User Guidance
IPC-1754 - Materials and Substances Declaration Data Exchange for Aerospace and Defence and Other Industries

Introduction

Materials and substances declaration has been established in various industries and companies to obtain product-related substance and material data from the supply chain. Downstream companies then use and interpret this data to manage related risks for product compliance and supply chain chemical obsolescence.

In order to be optimally efficient in gathering necessary data, while minimizing supplier impacts and resistance, declaration process standards and tools have been developed that specify the mechanical aspects of data gathering – data elements (and related formats, units and quality requirements) and information data transfer protocols. These standards have been developed to satisfy the needs of their users (e.g., for companies in the automotive, or electronics industries). IPC-1754 - *Materials and Substances Declaration for Aerospace and Defence and Other Industries* has been developed primarily for the aerospace and defence (AD) industry but can be used by any other industry seeking to communicate materials and substance data through their supply chains in a consistent and repeatable manner.

Why IPC-1754 Materials and Substance Data Exchange?

IPC-1754 provides the AD and other industries a standard set of criteria for the communication of information on substances and materials. Without standardized communication criteria, individual companies will create company- specific solutions and will cause much confusion and extra effort in the supply chain. Standardized industry requirements and format for substance data exchange provides:

- Improved supply chain awareness and buy-in
- Ecosystem to support development of tools to support data communication and management
- Reduced turnaround time for declarations
- Improved quality of data (vs. custom data request)
- Reduced cost versus custom IT tools development and training

The AD industry previously proposed common standards but these did not have adequate scope or buy-in from the industry or by the supply chain. There are existing standards that provide requirements for exchanging material and substance data but they do not cover data elements or the declaration processes that have been included in IPC-1754.

IPC-1754 sets out the data to be passed between requester and responder using standardized schema. It provides the ability for requestors to define which parts they seek declarations for. It provides suppliers the opportunity to push a declaration to all their

customers using a distribution option. It also provides the ability for a responder to collate their supplier data, as applicable, as part of their declaration to their customer.

In publishing this standard, it is expected that solution providers will create stand-alone software products for declaration generation and materials and substance data management or will integrate these features into existing PLM or ERP systems.

Development of IPC-1754

The IPC-175X family of standards provides two standards for substance and material declaration (IPC-1752A and IPC-1754); however, the two standards provide different features and are focused on addressing the needs of different industries. IPC-1754 was developed using the structure and lessons learn from IPC-1752A.

IPC-1752A was developed by the electronics industry for supporting the EU RoHS regulation and has been extended to support EU REACH and other similar lists applicable to the electronic industry. It is a preferred format for reporting an electronic component, such as a semiconductor, where the manufacturer controls, or has knowledge of the specifications and 100% composition of the materials being use. IPC-1752A is designed for regulatory compliance declaration against EU RoHS with either a product statement (class A) or a more accurate declaration against all prohibited substances classes (class C); it also supports material and substance declarations up to a full declaration (class D).

IPC-1754 was developed for industries with complex products and extensive supply chains, primarily structured for supporting EU REACH regulations. The standard is designed to allow data of materials and components to be combined in a manner that allows for compilation and regulatory compliance evaluation as the data is moved along the supply chain. This approach allows for communication of substance data even when some of the data is considered proprietary. The structure also enables combining and preserving existing IPC-1752A data elements to allow it to work for multiple industries for exporting data to internal systems.

Individual organizations or industries may require differing data elements in IPC-1754 that needs to be defined by the specific request for declaration or other business to business agreement. The standard allows for the declaration of process substances as well that may not be contained in the final product for technology obsolescence risk evaluation. Some industries do not require the material data as mandatory and only the presence of substances in the product is needed

IPC-1754 Features and Data Elements

IPC 1754 includes a number of features that support compliance assessment against a broad range of substance regulations and other uses such as obsolescence management. The standard specifies a data exchange format and rules for exchanging substance and material information.

Use of External Lists

IPC-1754 supports external lists that provide the basis for a declaration by a supplier to a downstream requester. This includes the declarable substance list, a query list, and optionally a use descriptor list.

Authority, Identity and Version of Lists

Each list used within a declaration requires a list authority, list identity and list version that are used to clarify whose list and what version of the list is being used. When creating an IPC-1754 declaration, there is also an authority which states what list or lists, such as the Declarable Substance List (DSL) and Query List (QL) is to be used. These DSLs and QLs can vary depending on who makes the data request. When preparing an IPC-1754 for a specific company, it is best to ask which authority and list they require for the declaration to make sure you are using the correct DSL and QL for that company.

Authorities can be industry committees (example: Aerospace and Defence, Heavy Equipment), specific companies, industry standard committees (IPC, IEC, etc.), government bodies or other jurisdiction that has defined DSLs and QLs. IPC does not have an official DSL or QL for IPC-1754, but DSLs or QLs they have for other standards can be used for IPC-1754.

Format of Lists

The Authority of a list will provide the list in XML format based on the IPC-1754 schema for that list. This XML format of the list is supposed to be used by solution providers to configure their solution for the corresponding industry. Individual companies may become authorities by generating these lists but doing so may limit the ability of solution providers to configure their tools.

Data Lists

The IPC-1754 standard is configured to support specific data lists:

1. Query List (QL) – The IPC-1754 declaration Authority established Product Statement with a list of queries that are answered either "true", "false" or "unknown" as the minimum content of the supplier declaration.
2. Declarable Substance List (DSL) - IPC-1754 declaration Authority established list of all substances to be reported as a Class F declaration.

   The organization that authors such list is defined as the Authority for that list; such an Authority shall grant their list a Unique ID that makes the list unique under their authority.

   For instance, the AD industry has defined their own data lists:

   - The AD-DSL Aerospace and Defence Declarable Substance List
   - The AD-QL contains 5 queries:

Authority	Query ID	Query Statement
IAEG	001	Product contains substance(s) on the AD-DSL
IAEG	002	Product process(es) requires the use of substance(s) on the AD-DSL
IAEG	003	Product contains radioactive material(s)
IAEG	004	Product contains biocide(s)
IAEG	005	Product contains conflict mineral(s)

3. Use Descriptor List (UDL) - The "Use Description" for substance, material and process is intended to be a predefined list of predefined descriptor to standardize the use data.

   For instance, ECHA Use Descriptor Tables (reference document[1]) could be used:

   - Substance Technical Function (TF) as use descriptor list for substances in product and substance in process;
   - Chemical Products Category (PC) as use descriptor list for materials or chemical products;
   - Process Categories (PROC) as use descriptor list for processes.

Substance in Process Declarations

Historically, material/substance declarations have focused on the content of the delivered part. The ever-changing global regulatory landscape and the promulgation of substance use restrictions (e.g. EU REACH) have driven an increased activity in material obsolescence.   This creates greater risk to manufacturing, operation, maintenance and repair of products. Some material suppliers / formulators have used the constriction of the marketplace as an opportunity to assess their business environment and in some cases, withdraw formulations from the market. In many cases, these notifications are not received by all downstream users in time to test and qualify alternatives. Depending upon timing and demanding performance requirements, mitigation can be expensive and disruptive.

Recognizing the increasing risk to industry, IPC-1754 incorporates the capability to provide declaration of substances in processes. It is not uncommon for substances used in processes to be reactive, evaporative or transformational and not remain as part of the delivered product. These process substances cannot be derived from the substances declared in product, making the visibility critical for global enterprises to identify and manage their substance related risks.

Additionally, if the processor locations and substances are declared, companies can identify and mitigate potential risks to production, operations, maintenance, and/or repair. If a supplier provides the formulation product name as part of the reported data, it is even possible to identify usage in the supply chain and share visibility of material obsolescence of explicitly identified formulations / products.

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[1] ECHA, Guidance on Information Requirements and Chemical Safety Assessment, Chapter R.12: Use description, Version 3.0, December 2015:
https://echa.europa.eu/documents/10162/13632/information_requirements_r12_en.pdf

Data declared by the many tiers/branches of suppliers for complex articles can provide information that can be used to efficiently share obsolescence notifications. This creates transparency to complex supplier interdependencies and enhances the ability to navigate the increasing global regulatory and obsolescence landscape.

Full Substance Disclosure

The intention of this guidance is to discuss how IPC-1754 can support the creation of a Full Substance Declaration (FSD), also known as a Full Substance Disclosure or a Full Material Declaration (FMD).

It is important to note that the terms FMD and FSD are industry terms which have different interpretation by various industry groups, individual companies, and/or individuals themselves. The rules by which these entities determine what is an acceptable FMD or FSD are up to those various entities and are not described in IPC-1754 or herein.

Some features of a FSD include:

- An FSD is only possible within a Class G Declaration unless a Class F Declaration includes ONLY substances on an applicable DSL or DSLs. In this instance, a Class F could also be a FSD
- An FSD can cover substances and materials in a product and/or substance in process
- FSD will be used when discussing 100% substance declaration
- Proprietary Information (also known as Confidential Business Information) are included in calculation of FSD.

Reporting REACH SVHCs in a Declaration

IPC-1754 provides a method for suppliers to declare articles in alignment with EU REACH 1907/2006 legislation, Article 3(3). In the legislation, an article is defined as "an object which during production is given a special shape, surface or design which determines its function to a greater degree than does its chemical composition." Articles may be materials or products. IPC-1754 has introduced a flag "isArticle", where the supplier can specifically let their customers know that a material or product has been determined to be an article per this definition.

Background

The EU REACH regulation applies significant requirements on product manufacturers to identify substances of very high concern (SVHCs) listed on the REACH Candidate List that are present in their products. Following a European Court of Justice ruling, the European Chemical Agency (ECHA) published a guidance document clarifying that the threshold level for reporting the SVHC is 0.1% of the first article in a product and not the finished product (as suggested in earlier ECHA guidance documents). According to the ECHA guidance, the first article is when a substance is applied such that an article is first created and not based on a complex object that is made up of individual parts that are themselves articles.

This creates challenges for product manufacturers and requires them to obtain additional information from their supply chain on whether a SVHC is present (above 0.1%) in the first

article of which it is a constituent. For compliance assessment, a key piece of information needed by downstream manufacturers is the mass percent of a SVHC in its first article.

To provide this information in a material declaration, the substance and mass relative to the first article needs to be provided. The challenge is how to communicate this within a material declaration.

Using the IPC-1754 'isArticle' flag to support REACH SVHC assessment

The IPC-1754 declaration standard supports this information requirement by allowing materials and subproducts to be reported in the declaration. The data exchange format also provides an (isArticle) flag for materials, subproducts, and the product so that the supplier can identify any object in the declaration as to whether or not it is an article. This may be either a material (that meets the definition of article), a subproduct or the product.

How to determine if the mass percent of a substance is above 0.1% of the article

When a substance is reported in a declaration it includes mass information – this may be either the mass of the substance or a mass percent (the mass of the substance divided by the mass of the material or subproduct (or product) that the substance is assigned to in the declaration hierarchy). However, the recipient of the declaration may not know enough about the manufacturing of the product (or its parts) to identify the first article. It is best if the supplier identifies this first article and passes sufficient information down the manufacturing chain for downstream manufacturers to assess compliance requirements. For the recipient to be able to determine the mass percent of the SVHC in the first article, the supplier needs to include the first article as an object in the declaration (this could be a material, subproduct or the product) and it needs to be identified as an article.

Examples of a single SVHC in the product

Figure 1 illustrates a simple declaration hierarchy of an SVHC (S1) that is included in a material (M1) which is included in part (P1) (which is the first article). Material M1 is identified as not an article (isArticle=False) and subproduct P1 is identified as the first article (isArticle=True) therefore the recipient is able to calculate that the mass percent of S1 in the first article (P1) is 0.2g / 10g = 2% (which is above the 0.1% threshold that triggers the REACH communication requirements). In this example, the top-level product is a higher level article (sometimes referred to as a complex object) and therefore also has isArticle=True.

There are instances where a material may have a specific shape and meets the definition of an article (see second example in Figure 2). In this case, the isArticle flag for material M1 is set to True and the SVHC mass percent in an article is 0.2g / 1.0g = 20%.
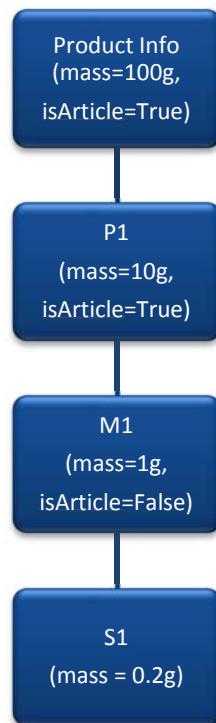
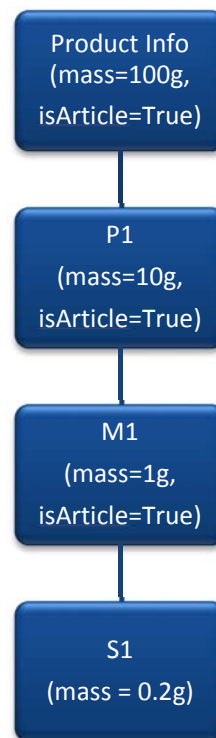Figure 2: Simple example of a declaration with an SVHC in an article (subproduct)   Figure 1: Example with a material that is an article

In both of these examples, the SVHC content is above 0.1% triggering REACH communication obligations, but there are cases where only a small amount of the SVHC is present and the selection of the first article will impact whether or not the SVHC is present above or below this threshold. It's up to the supplier that first incorporates an SVHC into an article to identify this to downstream manufacturers.

Multiple SVHCs added at different stages of manufacturing

There may also be products that include more than one SVHC. In some cases, the SVHCs may be applied at different stages during manufacturing, resulting in a complicated declaration hierarchy. One such example is illustrated in Figure 3.

- The substance S1 (an SVHC) is included in a plating material (M1) which is applied to a lead frame (P1) which then becomes a plated lead frame (P2).

  P2 is the first article that includes S1, therefore the mass % of S1 in an article is the (mass of S1) / (mass of P2).

  If this mass % is above 0.1%, then S1 has REACH obligations.

- The substance S2 (another SVHC) is a constituent of die attach material that is applied to the die (P3) and the plated lead frame (P2) to become the die assembly (P4).

  In this case, P4 is the first article for substance S2 and is used as the basis of the mass % calculation to compare to 0.1%.

- Overall, in this declaration hierarchy of the IC, subproducts P4 and P2 are both first articles for different SVHCs, which creates a complex declaration.

```
                            IC
                      (isArticle=True)
                            |
                      Die Assembly
                          (P4)
                      (isArticle=True)
         ┌──────────────────┼──────────────────────┐
    Die (P3)          Die attach (M2)         Plated Lead
 (isArticle=True)    (isArticle=False)         Frame (P2)
                            |               (isArticle=True)
                            |               ┌──────────┴──────────┐
                        S2 (SVHC)      Lead Frame (P1)      Plating (M1)
                                      (isArticle=True)     (isArticle=False)
                                                                 |
                                                             S1 (SVHC)
```
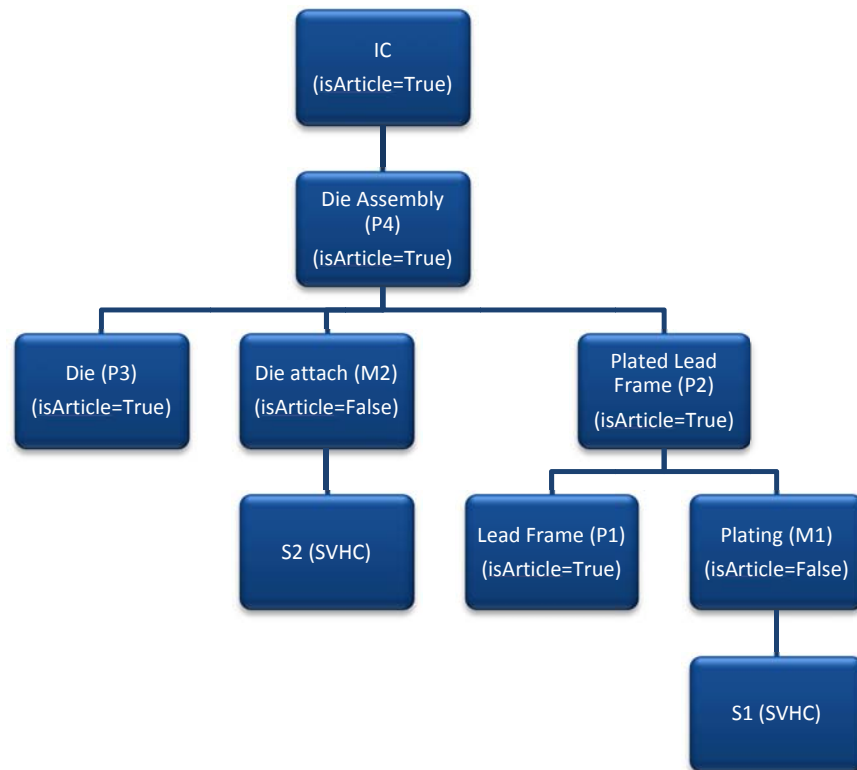
For the recipient of a declaration to properly assess REACH obligations, it's necessary for the supplier to declare the material or subproduct (or product) that is the first article and identify that it as an article (by using the isArticle flag).

Note: in some cases (for simple products), the product may be the first article (e.g. the product provided by a supplier may be a single piece of molded plastic) or the product may be a mixture (e.g. wet paint) and there is no article.

IPC-1754 Adoption at OEM's

A basic question that any organization needs to answer is "What are the obligations for reporting materials and substance declaration data?"   If not clearly understood by those receiving a declaration request, organizations that can help answer the questions about why am I doing this and what is needed to protect my company while fulfilling our obligations to our customers and government organizations include:

      Legal
      Program or Product Management
      Contracts
      Corporate or Social Responsibility
      Government Affairs
      Global Operations

Within original equipment manufacturer company structures, there are many organizations that are stakeholders in a materials and substance declaration program that need to agree on the use and internal structure of managing and promulgating materials and substances data.

For example:

1. Legal – Assessment of regulatory and contract compliance.
2. Materials and process engineering – Assessment of materials/substances changes upon product technical performance.   Assessment of constituent material and substance changes upon designs, perform tests, and implement design changes.
3. Supplier Management – Supplier surveys and decision on declaration tool use.
4. Risk Management – Risk of business disruption
5. Planning – When to implement changes.
6. IT – IT systems involvement from EHS, PDM, MRP systems integration with the IPC schema and tools and managing software suppliers. Overall cybersecurity oversight.
7. Systems Engineering – Compliance with customer requirements and implementation of engineering changes. Creation of product manuals and overhaul / repair manuals.
8. Program Management – Funding and customer declarations processing.
9. Sales and Marketing – Agreement on messaging relative to full understanding of the constituent chemical/substances in products as well as understanding of industry needs.
10. Manufacturing Engineering/Operations – Process engineering material/substance modifications and substance use databases.
11. Aftermarket Support/Overhaul and Repair - Creation of product manuals and overhaul and repair manuals. Updates when required. Knowledge of repair depot needs internationally.
12. Supply and Internal Quality – Assessment of materials/substances changes upon product quality performance.
13. EHS – Overall process management assessment including industrial hygiene studies and reports. Company green goals implementation.

IPC-1754 Adoption within Supply Chains

Obtaining accurate product-related materials and substances data largely depends on the ability to source data from as far upstream in the supply chain as possible. At every supplier level where hardware/components ("articles") are produced, added materials and substances may affect the composition of a final product at the lower (downstream) tiers of the supply chain. Thus, the requirements for data may be "flowed" up through the supply chain and acquired data must flow down supply chain and be summarized at each lower level in order to provide an accurate representation of the composition of final products.

In a business-to-business relationship, the data gathering process usually starts by downstream companies imposing declaration requirements on their direct suppliers. These suppliers may then impose similar requirements on their direct suppliers, and this approach may be repeated at each level in the supply chain. Related data management requirements (e.g., initial reporting deadlines, timing of updates, certification of information, protection of sensitive data, etc.) may also be specified, wherever needed.

Use of "Unknown"

IPC-1754 was developed to be inclusive of various industries while allowing for suppliers to communicate data while a query or complex details concerning the material or substance is being obtained. Specifically while the supplier is completing a declaration and the mass is "unknown" thereby notifying the requester that the information is still being developed and that follow-up may be needed. In this situation, further business-to-business communication may be initiated by either requester or supplier to follow up on this additional information.

Where to find Materials and Substances Data

Internal Data

If your company has a Product Regulatory compliance department, contact them for help on how to respond to this request. If you do not have an organization such as this, the data will come from a variety of areas within your company.

What are the product considerations? Organizations within a company that could have information on materials or substances in your product as supplied to your customer include:

    Product Engineering
    Materials Management
    Product Manufacturing
    Supplier Relationship Management
    Purchasing
    Enterprise Resource Planning
    Logistics
    Manufacturing Resource Planning
    Information Technology

What are the manufacturing process considerations? Organizations within a company that could have information on materials or substances are used in your manufacturing processes include:

    EH&S
    Purchasing
    Maintenance
    Process Engineering
    Custodial or Janitorial Services
    Information Technology

Supplier Data

The process for a company to obtain materials declaration information from external sources would essentially be the same for both product and process declarations. It would involve requesting the supplier of an item to provide the necessary information needed. A product declaration would include the chemical content of the delivered item. A process declaration would include the substance used within the manufacturing processes of the delivered item, even if these substances may not be delivered in the final item.

There may be difficulty in obtaining the necessary information from distributors since they do not manufacture the item. Your company may need to review your contractual obligations with distributors. In some cases a company may need to contact the suppliers directly even though they purchase the item via distributors.

In responding to a declaration request, the initial impulse may be to leverage information that has been gathered for similar activities in the past. It is a valid approach, but will not provide you with all the data that you need and in some cases may be invalid data for material regulatory reporting. For example, material safety data sheets (SDS) identify hazardous materials used in the work place. These may not be present in the final product, and so should not be reported in the final product composition. Another example is chemicals which undergo a change during manufacturing, such as paint or unfinished polymers.

Data Governance: Confidential Business Information (CBI) and Export Controls

The exchange of an IPC-1754 data set, under certain circumstances, may result in a conflict between contractual, intellectual property, and national security requirements.

It is up to each actor in the supply chain to understand their data governance requirements which are mandated by contract, law, or policy. The aforementioned data governance requirements should always supersede any requirements set forth by the IPC-1754 standard.

If the requirements of the IPC-1754 standard, during rare circumstances, result in a conflict with a data governance requirement, it is recommended to engage your business partners (customers, solution providers, internal stakeholders, and other relevant parties) to determine an appropriate resolution for data communication needs.

The following are non-exhaustive examples of when a data governance issue could arise during the communication of data:

Example 1:

A supplier has been asked by its customer to provide an IPC-1754 declaration for a product within an indented Bill of Materials (BOM) structure. The customer has also asked for supplier part numbers to be presented within each product and sub-product.

The product is an International Traffic in Arms Regulation (ITAR) and/or Export Administration Regulations (EAR) controlled good. The customer requesting the data may not be allowed to receive data in this format due to nationality and/or inadequate licenses. The supplier must ensure their data communication is within an ITAR controlled environment and may discuss options with their customer or other third parties which allow for meeting the data request expectations while following ITAR/EAR requirements.

Example 2:

If the product being provided by the supplier includes substances or special alloys that the supplier considers proprietary, the supplier may wish to have these treated as confidential business information (CBI) and to hide the identity of these substances and materials in the declaration. There are provisions in the IPC-1754 for suppliers to mask

substance name and identity information under certain circumstances as described below.

If the substance that the supplier wishes to remain anonymous is not on the declarable substance list (DSL), the supplier may wish to declare the substance using a generic name to hide its identity. Commonly used phrases to replace the substance name are "Trade Secret"; "Proprietary" or "Confidential". However, the identity of the substance may only be hidden if it is not listed on the DSL.

IPC-1754 requires that all DSL substances that are present in the product above threshold must be declared. This is because DSL substances typically have regulatory impacts that the requester needs to know about. For such substances, the supplier may wish to arrange a confidentiality agreement with the requester or another measure to ensure that CBI is appropriately protected.

Revision History

Date	Nature of Changes
18Aug2018	Initial Release