

A Chemical Substance Reporting System for Manufacturing Companies

Sukhraj Takhar^{a,1} and Kapila Liyange^b

^a*PhD Research Student, School of Engineering and Technology, University of Derby, Markeaton Street, Derby, DE22 3AW, United Kingdom.*

^b*Senior Lecturer, School of Engineering and Technology, University of Derby, Markeaton Street, Derby, DE22 3AW, United Kingdom.*

Abstract. While striving to mitigate the risk to human health and the environment, chemical substance regulations continue to impose greater legislative burdens on industry, which ultimately creates business continuity risk. Compliance to these regulations requires greater investment which ultimately undermines profits. Furthermore, as regulations vary between countries or politico-economic unions, impact on manufacturers is dependent on which areas of the world that its supply chain is most prevalent. A chemical substance reporting system for manufacturing companies requires information on parts and manufacturing processes that are both defined in-house and within the external supply chain. Without information on chemical substance uses within the downstream supply chain, manufacturers cannot fulfil their legislative obligations or effectively manage business continuity risk. Often the biggest hurdle to collecting this information is supply chain engagement, which is made more difficult with multiple, different industry standards and data exchange formats. As more and more chemical substances become heavily regulated, manufacturers require increased volumes of downstream supply chain information on a routine basis. The aim of this paper is to identify existing good practices which could be utilized to implement chemical substance reporting systems for manufacturing companies.

Keywords. Chemical Regulations, Supply Chain Engagement, Business Continuity Risk

1. Introduction

There are more than 129 million registered chemical substances [1]. A regulation can be defined as a set of rules, implemented upon society to ensure that a consistent set of behaviours/norms are maintained.

Chemical regulations are aimed at controlling and limiting the use of hazardous chemicals in use across industry, and therefore protecting humans, the environment and society as a whole. The evolution of chemical regulations from the EU Restriction of Hazardous Substances (RoHS), Waste Electrical and Electronic Equipment (WEEE) and Registration Evaluation Authorisation and restriction of CHEMicals (REACH) regulations and other international regulations has facilitated the need to record increasing amounts of supply chain data.

Supply chain uncertainty as a result of increased chemical regulations has become inevitable.

¹ Subject Matter Expert – Materials Management and Chemical Reporting (Europe), Assent Compliance Inc.; E-mail: Raj.Takhar@assentcompliance.com.

1.1. Objective

This paper uses qualitative and quantitative research to examine how different organizations have adopted to the use of material declarations for chemical substance reporting needs. Industry common issues are established and best practice steps for creating a viable chemical substance reporting system are suggested, for any organization, even in the few industries where limited standards already exist.

2. Methodology

A three step methodology was used based on (a) Literature review, (b) Expert interviews and (c) Online discussions. The literature review represents an overview of the evolution of chemical regulations and current state chemical reporting systems. The expert interviews and on-line discussion represent real world experiences of implementing chemical reporting systems.

During Q2/3 2016 over 20 organizations from various sectors (electronics, automotive, consultancies) agreed to participate in the research project. A series of expert interviews were conducted during Q4 2016. From the expert interviews and online discussions, Tables 1 and 2, below show issues which are currently being faced:

Table 1. Issues Organizations Will Suffer As a Result of Increased Chemical Regulations

Issues
(a) Articles being withdrawn (as they contain restricted substances), the end user may become aware of reduced supply, only when it is too late;
(b) Mixtures and formulations changing (as formulators remove the restricted substances), which in turn will lead to re-testing and validation of articles which contain the restricted substances;
(c) Formulators not obtaining authorizations for chemical substances / mixtures based on the current assumed usage. Chemical substance manufacturers and mixture formulators rely on the usage data provided to them by end users to update Safety Data Sheet (SDS) information.
(d) Reporting for specific compliance (targeting short-term regulatory impacts) as opposed to near full material declarations which gave rise to a more enriched data set,
(e) Neglecting process substances and the risk posed by supply chain disruption.

Table 2. Needs of a Chemical Reporting System

Need
(a) Identify chemicals used internally and externally across the supply chain.
(b) Ensure substance usage is defined.
(c) Where substance usage exceeds a threshold, level ensures applicable declarations / authorizations are made.
(d) Analyze potential supply chain disruption (as formulators / chemical refiners become deterred from supplying restricted regions).

The companies which agreed to participate covered:

Table 3. Participant organization types

Organization type
(a) Aerospace and Defence article manufacturers;
(b) Automotive industry article manufacturers;
(c) Consulting service organizations for material compliance across multiple industries;
(d) Distributors for chemical, electronic and mechanical articles;

Organization type

(e) Heavy machinery industry article manufacturers.

Online discussions took place via a series of articles published during Q3/4 2016 which discussed issues around the establishment of a material declaration system within any organization.

3. Findings

3.1. Literature Review

[2] identified prior to the introduction of recent chemical regulations such as EU RoHS, WEEE, and REACH regulations, the need to understand material composition of all articles used within a product transformation cycle.

[3] proposed a system of benchmarking product data for substance reporting, which suggested rather than perform detailed and costly analysis for every article sold, an organization could narrow the amount of analysis required, using a benchmark. This method was adopted across numerous companies initially, however as increasing chemical substances have become regulated, this type of analysis would today, be less effective.

The International Material Data System (IMDS) for the automotive industry and the IPC-175x series of standards for the electronics industries, are examples of collaborative industry efforts to establish data exchange standards for chemical substance reporting systems. These standards took several years to develop and publish; they were influenced by the highest tier manufacturers, who saw the need to collate data in a consistent format. Whilst establishing consistency in data exchange, the standards used declarable substance lists that were often too industry centric, and had little regard as to the potential impact for supply chain disruption as a result of any process chemicals no longer being available.

Initial attempts to implement chemical reporting systems were seen as being either too rigid, or inflexible. [4] presented a view that organizations that were developing environmental strategies should not see the process as being an additional burden; moreover, they could allow them to potentially gain competitive advantages. [5] developed a project management approach for implementation of material declaration systems. [6] argued that there was no one-glove fits all approach for material data collection and exchange, additionally that organizations must (a) Keep abreast of changes in reporting requirements; (b) Understand the value proposition; (c) Use of company and industry databases as sources of information; (d) Develop auditable systems; (e) IP protection of supplier data was expressed as being of paramount concern, resulting in the need for Non-Disclosure Agreements (NDA's) to protect supplier information.

3.2. Expert Interviews

The summaries of responses are shown in Table 4 and 5:

Table 4. Summary of Expert Interview Responses

Discussion Topic	Specific Example(s)	Meaning
Regulatory Awareness	Standard practice	Any chemical substance reporting system requires an awareness of how chemical regulations arise / change over time.
Map data needs.	Identify competent users	Core users within a business who will handle the chemical substance reporting information. Identify who these people are, how they handle and process data. Who else will use the data? How will they handle the data?
	Identify other users	
Stakeholder engagement	Executive buy-in	Develop executive leadership buy-in early on in the implementation process. Executives should be engaged to understand the impacts of non-compliance to chemical regulations (fines, business continuity risk, etc.)
	Engage	Stakeholders should not be seen just as internal users, engage with external users / data providers to agree the plausibility of a data supply chain, to provision your <u>chemical substance reporting needs</u>
Develop Commonality	Common platform	A generic data exchange platform should be seen as an enabler to transmitting and receiving data for multiple users (data requesters, suppliers, and service providers). This covers not only consistent data formats but also data element naming, formatting (in a template). It was noted that the best format types for data exchange were seen as XML or MS-Excel.
	Mandatory / optional	Define which data elements are absolute and which are optional.
	Full / partial / general disclosure	Define the manner in which suppliers can respond. Although full disclosure was the ideal state, in reality as a chemical substance reporting system is first implemented, there may be a number of 'rounds' of request/response from a supply chain over a 24-36 month period, in which occurs naturally a state of partial then complete material declarations
	Standards	There may be a need for creation of a specific data exchange standard such as IPC-175x to enhance the common data exchange format / template. This would be seen as useful in larger industries / supply chains.
Legality	Terms and conditions	Optional specific common terms within contracts to ensure article suppliers provide generic or specific chemical substance data.
	Maintains supplier Intellectual property	A chemical reporting system should have some of IP protection, to prevent full material composition data being displayed (unless the declarable substance list contains all the used chemical substances) or unauthorized data access.
	Supplier signature	Supplier sign-off as part of the audit trail. This signature could be scanned signature, wet-ink, email approval or other process to capture data being provided by a supplier.
Training	Need for training	In order to achieve accurate and complete data from suppliers requires consistent supplier training across a supply chain.
	Rich media	Any training whether face-to-face or on-line should include elements of videos (presenting executive viewpoints) and reporting system training.
	Face-to-Face training	Classroom led training, was seen as most effective close to actual supplier implementations. The longer

Discussion Topic	Specific Example(s)	Meaning
	Accessibility	the duration between training and actual usage, the more ineffective the face-to-face training becomes
	Language	The training should be accessible across a range of platforms such as web / tablet / phone.
	Traceability	Training material should not be limited to one language, consider the end users of the data. This was viewed as an optional requirement, used to trace if users have been trained in using a reporting system.
Communication	Clear lines	Clear lines of communication from the highest tier (top-level requestor / service provider) through a supply chain.
	Support	Communication should encompass the ability for suppliers to request information and time effective responses to supplier questions, to prevent any dis-engagement issues.
Supplier Engagement	Avoid ambiguity	Communicate with the supply chain in a clear and consistent manner.
	Escalation path	Define how your organization intends to deal with non-responsive suppliers – This may have been defined in the contract terms as stated in the legality section.

Table 5. In-House or Externally Hosted Material Declaration System Responses

In-House / Externally Hosted	Respondent Comments in Favour for	Respondent Comments Against
Internally maintained material declaration systems; Organizations operate own material declaration templates, which feed into internal systems	Bespoke systems, tailored for individual business use.	Results in high levels of customization which require a lot of maintenance activities. Customized declaration templates difficult to transmit across a supply chain. Customized systems take longer to get supply chain responses.
Externally hosted material declaration systems. A service provided by a third party to collate and process material declaration data for a customer across a supply chain.	Lower costs as the service provider will be performing supply chain contact, enforcement and receipt of material declarations. Works well in deep supply chains. Use of common template – better supply chain responses.	Where a supplier pays a fee to the hosted solution provider, for submission of a material declaration, usage rates decline. To achieve optimal results, the higher tier OEM 's may end up paying for entire supply chain material declaration processing, in which case, the costs increase.

3.3. On-Line Discussions

Table 6. On-Line Discussion findings via LinkedIn [7]

Steps
(a) Agree executive buy-in to support the implementation of a chemical substance reporting system.
(b) Development of chemical substance lists based on regulatory data.
(c) Common document formats were MS-Excel and XML. Other suggested formats were using PDF data from MSDS and SDS documents; Emails, etc.
(d) Development of data elements; common templates; supply chain engagement; developing a common core material declaration system.

3.4. Recommended Steps

Based on collected outcomes, these are these are the recommended best practice steps an organization should review prior to developing a chemical substance reporting system:

Table 7. Recommended Steps towards a Chemical Substance Reporting System

Steps
(a) Analyze and keep reviewing the chemical regulations which are likely to have an impact on your organization, create a declarable substance list.
(b) Ensure early engagement with all relevant internal and external stakeholders.
(c) Develop an agreed set of data elements which are understood by all.
(d) Develop a template form which captures data against the data elements. This template may be in MS-Excel or XML format.
(e) The template form should be simple to understand and complete, the more ambiguous the structure, the lower the likelihood of completion.
(f) A common method of exchange for exchanging data electronically should be utilized, while MS-Excel format can help, XML format data exchanges are seen as best practice.
(g) Examine existing data exchange standards, see if any existing standards (IEC/IPC/others) already meet your needs, fully or 80-90%, in which case you may be able to utilize an existing data exchange standard to meet your needs.
(h) If feasible, and all stakeholders are agreed, implement a data exchange standard. Developing a new data exchange standard with software vendors will lead to software products / services being created to meet industry needs.
(i) Make the process simple to understand and follow, avoid ambiguity.
(j) Develop a detailed training plan.
(k) Prior to full implementation, perform a detailed pilot and don't be afraid to pause, modify and then proceed with modifications to the existing standard

4. Conclusions

The undeniable truth quite simply, is the restriction of more and more chemical substances will persist over time. Therefore manufacturing companies need to embrace the need to implement some form of chemical substance reporting systems.

Developing a sound chemical substance reporting system will enable your organization to manage risks of Authorisation and restriction for all articles consumed within your organization.

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References

- [1] CAS Database, <http://www.cas.org/content>
- [2] Kubin, R. (2005), "Electronic Data Exchange Standards and Technology Developments to Support Eco-Compliance", *ISEE 2005 Proceedings of the International Symposium on Electronics and the Environment*.
- [3] Ninagawa, N. and Hamatsuka, Y. and Yamamoto, N. and Hiroshige, Y. (2007), "Checking the Accuracy of Environmental Data for Compliance with Environmental Rules", *IEEE 2007 Proceedings of the International Symposium on Electronics and the Environment*.

- [4] Esty, D.C and Winston, A.S (2006), “Green to Gold – How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage”, Yale UP, New Haven.
- [5] Dully, S and Schiffler, A. (2012), “Implementing product-related hazardous substances management through a reporting-oriented project management approach”, *Electronics Goes Green, IEEE*.
- [6] International Electronics Manufacturing Initiative (www.inemi.org) (2012), “Harmonization of Environmental Data Management”.
- [7] Takhar, S. (2016), LinkedIn Publications on <https://www.linkedin.com/in/raj-takhar-4791134/>