the entire process and minimize the length of required responses. Moreover, to avoid costly losses in translation, the forms should specify the units of measure (such as inches or centimeters, gallons or liters and ounces or grams). The forms/system should be rules-based to maintain adherence to a company’s specific data formats. The crash of the Mars Probe is a testament to the need for rules-based data collection with specified units of measure. The supplier and OEM never translated their measurements between the English and the Metric systems, causing the Probe to crash into the planet rather than maintaining a safe distance. Moreover, without such a rules-based form/template, a single OEM or Tier 1 supplier would struggle to accurately and consistently aggregate the millions of data types provided by its massive supply base. This would make internal parts and assembly comparisons extremely difficult, costly and inefficient.

The final step in data collection and integration is to make certain that all material and substance data related to products under development resides in a single PLM system. In this way, design engineers should be able to see complete and up-to-date information about the following elements of product data:

- Product requirements from the customer, including hazardous substance thresholds
- EBOM and MBOM data
- Internal and external supplier part numbers for each part/assembly
- Material and substance data for each part/assembly
- Material compliance exposure for the product to the component/supplier level

Analysis

Once hazardous material and substance data is integrated into the PLM system, analysis of that data must be fast and simple. Engineers striving to hit new product design targets have little time to analyze a wide range of hazardous substance data. Moreover, since customers mandate hazardous

substance “thresholds” on both individual parts and entire assemblies, compliance solutions should offer the ability to automatically analyze both assembly-level and part-level data so that trade-offs and choices can be made quickly during design. For example, a mobile phone OEM might require its Tier 1 supplier to provide a phone assembly with less than 0.1% Lead, or less than 1000 PPM—today’s threshold set by European governments. Many Tier 1 suppliers (and OEMs) mistakenly believe that they may choose any configuration of parts or part types, as long as the entire phone assembly falls under the 0.1% Lead limit. This is simply not true. Even though the entire assembly may have less than 0.1% Lead, if a single component (resistor, capacitor, etc.) has more than 0.1%, the entire assembly is deemed non-compliant. Such was the situation surrounding the product banned by The Netherlands’ government (cited earlier). The insulation on the product’s power cable, a miniscule amount of the overall product, contained Cadmium levels above the Cadmium threshold set by the government, leading to the product ban.

Given the thousands of parts originating from a wide array of suppliers, the list of acceptable design options could be tremendously long for a design engineer to review. But with an automated analysis tool, the design engineer could request various views that suit his/her needs. Such views could include, but are not limited to:

- Descending levels of hazardous substances for all assembly options (based on the entire BOM)
- Best case analysis when incorporating a specific part (perhaps an engineer’s favored part)
- Worst-case analysis using a specific part
- Descending hazard levels when utilizing only certain suppliers

Given the increasing percentage of recycling and reclaiming of materials mandated by the EU’s ELV and WEEE directives—85% in 2006 and 95% in 2015—companies will need to make threshold choices early and often. That is because end-of-life product cost could become as big of an issue as chemical substance compliance. Since most product companies outsource disassembly and recycling to 3rd parties, the higher their hazardous substance levels, the higher the price of these 3rd party services. So even if a part with hazardous substanc-

es does not push an assembly above a customer’s required threshold, the existence of the part within the final product can still cost the supplier or OEM at the product’s end of life. These costs can really affect the bottom line and long-term company value. Companies need to drive out these end-of-life costs by analyzing and eliminating them at their source—the early design phase.

Reporting

Reporting is the final stage for any regulatory compliance solution and is the culmination of the collection, integration and analysis processes. A materials compliance data management solution should provide reporting capabilities for both internal and external company stakeholders. Such reports could include, but are not limited to:

- Statement of Compliance/Certification report for external customers and government agencies
- Report of insufficient part data: helps customers understand which parts have not yet been reported as being in compliance
- Report of non-compliant suppliers: helps design engineers and purchasing personnel to qualify eligible suppliers
- Report on percentage of all materials reported: helps a company understand how much progress it has made in reaching full compliance
- Compliance scorecard for parts/assemblies: helps engineers to recognize the most optimal parts and assemblies for use

There can be numerous types of reports. Companies should investigate the flexibility of reporting within a compliance solution, particularly since regulations continue to evolve and will require new and different reports going forward.

How MatrixOne Materials Compliance Central Can Help

MatrixOne Materials Compliance Central™ (MCC) is a business process solution designed to enable companies to Design for Environmental Compliance. The solution provides methods for collecting, integrating, analyzing and reporting material and substance data and specifications throughout the product development process. Users can apply its functionality to internal BOMs (EBOM or MBOM) or to product content information from any source, and can easily and accurately cross-reference the data against multiple substance lists and regulation requirements from the earliest stages of product development. In this way, product teams can leverage MCC to quickly determine whether a product's components meet compliance standards and certain design thresholds from the start of a project. MCC also allows for suppliers to be incorporated into the compliance process at its earliest stages to ensure up-front adherence to new regulations regarding their designs and components, avoiding costly downstream design changes or recalls.

MCC provides full support for the critical functions of Design for Environmental Compliance.

Collection and Integration

MCC provides companies with the capability to collect detailed material and substance data for components, whether they are purchased or developed internally. The core of this capability is ENOVIA MatrixOne's application called the MCC Compliance Connect Spreadsheet, a rules-based reporting tool that enables a company to dictate to its suppliers both the nomenclature and units of measure for reporting material and substance data.

The MCC Compliance Connect Spreadsheet comes in three versions.

The first is an Automotive-specific version that supports the Automotive industry requirements. This has become a *de facto* standard data collection tool for the 1,600 member companies of the Automotive Industry Action Group, popularly known as AIAG. Not only does this afford streamlined compli-

ance, it also supports design reuse for all participating companies, saving valuable development time and costs. In addition, the AIAG Compliance Connect Spreadsheet can automatically import and export material substance data into IMDS, the material and substance data repository of choice for many large automotive OEMs (developed by EDS).

The second version of the MCC Compliance Connect Spreadsheet caters to the Electronics industry by supporting the Electronics and Electrical Equipment industries' requirements. While Electronics companies currently have no central data repository option similar to that of IMDS, the RoHS Compliance Connect Spreadsheet and its associated data importer can recognize and translate data across any set of enterprise or supplier systems. Thus, an electronics company can include all internal and external data relevant to materials compliance.

The third version of the MCC Compliance Connect Spreadsheet provides for both the Automotive and Electronics relevant product and material compliance information.

To ensure participation of all compliance stakeholders—including OEMs, Tier 1 suppliers and Tier 2 suppliers—the MCC Compliance Connect Spreadsheet can be shared either as a stand-alone spreadsheet over e-mail or accessed via the MatrixOne MCC Supplier Portal environment. In either scenario, design engineers can enforce supplier submission of material and substance composition data as part of the assembly/part selection process.

Analysis

Once compliance data has been collected from both internal systems and external suppliers, design engineers can leverage MCC to analyze parts or assemblies to see if they meet compliance thresholds—whether those thresholds are dictated by regulations internal to the company, or externally from customer requirements. To further streamline the analysis function, MCC also provides for rolled-up views of entire BOMs.

Combining MCC with MatrixOne's wide-ranging PLM data management capabilities, design engineers can bring together all product-related data, even data outside of the realm of regulatory compliance. As a result, design engineers can achieve the following:

- Drive hazardous substances out during the design process
- Meet all compliance threshold requirements through compliance indicators
- Ensure replacement components meet the design and manufacturing requirements (i.e. flow rate, heat, etc.)
- Search for new parts based upon compliance indicators
- Search by substance to see how all product parts comply
- Allow for exceptions to compliance regulations as dictated by customer specifications
- Compare parts/assemblies and perform trade-offs that consider customer requirements, product performance, end-of-life issues, and supplier capabilities
- Choose the best performing compliant part
- View "where-used" information on all parts/assemblies
- Perform individual and aggregate supplier analyses
- Understand best-case/worst-case scenarios for both compliance and non-compliance parameters
- Support both Manufacturers Part Numbers and Customer Part Numbers (MPN/CPN)
- Receive automatic updates regarding RoHS and other compliance values
- Receive automatic updates regarding new regulations introduced worldwide (i.e. Green Procurement, REACH, etc.)
- View standard or custom reports on hazardous material and substance levels to ensure compliance

Reporting

Critical to the success of regulatory compliance initiatives is having the ability to quickly and easily report a wide variety of compliance data both externally to customers and governmental agencies and internally to design engineers and quality assurance teams.

MCC provides a wide array of standard reports as well as customizable applications so that users can manipulate compliance and product data as their business needs dictate. Whether it is a tree view of the properties and substances of concern for all parts within a BOM or a simple pie chart depiction of all substances within an assembly, MCC can associate virtually any product data to support a user's specific compliance needs and provide a succinct report that provides proof of compliance. Examples of such reports include, but are not limited to:

- Ranking of suppliers' compliance
- Percentages of materials reported for a given product/part/assembly
- Compliance scorecards for parts/assemblies/BOMs
- Customer substance lists depicting percentages of hazardous materials and associated thresholds
- Automotive-specific reports that comply with industry standards
- MPN reporting
- CPN reporting
- RoHS JIG levels "A" and "B" reporting
- IPC-1752 reporting

MCC also provides out-of-the-box capabilities that allow for creating reports with customer-specific analysis and reporting in customer-dictated formats.

Conclusion

MatrixOne Materials Compliance Central enables the linkage of material and chemical substance compliance data to all product lifecycle processes supported within the ENOVIA MatrixOne PLM solution set. As a result, OEMs and Tier 1 suppliers, especially within the Automotive and Electronics industries, can gain full product regulatory compliance visibility across their organization and supply chain. This will help them to drive hazardous substances out of their products and avoid a litany of problems, such as slower time-to-market, product recalls, potential fines, product bans, poor customer satisfaction and possibly a damaged public image.

For those companies seeking to gain competitive advantage through compliance with current and emerging environmental regulations including WEEE, RoHS, ELV and REACH, MatrixOne Materials Compliance Central enables them to leapfrog the competition by helping to speed their product development cycles and deliver compliant products to the marketplace.

About ENOVIA MatrixOne

MatrixOne, Inc. was acquired by Paris-based Dassault Systemes in May, 2006 and today is part of its ENOVIA PLM Collaborative Environment family of solutions. The ENOVIA MatrixOne solutions enable companies to accelerate product innovation to achieve top line revenue growth and improve bottom line profitability. ENOVIA MatrixOne is focused on helping companies across the automotive, aerospace & defense, consumer, machinery, medical device, semiconductor and high-tech industries solve their most challenging new product development and introduction problems. More than 850 companies use ENOVIA MatrixOne solutions to drive business value and gain a competitive advantage, including industry leaders such as BAE Systems, Bosch, Comau, General Electric, Honda, Johnson Controls, Linde AG, NCR, New Balance, Nokia, Philips, Porsche, Procter & Gamble, REI, Sony Ericsson, STMicroelectronics and Toshiba. ENOVIA MatrixOne (www.MatrixOne.com) is headquartered in Westford, Massachusetts, with locations throughout North America, Europe and Asia-Pacific.



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