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# Environmental Regulations Impose New Product Lifecycle Information Requirements

John Messina<sup>a,1</sup>, Eric Simmon<sup>b</sup> and Matthew Aronoff<sup>b</sup>

<sup>a</sup>Computer Scientist, National Institute of Standards and Technology, USA.

<sup>b</sup>National Institute of Standards and Technology, USA.

**Abstract.** In a global response to increasing health and environmental concerns, there has been a trend towards governments enacting legislation to encourage sustainable manufacturing where industry creates products that minimize environmental impact. This legislative trend seeks to shift the environmental responsibility of product manufacturing to the finished goods manufacturer. To meet this new responsibility, data relevant to the material composition of a product must flow unimpeded from the raw material producers to the final producers. Unfortunately, existing systems are ill-prepared to handle the new data requirements. For example, the European Union's (EU) Energy Using Product (EuP) Directive will require that companies provide total energy used during a product's lifecycle, including manufacturing and transportation energy. To meet these new requirements, new systems must be designed and implemented, or modifications made to existing data management systems. Because every law poses its own unique requirements on industry, it is not always clear what information will need to be collected and stored. This paper seeks to provide industry with a forward-looking view at new data exchange requirements needed within the manufacturing supply chain of the future. It surveys current and forthcoming environmental legislation including EU Restriction of Hazardous Substances (RoHS), China RoHS, California RoHS, EU EuP, and the EU Registration, Evaluation and Authorization of Chemicals Directive (REACH). The paper identifies the unique data requirements that will need to be incorporated in a products supply chain in order for companies to comply with each law.

**Keywords.** RoHS, EuP, sustainability, product, lifecycle, supply-chain

## 1 Introduction

Many governments, corporations, and other regulating political bodies are seeking to address health and environmental problems through initiatives and laws. The prevailing idea is that legislation can be used to encourage "sustainable manufacturing" (i.e., requiring that industry create products with minimal negative

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<sup>1</sup> Computer Scientist, National Institutes of Standards and Technology (NIST), 100 Bureau Drive, Gaithersburg, Maryland, 20899, USA; Tel: 301 975-4284; Fax: 301 975-8069; Email: john.messina@nist.gov; <http://www.eeel.nist.gov/812/IIEDM/>

health and environmental impacts). One example of this policy trend is the emergence of Extended Producer Responsibility (EPR) Directives in the European Union in the early 1990s (known in the US as Product Stewardship). These directives seek to shift the environmental responsibility of product manufacturing to the finished goods manufacturer. Encouraging manufacturers to eliminate toxic materials from a product's design is an excellent way to keep those materials from ultimately being released into the environment. Still, regardless of the origin or benefits of these new laws, the laws will certainly have a substantial impact on current manufacturing practices. Adaptation will require new materials, modified manufacturing processes, and new information systems.

This article surveys and discusses several current and forthcoming environmental laws that fall into two broad categories: Restrictive/Toxic Substances and Energy Efficiency. Within these laws and directives, the survey identifies each law's unique data requirement that will need to be incorporated in a product's supply chain in order for companies to comply with the given legislation. As such, this paper seeks to provide industry with a forward-looking view of upcoming requirements.

## **2 Restrictive / Toxic Substance Legislation**

Restrictive / Toxic Substance Legislation focuses on banning certain known hazardous materials from the manufacturing process. While many countries are currently evaluating and developing such laws, there are four specific laws that will likely have wide ranging implications for industry.

### **2.1 European Restriction of Hazardous Substances (RoHS)**

The European Union's Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment is the most famous of the new type of toxic substance legislation. The directive bans various substances (such as heavy metals) from being incorporated into electronic devices. In essence, the directive seeks to shift the responsibility for a product's environmental impact back to the manufacturer of the product. The directive, which went into effect July 1, 2006, has left the electronics industry scrambling to develop substitute materials [1] and new data exchange mechanisms in order to ensure compliance.

#### **2.1.1 Key Elements of EU RoHS**

The directive has several key elements that directly impact any company importing electronic products into the EU [2]:

- It bans the use of lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE) in products above a maximum concentration value (MCV).

- Anything that can be identified as a homogenous material within the product must meet the MCV limits.
- It maintains the right to ban or restrict future toxic or hazardous substances.
- The EU RoHS directive is very broad in scope (8 product categories), but excludes specific items through the use of exemptions.
- Defines “electrical and electronic equipment” as being dependent on electric currents or electromagnetic fields in order to work.
- Enforcement implementations are left up to the EU member countries.

### 2.1.2 Unique Data Requirements

Compliance with RoHS is the responsibility of the company that seeks to market the product within the EU. There is no detailed declaration requirement, simply a yes/no declaration of compliance by the manufacturer. However, since the six banned substances are tracked at the homogeneous level, it is now the responsibility of the final product producer to track those six substances through the supply chain from raw materials to the final product. The final product producer needs to ensure that their products do not exceed the MCVs[3] listed in Table 1.

**Table 1.** EU RoHS Allowable MCVs

<b>Restricted Substance:</b>	<b>Allowable Concentration:</b>
lead, mercury, hexavalent chromium	0.1 % by weight in homogeneous materials
Cadmium	0.01 % by weight in homogeneous materials
polybrominated biphenyls or polybrominated diphenyl ethers	0.1 % by weight in homogeneous materials

## 2.2 Administrative Measure on the Control of Pollution Caused by Electronic Information Products (China RoHS)

This proposed law is very similar to the European Union’s RoHS. So much so, in fact, that it is commonly referred to as China RoHS by industry. Unfortunately, while both pieces of legislation target the same set of six substances [4], there are substantial differences between the two that could pose problems for industry.

### 2.2.1 Key Elements of China RoHS

The directive has several key elements that are very similar to EU’s RoHS:

- It bans the same six hazardous substances (lead, mercury, cadmium, hexavalent chromium, PBB’s, PBDE’s) in products with specified MCVs.
- It maintains the right to ban or restrict future toxic or hazardous substances.

However, beyond the six restricted substances and their MCVs, there are differences between the two sets of legislation in both their scope and how they are to be implemented.

- Rather than broad product categories, China's RoHS specifically lists which items are included in the legislation; no product exemptions are needed. A product catalog will be revised yearly to add additional products.
- China RoHS has a new requirement that compliant products must be properly labeled to indicate the presence of the restricted substances (as measured above the MCV at the homogenous material level).
- China RoHS, in a future phase of the law, will require that products be tested for compliance by a certified Chinese testing laboratory (or possibly some certified external laboratory).
- The new law defines a new "environmentally-friendly use period" for a product which indicates the stable shelf life of a product.
- China RoHS requires manufacturers to list on their packaging the substances contained within the packaging.
- In certain instances, China RoHS establishes different criteria for evaluating the MCVs.

### **2.2.2 Unique Data Requirements**

Several new unique data elements stand out in the China RoHS legislation: "environmentally-friendly use period", an alternate way to calculate the maximum permitted substance concentration basis, product catalogue information, and compliance testing data. The new use-period requirement identifies the period during which toxic and hazardous substances contained within the electronic information product will not leak out or mutate. It is still undecided which substances qualify for this requirement or how the use period will be determined, but the requirement will be put in place. China RoHS also allows for reporting on the basis of the mass proportion of the entire device for devices smaller than 4mm<sup>3</sup> (the approximate size of a surface mount transistor). This will lead to differences in reporting mechanisms for the EU and China legislations; a product could pass one but fail the other based on size. With the product catalogue subject to yearly modifications, it will be important to keep a link between the product and a specific version of the catalogue. Finally, with the products being tested for compliance it will be important to propagate the test results throughout the supply chain.

### **2.3 California Electronic Waste Recycling Act of 2003 (SB20/50) (California RoHS)**

The California law also seeks to limit the levels of hazardous materials that appear in some electronic devices. This law is in fact so closely linked to the EU's RoHS that it seeks to prohibit an electronic device from being sold or offered for sale in California if it is also currently prohibited from being sold in the EU due to Directive 2002/95/EC. However, as the California RoHS was implemented by two

sets of emergency legislation in late December 2006[5], there are noticeable differences between the pieces of legislation. Specifically, California RoHS targets fewer restricted substances and focuses on a smaller set of covered electrical devices (CED)[6].

### 2.3.1 Key Elements of California RoHS

- California RoHS bans only the four heavy metal substances (lead, mercury, cadmium, hexavalent chromium) and establishes an allowable MCV (Harmonized to match the MCV values in EU's RoHS).
- The law covers only CED which are enumerated in Public Resources Code section 42463 as video display devices beyond a certain size. More specifically, in 2005 eight broad categories of displays were established by the California Department of Toxic Substances Control (DTSC).
- The second legislation added portable DVD players to the list of CEDs.
- The law targets only retail products, not business to business products.
- California RoHS allows exemptions for some classes of products.

### 2.3.2 Unique Data Requirements

As California RoHS is clearly a subset of the EU's RoHS legislation, it contains little in the way of unique data requirements. Since the MCV values are the same, the only unique data that will need to flow through the supply chain are California-specific exemptions.

## 2.4 Registration, Evaluation and Authorization of Chemicals Directive (REACH)

REACH is a new proposed regulatory framework for the EU Chemical Industry created by the European Commission in 2003 [6]. Its stated goal is to provide a mechanism to protect human health and the environment, while maintaining the EU's Chemical Industries competitiveness and innovation. It seeks to replace the existing patchwork of laws currently in place with a single, EU-wide framework. Working on the assumption that industry is best positioned to know the properties of the substances used during the manufacturing process, REACH seeks to shift responsibility to industry to manage risks from chemicals and to provide safety information to downstream users. It requires that all substances identified as persistent, bio-accumulative, or toxic (PBT) be registered prior to being sold in the EU. The registration process itself would require producers / importers to create a dossier which would include a chemical data sheet (CDS) that covers safety information throughout the product's entire supply chain.

### 2.4.1 Key Elements of REACH

- "No Data, No Market" – Without registration, products can not be sold in the EU.

- A newly created European Chemicals Agency (ECA) will handle registration of the product dossiers.
- Registration limited to chemicals imported or produced by one company in excess of one ton annually.
- Beyond registration, chemical safety reports (CSR) will be required for substances produced in excess of 10 tons or are of “very high concern”.
- CSR will contain information on the substance’s hazards, classification, and exposure scenarios.
- Chemicals are registered for specific uses (which may result in chemicals being registered multiple times).
- Subset of substances of “very high concern” will required specific EU authorization to be sold and might be restricted in their use or marketing.
- Will treat old chemicals exactly the same as new chemicals (no grandfather clause for the over 100,000 chemicals in use).
- Due to the vast number of old chemicals on the market (of which 99% have limited safety information) the directive proposes to assess about 30,000 (leaving out ones produced in volumes less than 1 ton).
- REACH will enter into force on June 1, 2007.

#### **2.4.2 Unique Data Requirements**

REACH is unlike any existing restrictive substance legislation, and its unique data requirements will have far reaching implications for industry. First, REACH will require new data information flows: downstream to customers (chemical safety information), upstream to suppliers (chemicals’ expected use) and sideways (dossiers) to the new ECA. While systems for the exchange of chemical safety data sheets (SDS) exist and work, new and expanded SDS will be required to include information such as proposed use, exposure scenarios, etc. Also, implicit with REACH is that there will likely be a need for material declarations for the substances of high concern, to avoid legal liability. It is likely that upwards of 2,000 substances will need to be declared if they appear in a product.

### **3.0 Energy Efficiency**

This type of legislation focuses on helping industry and consumers improve their own energy efficiency in order to reduce overall energy usage. The main example of this is the upcoming European Union’s Energy Using Products legislation.

#### **3.1 EU’s Energy Using Products (EuP)**

The EuP is different from the other legislation in that, rather than focusing on restricting hazardous substances, it focuses on improving energy efficiency [8]. In fact, the EuP is part of the EU-wide Energy Efficiency Action Plan [9], which seeks to reduce energy consumption by improving energy efficiency. The EuP targets the negative environmental impacts of energy-using products that occur

throughout the product life-cycle. These impacts arise from the extraction of raw materials, the manufacturing process, distribution, use and eventual disposal. In essence, the EuP will require manufacturers to calculate and track the energy used to produce, transport, sell, use and dispose of any non-transportation product all the way from extracting raw materials to the product's end of life disposal. The energy data collected by manufacturing companies will then be used in a variety of ways to spur energy conservation (consumer labeling, setting limits, etc.)

### 3.1.1 Key Elements of EuP

- EuP is a “framework” that specifies a fast-track mechanism for implementing future legislation, rather than setting any specific requirements itself.
- As its name implies, its focus is broader than just the electronics industry; it applies to any non-transportation products.
- The first set of implementing legislation will focus on energy efficiency in a very narrow range of products, specifically those that match the following criteria:
  - High-volume market: >200,000 units are placed annually
  - Have a significant environmental impact on the EU community
  - Significant room for improved energy efficiency is already possible based on comparable products already on the market
- The energy usage data collected by manufacturers will likely be used in at least two ways: to set limits on the total allowable energy used to produce certain products, and to produce better product labeling.
- The EuP is seen as complementary to the Energy Labeling Framework Directive: it makes comparative labeling compulsory in all member countries once a product (implementing) directive has been passed.
- Future modifications to the Energy Labeling Directive (based on the EuP) could lead to new energy labels, which identify both the product's running cost and the total energy cost of production.
- The idea is that these new energy labels will allow customers to change their buying behaviors in favor of products that cost less energy to produce and use.

### 3.1.2 Unique Data Requirements

The EuP introduces data tracking requirements that could be an order of magnitude greater than RoHS, REACH, or any other pending environmental legislation. Most companies do not currently track this information and have no systems or processes in place to measure energy usage, let alone pass it along to customers. To make matters worse, no metrics for tracking rate of energy usage have been finalized and no specialized reporting format for energy usage has been introduced. While EuP is limited to energy, it is likely that additional data reporting requirements, such as greenhouse gases and water usage, will be added.

## 4 Suggested Next Steps for Industry

One primary point revealed by this survey is that many political entities (countries, states, and unions) are seeking to protect human health and the environment through implementation of new legislation. Unfortunately, each directive provides its own unique take on what to limit and protect. The result is a patchwork of confusing (and possibly conflicting) regulations with which industry cannot comply unless further steps are taken. The best option for industry is to start collecting as much material composition and energy usage information as possible about the components used to build their products. Rather than aiming for basic yes/no compliance with each new piece of legislation, industry should strive to fully describe the contents of each product's bill of materials. In the end this method would likely be cheaper since companies would not have to scramble to update their supply chain information systems with every new law. By collecting and tying all this information into a product lifecycle, companies will be able to create on-demand declaration reports for any applicable legislation. Also, by collecting all available information, companies will protect themselves from changing requirements in the future.

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