

Maximize the value of full material disclosure (FMD) data for product compliance

Why data is your most valuable asset

White Paper

This paper describes how a company can process full material disclosure data from a supplier with a product lifecycle management system to determine the compliance of a product against multiple environmental regulations and directives.

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Executive summary

The visibility of restricted or controlled substances in components purchased from suppliers is one of the biggest challenges facing every manufacturer's product compliance team. Collecting full material disclosure (FMD) data from suppliers helps solve this problem, but many people do not realize the full potential of the value of possessing this level of data. This paper describes how a company can utilize a

product lifecycle management (PLM) system to collect and process FMD data from a supplier to determine product compliance against environmental regulations and directives such as the European Union's (EU's) RoHS¹ and REACH² directives, and the US Conflict Minerals³ law, and to stay ahead of evolving and new regulations.

1. Introduction

There are a number of regulations and directives throughout the world that target the use of specific substances in manufactured products. Environmental compliance regulations such as the RoHS and REACH directives from the EU restrict the use of certain substances that are known to be hazardous. Social compliance regulations such as the US Conflict Minerals Law attempt to identify the origin of specific substances and discourage sourcing from mines whose proceeds support armed conflict and human rights abuses. How can a company effectively comply with these existing regulations, anticipate changes to them, and be flexible enough to

address new substance-based regulations? By using a holistic product compliance process based on these sustainability principles:

1. Centralize compliance efforts into one department and clearly communicate this throughout the company
2. Collect FMD data from suppliers using an automated process and engage them as partners in the process
3. Leverage a PLM system to automate the supplier declaration process and analyze the data to understand how well your products (and supply chain) meet your stated goals

1. RoHS – Restriction of Hazardous Substances in Electrical and Electronic Equipment
http://ec.europa.eu/environment/waste/rohs_eee/events_rohs3_en.htm
2. REACH – Registration, Evaluation, Authorisation and Restriction of Chemicals
http://ec.europa.eu/enterprise/sectors/chemicals/reach/index_en.htm
3. Section 1502 of the Dodd-Frank Act
<http://www.sec.gov/News/Article/Detail/Article/1365171562058>

2. Holistic enterprise approach

The first step a company must take is to build a comprehensive product compliance strategy based on a determination around their preferred place in the industry – will they lead the industry and proactively stay ahead of new regulations, or be reactive and only do what is needed to be in compliance? In our experience the latter approach is more costly over the long run, because these companies typically rely on the use of an absence (or negative) declaration to query their supply chain about the presence of specific substances. As a result, when regulations change (for example, REACH is typically updated twice every year) or a new regulation is passed, every supplier will have to be re-contacted to update their previous declarations. Also, the lists of regulated substances vary across regulations which may also result in multiple requests for supplier data to address each requirement. This can result in supplier fatigue, causing long delays in responding to requests because in addition to receiving multiple requests from the same company, suppliers are probably also getting requests from many other companies.

Some companies also make the mistake of segregating regulatory compliance management across different teams; one team may be responsible for REACH while another is responsible for conflict minerals. These teams may take different approaches to data collection and use different tools, resulting in higher costs and a longer time to determine compliance. In addition, they are most likely contacting the same suppliers – again, leading to supplier fatigue and frustration. If these teams do not communicate with each other they will send the suppliers mixed messages and if they do not cross-reference the data they collect it will lead to data redundancy and errors in data collection.

A better way to address product compliance at an enterprise level is to:

1. Form a core team responsible for determining which regulations apply, how to address them, and a standard corporate policy
2. Clearly state data compliance and reporting

responsibilities in supplier contracts

3. Define a single cohesive data collection mechanism to use across the supply chain
4. Train all suppliers on why compliance is important to them and how to effectively provide the necessary information as an FMD
5. Deploy a tool that helps the supplier catch errors and omissions so they submit the correct information the first time
6. Collect and process the FMD data using a PLM solution with the capability to automate the process of collecting the data from suppliers, validate the data and refresh it on a regular schedule
7. Learn from the data and adjust the product compliance policy and support processes as necessary

Another best practice is to outsource data collection to a company that can dedicate knowledgeable resources to this task and has practical experience providing this service with a PLM solution to others. Many companies simply do not have the bandwidth to set aggressive corporate policies and goals, train their suppliers on data collection techniques, provide help desk support, follow up with lagging suppliers, and analyze incoming declarations while staying ahead of evolving regulations. Software tools do a remarkable job of automating tedious processes, but ultimately you are dealing with people in your supply chain and people who understand your suppliers will need to reach out to them. WSP | Parsons Brinckerhoff has functioned as an extension of Seagate Technology's product compliance team for many years. Because of our expertise in product compliance and our experience in supply chain engagement and data management for other electronics manufacturers, Seagate realizes an FMD data collection rate that today exceeds 95 percent.

Seagate Technology LLC, based in Cupertino, CA, is committed to producing sustainable and socially responsible products. The company's vision of proactive product development is based on a policy of partnering with its suppliers to obtain FMD data for every component in the supply chain.

Seagate uses Teamcenter from Siemens PLM Software to manage this data and determine how its products comply against various regulations and directives.

Since 2005, WSP | Parsons Brinckerhoff has been supporting Seagate's vision by acting as an extension of its product stewardship team, focusing on improving product sustainability, environmental performance, and supply chain optimization.



WSP | Parsons Brinckerhoff's strategic consulting services to Seagate include:

- Establishing corporate goals and metrics targets around product stewardship to drive process improvements.
- Managing the environmental attributes of supplier-provided products by facilitating supplier engagement through training on Seagate's environmental policies, and providing help desk support for FMD data collection.
- Analyzing and preparing Seagate customer sustainability reports which provide detailed breakdowns of product material composition and recyclability.

As a result of the collaboration, Seagate's products consistently meet customer product environmental sustainability requirements and comply with worldwide regulations. Seagate is well positioned to anticipate, meet, and exceed customer expectations for product sustainability performance and reporting.

3. Data collection

It is important to realize that a supplier knows more about the design and composition of the component that they manufacture than anyone. Many companies send components out to a laboratory for a spectral analysis to determine its substance composition, but this can be very costly to do for every component that is sourced. And it may lead a supplier to fear that the company is trying to reverse engineer the component and take business away from them. A better solution is to actively engage suppliers as partners in the product compliance process and help them to understand that no market for their customers means no market for them. Non-disclosure agreements (NDAs) help to assure suppliers that they and their information will be protected. Use clear but firm language in purchasing agreements and contracts to compel them to give you product content information as part of component delivery.

3.1 Automate the FMD data collection process

Once you have established a policy to win your supplier as your partner in the compliance process, you need to determine what type of information you want. In a previous paper⁴ we advocate in favor of FMD data because:

- It minimizes supplier fatigue – collecting FMD data results in a complete material DNA at the beginning of the sourcing process. Suppliers only need to go through the material declaration process once; they only need to refresh the data if the component composition changes. Ask suppliers annually if the material DNA has changed; for 80 percent of your supply chain the answer will be “no.”
- Standardized forms and formats help reduce supplier frustration. The IPC-1752A⁵ Materials Declaration Management Standard has become the preferred FMD data exchange format in the electronics industry and many others.
- You can proactively plan for changes to regulations (more on this in Section 4).

The choice of automating the data collection mechanism is typically one of using a web-based portal vs. an email exchange. A portal enables the operator to dynamically track statistics such as whether the supplier has begun the response, how many requests are outstanding, how many requests are complete, and what is the average turnaround time per supplier. Portals can also employ guidance processes that lead the supplier through specific steps to leave no gaps in the data or incomplete information. Validation checks can also be implemented as part of the portal to avoid rework and time-consuming communication cycles with the supplier. Email is asynchronous: a request is sent and the supplier works offline to complete the declaration. Responses are tracked, retrieved, and analyzed by the PLM system when the supplier emails the FMD data as an attachment. Both methods have advantages and disadvantages based on the company’s unique business needs. We have observed that many companies chose a phased approach to their FMD data collection process, beginning with email and gradually phasing in a well-defined portal strategy. The key is to choose a method that:

- Is easy to use for your team and suppliers. Training is essential no matter which mechanism is chosen.
- Fits within your cost structure.
- Enables automated reminders to suppliers and escalations to your team when requests are outstanding.
- Provides automatic checks and validations to improve data quality and reduce rework.
- Supports industry standard formats such as IPC-1752A that reduce supplier frustration.

4. “A Review of Data Collection Methods in Product Compliance,” June 2015, http://www.plm.automation.siemens.com/en_us/products/teamcenter/environmental-compliance/index.shtml

5. IPC <http://www.ipc.org/ContentPage.aspx?pageid=Materials-Declaration#1752a>

3.2 Supplier-side data validation

A difficult problem some companies face with FMD data collection is getting accurate data the first time. Typically, since the response is created by a human, it can be riddled with problems including:

- Incorrect and missing information – this may be anything from missing part numbers to misspelled company names.
- Invalid Chemical Abstract Service⁶ (CAS) numbers – to alleviate the problem of typographical errors in the names of substances, the CAS Registry Numbers were set up to assign a unique ID to every chemical substance described in the scientific workplace such as organic and inorganic compounds, minerals, isotopes, and alloys. Changing a single digit of a CAS number can result in reporting on a different substance or an invalid number.
- Incomplete mass disclosure – a request for FMD data is a request for disclosure of the total mass of every substance and material in the component. It is easy for a human to miscalculate and under-disclose mass.

Web portals can be designed to perform supplier-side validations and guide the individual to provide complete and accurate information. Email requests require a tool such as the Material Declaration Tool (MDT) by PLM Logix⁷ to be run on the user's personal computer. It color-codes mandatory fields in purple and prevents the user from creating simple errors such as inputting non-numeric characters in a required numeric field, for example, for "phone number." MDT also provides the supplier with other checks such as validating the CAS number, calculating masses, and identifying incorrect exemption syntax. All of this hinges on the company providing the supplier with clear guidelines on what is expected in the FMD, and MDT will help the supplier build a compliant declaration in the IPC-1752A XML format. It can also be configured to email the completed FMD back to the company, or the user can manually attach the document in response to a request using any standard email program.

Figure 1: The MDT graphical user interface showing mandatory fields in purple and the Validations tab.

6. CAS REGISTRY and CAS Registry Number FAQs,
<http://www.cas.org/content/chemical-substances/faqs>
7. PLM Logix LLC
<http://www.mdtapp.com>

4. Processing FMD data

Integration of material and substance data from supplier FMDs across the product development process is a key element in helping to determine product compliance against various regulations and addressing efficient, green design. Management of material and substance information combined with core PLM capabilities such as program and process management, configuration and change management, requirements management, and document management provide companies with a framework to address current and future sustainability and product stewardship goals. Supplier FMD data managed in PLM can also be used in lifecycle assessment (LCA) initiatives, which help companies measure and understand the environmental impact of their products from cradle to cradle.

4.1 Review and aggregate supplier FMD to PLM

Companies can leverage the document management and workflow capabilities of a robust PLM framework to automate the request and receipt of supplier FMDs via email. A PLM tool can be configured to process and aggregate the approved FMD data into engineering and other product bills of materials (BOMs). It can also preserve a record of every transaction with the supplier, and archive the FMD data as it evolves over the lifetime of a product. With strong material management and data collaboration capabilities, all members of a product development team can view material and substance information related to parts and components, understand concentrations at the component level, and roll it up across entire product structures.

4.2 Grade for compliance

A PLM system that supports FMD data aggregation across components supplied from multiple sources will enable users to visualize a more complete picture of a BOM early in the design process. For example, Teamcenter® software from Siemens PLM Software includes a substance compliance solution that can grade a product against one or multiple regulations. It can be configured with a list of CAS numbers and rules that determine how to calculate allowable thresholds at various levels (for example, homogeneous material, component, or product). With advanced configuration capabilities, users can choose different revision levels, options or variations of a product structure for compliance grading. Entities can be marked with various compliance statuses (for example, pass, fail, compliant, or noncompliant) and exemptions to the regulations (such as those applicable under RoHS) can be applied to a compliant result in accordance with industry guidelines.

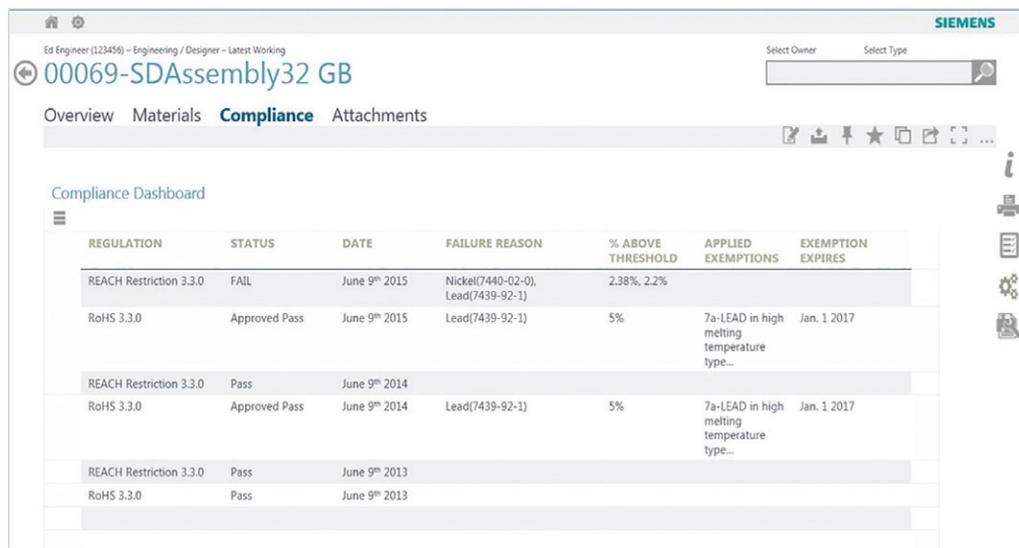


Figure 2: Compliance dashboard for an assembly showing regulation statuses.

Regulations and directives are continuously evolving and a PLM system such as Teamcenter can be easily updated with new rules and CAS numbers without changes to its core programming. Companies can also choose to define their own substance specifications and rules to grade against without requiring support from the software vendor. For example, if a company has received lists of substances that should not be in its products from multiple customers, the company can build a custom specification (regulation) with the CAS numbers and check each of its products against it.

FMD information in a PLM system like Teamcenter can also be used for forward-looking purposes. The European Chemicals Agency (ECHA) typically publishes a list of all substances being considered for inclusion in the REACH regulation months ahead of time for public discussion. With Teamcenter, companies can begin searching for these substances in their product database and begin taking steps to address them long before they are regulated or restricted.

4.3 Search, analyze, and report

A robust PLM system such as Teamcenter also enables users to manage the results of compliance grading in context with the product structure. With its strong search capabilities users can find an entity based on multiple attributes such as compliance status to a regulation, date graded, date the FMD data was received and exemption expiry date. Users can also search for products and components that use specific materials or substances, and roll up masses of substances and materials. For example, the system can calculate the total mass of lead in a product by adding all of the occurrences distributed across components from multiple suppliers. This enables forward-looking companies to set tangible goals such as reducing the use of lead by a set percentage over a specific period.

Users can cross-reference FMD data with other product data to verify that information has been reported correctly by suppliers. This can help to enhance and improve other business initiatives, and further reduce the risk of non-compliance. For example, a company doing conflict minerals reporting can search through the FMD data and identify only those components that contain tungsten, tin, tantalum, and gold (3TG). Using this information they can save time and money by narrowing the scope of their conflict minerals data collection activities and have Teamcenter initiate a conflict mineral request to only the suppliers of those components. When the conflict minerals reporting templates (CMRTs) are collected from each supplier and the data is assembled in Teamcenter, another report can be run to verify that the supplier reported the correct minerals and corresponding smelters. Most importantly, the report can be used to omit minerals and smelters reported in a supplier's company-level CMRT which are not present in components sourced by the company.

METAL	NAME	IDENTIFICATION	CITY	STATE	COUNTRY	CONTACT	EMAIL	AUDIT STATUS	CERTIFICATION EXPIRES
Tin	Alp Metals	CD010273	Belmont	Pennsylvania	USA	Tom Johnson	tlj@ap.com	Validated	
Tin	Tinco	CD010181	Sungaiat	Bangka	Indonesia	Fred Booth	fred.booth@tinco.us	Certified	Jan 1, 2017
Gold	The Gold Mint	CD022196	Newcastle	Western Australia	Australia	Sam Smith	sam_s@themint.com	In-Process	
Gold	Zachra	CD990175	Montréal	Quebec	Canada	Mary White	mwhite@zachra.com	NO USE	

Figure 4: Assembly view showing smelter status and vendor information.

MATERIAL NAME	MASS GRAMS	SUBSTANCE NAME	CAS NUMBER	MASS GRAMS	% OF COMPOSITION
Phosphor Bronze	5	Phosphorus	7723-14-0	2	40
		Copper	7440-50-8	1.5	30
		Tin	7440-11-5	1.5	30
CONTACT Nickel Plating	2	Nickel	7440-02-0	2	100
COVER LCP	3	Aromatic Liquid Crystal Polyester	60288-52-0	2	66.66666666
		Carbon Black	1133-86-4	25	8.333333333
		Glass Fiber	65997-17-3	75	25

Total Material Mass: 10g Total Substance Mass: 10g

Figure 3: Rollup of materials and substances across the product structure of an assembly.

4.4 FMD data and sustainability initiatives

FMD data can be the most valuable intellectual property (IP) that your company possesses because it has critical uses beyond product compliance. For example, the growing trend in material research to create more innovative and competitive products has driven a lot of companies to design out the old materials and design in the new. Having a complete view of your product DNA, including all of the supplier material data when performing research on products, is critical to this effort.

Also, most companies determine compliance after a product has been designed, and in many cases, after it has entered manufacturing. Discovering that a product is non-compliant (or contains a restricted substance) can be costly to remediate at this late stage. Using a robust PLM system, material, substance and compliance information can be made available upstream during the decision-making process, enabling designers to avoid components that could cause a product to be non-compliant when it is manufactured. Including compliance in the requirements phase of a product's design requires FMD data and can help companies significantly reduce costs (and rework) and shorten time-to-market.

The environmental impact of a product can be estimated using FMD data. Consumers and governments around the

world are becoming more sensitive to the impact that products and product manufacturing have on the environment. For example, the EU has instituted a voluntary Ecolabel⁸ license program which helps consumers identify products and services that have a reduced environmental impact throughout their lifecycle, from the extraction of raw materials through production, use and disposal. LCA tools can use information from FMD data to build baseline assessments of carbon emission, water use, energy use, emissions, waste, use of materials and natural resources, social impact, costs, and health and safety. From this information companies can identify problem areas and set goals to reduce the impact of their products on the environment.

FMD data helps companies become more sustainable by identifying the presence and role of critical materials in the product development process. For example, companies with PLM-enabled reporting systems can quickly identify and quantify the amount of rare earth minerals in a supply chain and the components which rely on them. This enables them to forecast the future availability of these components and plan for shortages or other impacts on their product line. Companies can also mine FMD data to discover other potential hazards (such as whether the market shortage of an ancillary cleaning fluid will impact the availability of components that use a specific substance) and advantages.

8. EU Ecolabel
http://ec.europa.eu/environment/ecolabel/index_en.htm

Summary

The essence of effective product compliance is getting an abundance of “good” data in a timely manner and being able to turn the data into knowledge about a product. The best way to accomplish this task is with FMD data from suppliers and a robust PLM system such as the Teamcenter solution from Siemens PLM Software. Good supplier data must be complete and as accurate as possible. Validating the FMD data on the supplier’s side saves time and money and helps to get buy-in from the supplier on this important initiative. If more companies adopt and use a format such as the IPC-1752A standard, everyone will benefit from shorter cycle times (and costs) because suppliers are familiar with the data requirements.

Companies must clearly identify their product compliance objectives and articulate the requirements across the supply chain. Appropriate language should be used in procurement contracts to inform suppliers up front that no data means no market for everyone. Companies should also take advantage of outsourcing data collection and let experts handle the manual task of training suppliers and providing support for completing FMD data submittals. Company resources are best used to interpret the data and determine the forward-looking corporate policy and objectives.

An automated process should be used that is based on a robust PLM platform to collect, process, and analyze FMD data from suppliers. It will enable companies to move beyond compliance with regulatory requirements to product sustainability, and help them understand the level of risk in their supply chains. The result will be full visibility and traceability of supplier components via dynamic status searches, advanced reporting which could include forecasts, estimates of volume shipping, and visual reports to understand and anticipate where problem areas may exist. This in turn will enable companies to treat compliance as an upfront requirement, not as a separate task that is not connected to product design.

In conclusion, having complete and accurate FMD data, and maintaining it in a robust PLM system enables product manufacturers to:

- Determine a product’s compliance against multiple regulations without overstressing the supply chain
- Predict a product’s compliance against upcoming and evolving regulations
- Quantify the total amount of specific substances and materials in the supply chain
- Set performance goals such as reducing the use of specific restricted substances and materials over time
- Address other product sustainability initiatives such as environmental impact analysis, recycling, and conflict minerals
- Engage designers in the product compliance process by making material, substance and compliance information available upstream

Addressing the challenges of product compliance using core sustainability principles is key to creating sustainable, green, and innovative products that will ultimately help companies win in the global markets. Please read our previous white paper “A Review of Data Collection Methods in Product Compliance,” which describes the advantages and disadvantages of FMD data vs. absence declarations.

Siemens PLM Software

Headquarters

Granite Park One
5800 Granite Parkway
Suite 600
Plano, TX 75024
USA
+1 972 987 3000

Americas

Granite Park One
5800 Granite Parkway
Suite 600
Plano, TX 75024
USA
+1 314 264 8499

Europe

Stephenson House
Sir William Siemens Square
Frimley, Camberley
Surrey, GU16 8QD
+44 (0) 1276 413200

Asia-Pacific

Suites 4301-4302, 43/F
AIA Kowloon Tower, Landmark East
100 How Ming Street
Kwun Tong, Kowloon
Hong Kong
+852 2230 3308

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Siemens PLM Software, a business unit of the Siemens Digital Factory Division, is a leading global provider of product lifecycle management (PLM) and manufacturing operations management (MOM) software, systems and services with over nine million licensed seats and more than 77,000 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with its customers to provide industry software solutions that help companies everywhere achieve a sustainable competitive advantage by making real the innovations that matter. For more information on Siemens PLM Software products and services, visit www.siemens.com/plm.

“Maximize the value of full material disclosure (FMD) data for product compliance” was authored by Tord Dennis, Practice Leader, WSP | Parsons Brinckerhoff

Tord Dennis is a Practice Leader in WSP | Parsons Brinckerhoff’s Integrated Product Compliance Management practice. Based in Los Angeles, CA, Mr. Dennis has over twenty years of technical and marketing experience for multinational entities in North America, with projects related to product development, supply chain management, and business collaboration; governance, risk management and compliance; and process analysis, re-engineering, improvement and documentation. Previously, Mr. Dennis worked as a product manager at Siemens, where he built and managed strategy for embedding environmental compliance into the PLM process and integrated new solutions into the software portfolio. Mr. Dennis holds an MBA and an M.S. in mechanical engineering from the Georgia Institute of Technology in Atlanta, GA.

About WSP | Parsons Brinckerhoff

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