

Product Environmental Data Management System: ECODUCE

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(Manuscript received January 7, 2005)

Environmental problems have become important topics in corporate management. The regulations governing hazardous chemical substances contained in products have become strict. Manufacturers now have to consider more than just product quality, cost, and delivery time and will find it difficult to sell non-Green Products. Their parts procurement and product design must conform to regulations. Since 2000, to solve these problems, Fujitsu Nagano Systems Engineering Limited (FNS) has been providing a product environmental data management system, the core of which is a package called ECODUCE. This package supports the production of environmentally conscious products from design for environment (DfE) to green procurement. It uses surveys of hazardous substances contained in the parts of a product and the other materials used to make it. This paper describes ECODUCE.

1. Introduction

In order to protect the environment, the legal regulations for hazardous substances contained in products have been strengthened worldwide, including the Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive of Europe.¹⁾ This directive bans the use of certain substances in electrical and electronic equipment after July 2006. Manufacturers that sell products worldwide must carefully watch the trends of regulations around the world. With the appearance of these strengthened regulations, when hazardous substances are included in a product, the manufacturer must make improvements so the product complies with the regulations. Since 2000, Fujitsu Nagano Systems Engineering Limited (FNS) has been providing an IT system called ECODUCE that streamlines the management of hazardous substances and green procurement.²⁾

This paper describes the background of product environmental data management in Japan.

It also outlines the function of green procurement and the design for the environment (DfE)³⁾ of ECODUCE.

2. Importance of managing hazardous substances

Demands that manufactures manage the amounts of hazardous substances their products contain have strengthened considerably. In Japan, manufacturers and various associations are playing important roles in standardizing green procurement surveys. Against this background, overseas legal regulations have become much stricter. The Japanese electrical industry takes the RoHS Directive especially seriously. This directive bans the use of six restricted substances in electrical and electronic equipment products after July 2006. The six substances are lead, cadmium, mercury, hexavalent chromium, and PBB and PBDE flame-retardants.

Typical electrical and electronic products consist of several thousand parts. Therefore, it is

difficult to determine which hazardous substances they contain at the product shipment stage. Therefore, to comply with the RoHS directive, it is essential to integrate the management of hazardous substances with the entire supply chain and achieve upstream management of parts and materials.

Until now, many assembly manufacturers have asked suppliers for data about the hazardous substances their parts contain. However, suppliers were experiencing difficulties because the substance investigation list and the reply format were not standardized.

Therefore, since January 2001, a volunteer group of electrical and electronic equipment manufacturers in Japan called the JGPSSI⁴⁾ has been discussing the standardization of surveys for substances contained in parts and materials. JGPSSI issued guidelines in June 2004. These guidelines aim to reduce the burden on suppliers involved in green procurement surveys and improve the accuracy of the answers they provide.⁵⁾

JGPSSI uses an original approach to reducing the investigative work related to green procurement and improving the quality of answers.

This guideline provides a list of 29 substances and a reporting format (JGP) for conducting substance surveys. Standardization can be achieved by exchanging electronic data for the answer according to the JGP format. In addition, the following can be downloaded from the homepage of JEITA:⁶⁾ Survey Tool,⁷⁾ which is used for creating JGP files, and Data Confirmation Tool,⁷⁾ which is used for verifying JGP files. Also, to establish global standards, JGPSSI has been advancing discussion on this matter with the European Information, Communications, and Consumer Electronics Technology Industry Associations (EICTA) and the Electronic Industries Alliance (EIA) of the US.⁸⁾

Many big Japanese companies have developed their own systems. However, such systems are expensive to develop at small and medium-

size companies, so those companies performed the necessary work manually using a spreadsheet program such as Excel. Therefore, to help those companies, FNS packaged a system called ECODUCE that streamlines green procurement surveys in accordance with the JGPSSI guidelines.

3. ECODUCE

FNS started providing ECODUCE in early 2000. This section outlines ECODUCE and describes its main features.

3.1 Aim of ECODUCE system

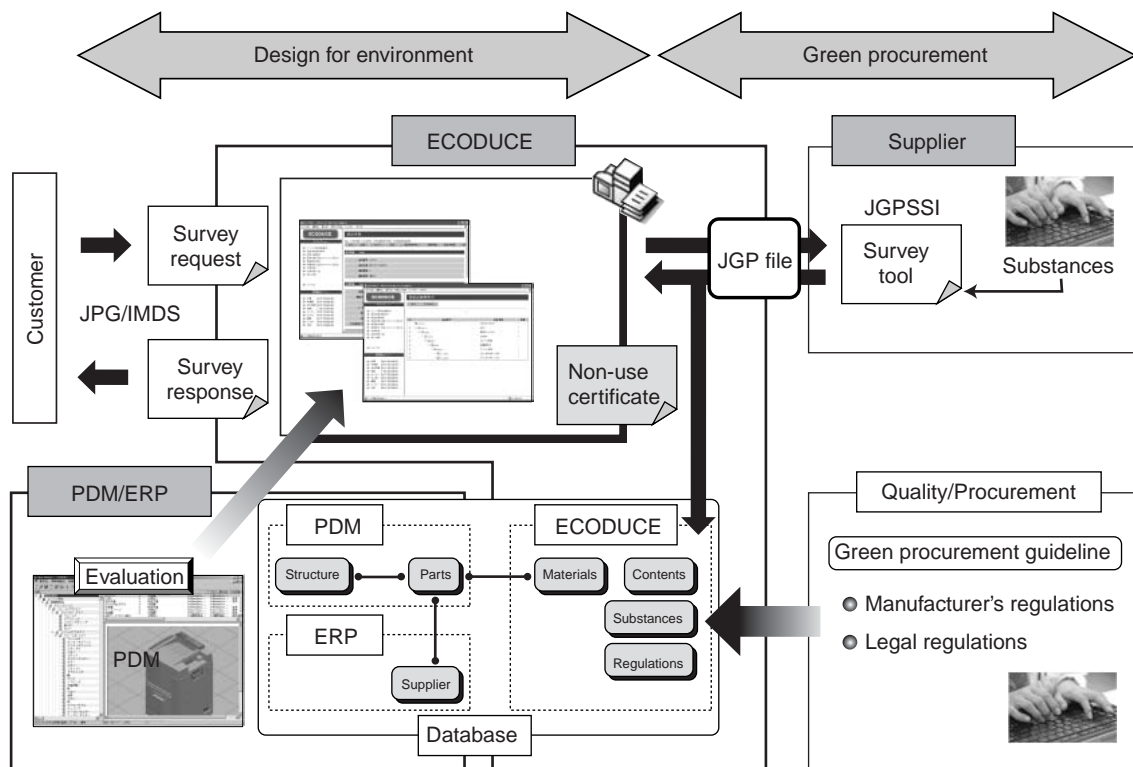
ECODUCE has five aims:

- 1) Realization of DfE
 - Compliance with regulations of manufactures and governments
 - Selection of green parts
 - Easy-to-understand display of product structures for designers
- 2) Prompt response when a problem occurs
 - Searching for products, parts, and materials that have problems
 - Identification of products that use parts with problems
- 3) Quick release of environmental information to customers
 - Totalizing the amount of hazardous substances in a product
 - Improvement of data retrieval efficiency by unifying environmental information
- 4) Application to an entire company
 - Application of multiple phases (design, procurement, quality assurance, etc.)
 - Web system
- 5) Quick system construction
 - Providing a total service that covers the planning, development, and operation of a system

3.2 Features

Figure 1 shows a product environmental data management system based on ECODUCE.

ECODUCE is a Web-based system that has databases containing information about parts,



JGP: Japan Green Procurement, IMDS: International Material Data System, PDM: Product Data Management, ERP: Enterprise Resource Planning, JGPSSI: Japan Green Procurement Survey Standardization Initiative

Figure 1
Product environmental data management system.

parts structures, materials, chemicals, regulations, suppliers, and other information. It has two main functions:

- 1) A green procurement survey support function and
- 2) a design for environment support function.

These functions streamline the work for surveying the hazardous substances contained in the parts of a product and the other materials used to make it. They also analyze hazardous substance information for surveyed parts and materials at the product unit level.

ECODUCE totalizes the amount of hazardous substances in a product so that products can be quickly improved to comply with regulations based on the total and analysis results. By streamlining this work, products can be brought to market more quickly.

The following sections describe these two functions.

3.3 Green procurement survey support function

The green procurement survey support function of ECODUCE conforms to the Guidelines for Standardization of Material Declaration issued by JGPSSI. **Table 1** lists the 29 substances that have been registered by the standards usually provided by ECODUCE. In addition, this function makes it possible to unify the management of hazardous substances by registering additional ones with JGPSSI. Parts and products that contain a specific hazardous substance can be found. Also, quick surveys of parts and products that contain hazardous substances become possible.

RoHS regulation information is registered in ECODUCE as a set of standards. In addition, it is possible to unify the management of regulations by registering the regulations of other vendors. Parts structure information can be obtained from Product Data Management (PDM) and Enterprise

Table 1
Survey list of hazardous substances.

Level A		Level B	
No.	Substance	No.	Substance
1	Cadmium and its compounds	16	Antimony and its compounds
2	Hexavalent chromium compounds	17	Arsenic and its compounds
3	Lead and its compounds	18	Beryllium and its compounds
4	Mercury and its compounds	19	Bismuth and its compounds
5	Tributyl tin oxide (TBTO)	20	Nickel and its compounds
6	Tributyl tins and triphenyl tins	21	Selenium and its compounds
7	Polybrominated biphenyls (PBBs)	22	Magnesium
8	Polybrominated diphenyl ethers (PBDEs)	23	Brominated flame retardants
9	Polychlorinated biphenyls (PCBs)	24	Vinyl chloride polymer (PVC)
10	Polychloronaphthalenes	25	Phthalates
11	Short-chain chlorinated paraffins	26	Copper and its compounds
12	Asbestos	27	Gold and its compounds
13	Azo colorants	28	Palladium and its compounds
14	Ozone depleting substances	29	Silver and its compounds
15	Radioactive substances		

Resource Planning (ERP) tools in the Comma Separated Value (CSV) format. Therefore, it is possible to cooperate with almost any PDM and ERP. Especially, bill of materials (BOM) data can be made to cooperate with ECODUCE in real time by introducing Fujitsu's MESLINK⁹⁾ PDM package.

A green procurement survey that uses ECODUCE proceeds as follows:

- 1) The survey request is received from the customer.
- 2) The product to be surveyed is selected.
- 3) The parts to be surveyed are selected from the product parts list screen.
- 4) Time limits for answering and other actions are input, and the survey request is issued.
- 5) The supplier data (JGP file) for the survey is generated automatically.
- 6) The supplier answers using the Survey tool of JGPSSI.
- 7) The answer data (JGP file) is received from the supplier and uploaded to ECODUCE.
- 8) A JGP file containing the answer data is created and sent to the customer.

This procedure eliminates a lot of labor and therefore significantly improves efficiency. Also, the following functions are added as functions of investigation management:

- Retrieval of survey requests
- Aborting an investigation
- Specifying a demand day
- Progress management of surveys
- History management of surveys
- Registration of related documents
- Approval of survey results

If suppliers do not provide the above answers, most manufacturers ask them to provide non-use certificates or non-containment certificates; therefore, a registration function for the related documents is required.

In addition to JGP files, ECODUCE also supports answer data in the upload interface format of the IMDS.¹⁰⁾ This interface is based on an extensible Markup Language (XML) format that uses a Data Type Definition (DTD) to define the form and structure of the data to be uploaded to IMDS.

3.4 DfE

DfE limits or eliminates hazardous substances in the design phase. To achieve this, ECODUCE has the following functions.

3.4.1 Management of parts and materials

To achieve DfE, hazardous substances should be managed in two patterns (Figure 2). Pattern 1 is a pattern for domestic production parts, and pattern 2 is a pattern for managing the purchasing of parts such as electronic parts. ECODUCE can use both these patterns.

3.4.2 Totalizing hazardous substances

To achieve DfE, it should be easy to grasp the amount of hazardous substances a product will contain in the design phase. Therefore, the product data and hazardous substances data should be able to closely cooperate with each other. ECODUCE was originally an option of our PDM tool MESLINK and is excellent at cooperating with it. From the viewpoint of the design BOM, information about environmental regulations can be displayed using a multistage configuration for a product's structure. MESLINK and ECODUCE both use the same database standard and there-

fore can cooperate with each other in real time. Also, the amount of hazardous substances in a product can be totalized at any time based on the latest BOM.

3.4.3 Alternative parts retrieval

To achieve DfE, designers should be able to search for alternative parts. When parts that do not comply with regulations are discovered in the design phase, ECODUCE can list alternatives and determine whether the regulations can be met by using them. In addition, because ECODUCE can search for units and products that use a problem part, it becomes possible to quickly identify units and products that contain hazardous substances.

4. Conclusion

The RoHS Directive of Europe will soon come into effect, and manufactures will soon find it difficult to sell non-green products. However, it is a big burden on small and medium-size companies to develop products that comply with environmental regulations. ECODUCE solves these problems by reducing the labor related to green procurement surveys. It totalizes the amounts of hazardous substances in a product so it can be

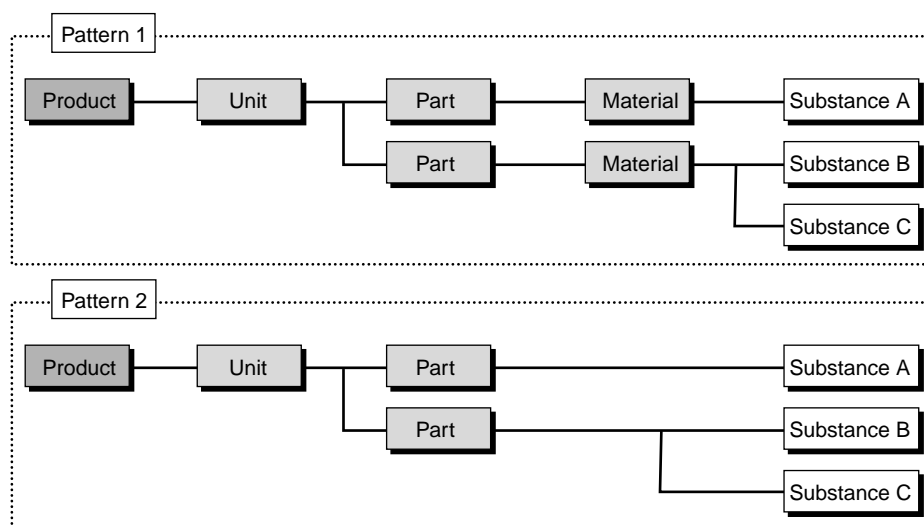


Figure 2
Substances data management pattern.

quickly improved to meet regulations.

We will implement a function for keeping hazardous substances within the levels stipulated in the RoHS directive and also a contracted-parts management function. Then, we will make ECODUCE compliant with the green procurement survey format being promoted by the Japan Automobile Manufacturers Association (JAMA).¹¹⁾ We also plan to enhance the DfE function to achieve better cooperation with PDM and Computer Aided Design (CAD) tools. Concretely, we are developing a method for evaluating ease of disassembly based on BOMs to make reuse and recycling easy and integrate the management of hazardous substances into manufacturing processes.

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