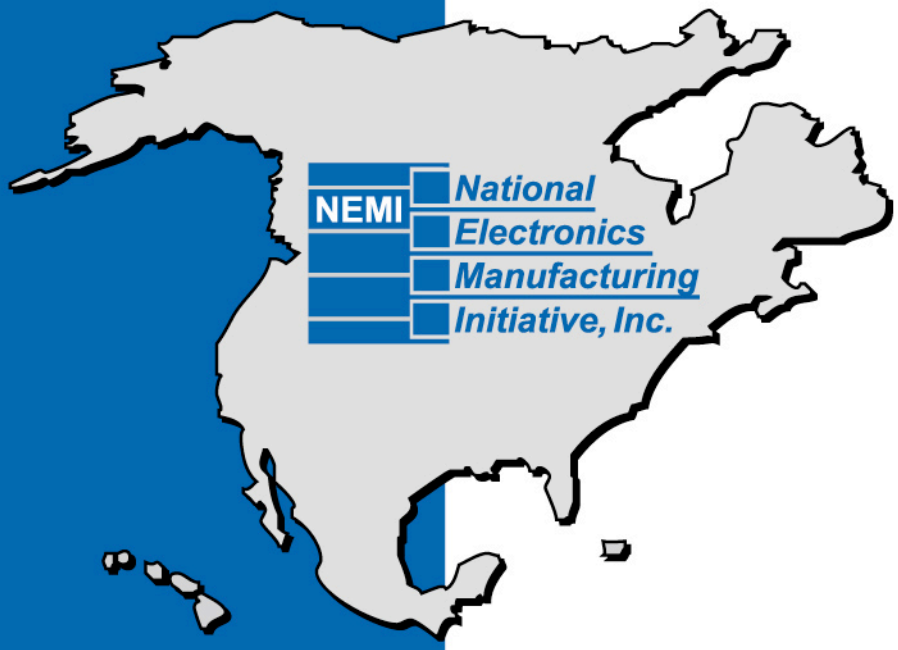

NEMI Materials Declarations Project

Phase 1 Report

May 2004

Connect with and Strengthen your Supply Chain

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Executive Summary

Regulatory and market-based restrictions, such as the European Union's Restrictions on the use of certain Hazardous Substances (RoHS) Directive, the Swedish Confederation of Professional Employees (TCO), German Blue Angel and the like, will soon require electronics manufacturers to track and disclose the material composition of their final products. This information will be used to ensure that products do not contain banned materials (such as lead) and will also be important for end-of-life disposition. Manufacturers will be expected to prove conformity, which will require IT systems and audit trails that can cover the entire supply chain and manufacturing cycles. These systems must be able to track materials content and provide aggregate percentages at subassembly and whole unit levels. The 2002 NEMI Roadmap highlighted the need for development of standards and requirements for collection, documentation and transmittal of material content data of components, assemblies and systems to meet these requirements. The NEMI Materials Declarations Project, organized in late 2003, is running a set of pilot tests, leading to development of recommendations for a standard materials declaration process. The group is aligning its efforts with the Draft Joint Industry Guide: Material Composition Declaration Guide, and is focusing on the legally banned and restricted substances listed in Annex A of that guide.

In Phase I of the NEMI Materials Declarations Project's work, participants ran pilots using software tools from three vendors: Centor Software Corporation, The Goodbye Chain Group and Synapsis Technology, Inc.. Ease of use, scalability, reporting scheme, analytical processing and data integrity were analyzed for each tool. All three of the materials declaration tools piloted are recommended by the project team for reporting to the Joint Industry Materials Declaration Guide Annex A and are considered capable of reporting the Annex B list of substances and substance amounts.

Introduction

The NEMI Materials Declarations Project objective is to make a recommendation on a standard materials declaration process and format by running a set of pilot tests to identify issues that:

- Align with the Draft Joint Industry Guide: Material Composition Declaration Guide, developed by the Electronic Industries Alliance (EIA), European Information, Communications and Consumer Electronics Technology Industry Association (EICTA), and Japan Green Procurement Survey Standardization Initiative (JGPSSI).
- Focus on the legally banned and restricted substances (i.e., Annex A in the above Guide).

Goals: to create/establish an automated global reporting process with minimal cost impact to the supply chain [1].

Background and Drivers

Global efforts are underway to standardize how the global electronics industry will declare hazardous and other materials in products and components. Original equipment manufacturer (OEM) customers are already asking for this information, primarily from customers in Europe and Japan, and are starting in North America. Global impact is anticipated on all OEM hardware products, particularly commercial products. OEMs' ability to sell to customers will be seriously affected if they are unable to provide materials declaration information. These requirements are driven by regulatory and market-based restrictions, such as the European Union's Restrictions on the use of certain Hazardous Substances (RoHS) Directive, the Swedish Confederation of Professional Employees (TCO), Blue Angel, and the like. Three major industry associations have been involved in this effort: EIA, EICTA and JGPSSI. Work within and between these organizations over the past three years has resulted in a draft of the Joint Industry Guide (JIG): Material Composition Declaration Guide [2].

Pilot Process

The NEMI Materials Declarations Project began work with a review of existing tools and standards. They had presentations from, and discussions with, Agere Systems, Agile Software, Centor Software, The Goodbye Chain, Japanese Green Procurement (JGPSSI), PDX 2.0 standard, Synapsis Technology and RosettaNet lite [3].

Data Collection

- Start with a blank BOM and choose at least five components and data from the sample BOM. (See sample BOM worksheet, Appendix D.)
- Request data for these components from five suppliers, and ask the suppliers to respond to the supplier questionnaire regarding ease of use, data entry experience, etc. **(**See Appendix E for questionnaire.)

Data Exchange

- Try to cascade data exchange from at least three tiers of suppliers (will depend on the component and supply chain, might get all the data from the first supplier).
- Populate the blank BOM using the software tool.
- End result should match the appropriate line items in the sample BOM.

Data Analysis and Reporting

Provide two materials declaration reports that contain the BOM column information, and meet the following requirements:

- All reports should be in electronic form.
- Reports must, at a minimum, include the column information in the BOM. Anything beyond this is optional.
- Produce a report at the product/system level (PCA part).
- Produce a second report at the component level.

Results
Motorola Pilot of EMARS™ (Synapsis Technology)

Tools Used

Data collection & exchange	• Compliance Connect™ Excel spreadsheet (Centor Software) • International Material Data System (IMDS) (an EDS web-based tool used by the automotive industry)
Data analysis & reporting	• Environmental Materials Aggregation and Reporting Systems (EMARS) (Synapsis Technology)

Data Collection & Exchange

Motorola invited six suppliers to participate in the pilot. Each supplier was asked to supply material declaration data to Motorola based on the NEMI pilot BOM, using either the Automotive Industry Action Group (AIAG) Compliance Connect™ tool (from Centor Software) or the IMDS web-based tool, as specified by Motorola. Process flow diagrams are provided in Appendix A. Suppliers were also asked to complete an evaluation questionnaire at the end of the material declaration reporting exercise. One supplier did not respond to the request to participate.

The suppliers that participated in the Motorola pilot are profiled below. All supplier names were withheld, per Motorola's initial survey agreement with them.

- Supplier D – Japanese-based passives manufacturer, 2003 revenues of approximately US $10 billion.
- Supplier F – US-based capacitors manufacturer with revenues in excess of US $400 million.
- Supplier H – US-based semiconductor manufacturer, 2003 revenues of approximately US $2 billion.
- Supplier X – US-based mechanical component manufacturer.
- Supplier Z – Taiwanese-based privately held PCB manufacturer.

In general, the suppliers that participated in the pilot indicated a general satisfaction with the Compliance Connect tool, but cited upgrade compatibility as an issue. The supplier utilizing IMDS to disclose material content indicated issues with system response time and preferred the use of Compliance Connect.

Data Analysis and Reporting

The second part of this evaluation dealt with the Motorola evaluation of the EMARS™ application. This application provides the ability to manage supplier part compliance, selectively aggregate materials content information and generate product material declaration reports.

Motorola conducted the pilot using the system installed in its automotive group, which provides electronic products to the automotive industry. There was minimal effort involved to load and report the NEMI standard BOM. Motorola reported that EMARS was fairly easy to use and that the user interaction flow was very intuitive. Motorola was able to complete the pilot activities with no issues. The only recommendation was that it would be nice to have some additional help features available to new users.

A complete report is provided in Appendix A.

Results
Eastman Kodak Company Pilot of Material Declaration Wizard

Tools Used

Data collection & exchange	• Material Declaration Wizard (The GoodBye Chain)
Data analysis & reporting	• Material Declaration Wizard (The GoodBye Chain)

Data Collection & Exchange

Eastman Kodak made the decision to involve its suppliers only at the point where it could make a recommendation for a tool that could be integrated across systems that describe the life cycle of Kodak's products. Therefore, in this pilot, Eastman Kodak reviewed the Goodbye Chain Group's Material Declaration Wizard (MDW) and its capabilities much as a supplier would, by (i) manually loading the predefined data from the NEMI BOM into the system and (ii) importing data from an outside source or other supplier into the system. The Goodbye Chain Group was the "other supplier" who exported data from their system.

Kodak used the tool over the course of a 15-day trial period, first with the desktop installation of the product, and also with the CD version. Data from the NEMI BOM were loaded manually in each case, following the logic tree of subpart to material to substance. The MDW processes included (i) choosing the product for declaration and loading unique product details (name, total mass, etc), (ii) building the product structure ultimately with unique substances from a family of substances, and (iii) being able to certify the product and export the data to outside sources. Additional data sent by electronic mail were also imported into the product library.

The MDW was exceptionally easy to use, and required no advance training. Manual input into the system was tedious, but this was not a function of the tool itself. From the outset, help was available through the MDW Advisor, a feature that would give a novice the capability of identifying substances and materials belonging to the draft Joint Industry Guide A or B lists, or not. With knowledge of the component's logic tree, each screen's input focused on the attributes of a subpart, or a material, or a substance. While mass was conveniently given in grams, parts-per-million calculations were done automatically to compare with the thresholds of the draft JIG. The "Calc ppm" (calculate parts per million) function was always available on the product composition screen.

In accordance with the requirements of the pilot evaluation matrix, Kodak reports the following:

- The MDW was exceptionally easy to use, and required no advance training.

- Help was given in the form of sample forms populated with data or through the MDW Advisor which, functioning as an expert system, gave content information on the appropriate legislative or regulatory requirements, depending on the activity/need.
- It appeared that the MDW could be used in other parts of the company, and is scalable.
- The MDW was capable of being populated with composition data while maintaining data integrity.
- Parts per million calculations were done automatically, and could always be queried for on the product composition screen.

Data Analysis & Reporting

Kodak found the MDW to be a tool that could be used for collection of data such as provided by the NEMI BOM, for managing the data with accuracy and integrity, and most of all, for the reporting of substances specifically targeted by the European Union RoHS Directive and the Draft Joint Industry Material Declaration Guide, or Joint Industry Guide (JIG).

In accordance with the requirements of the pilot evaluation matrix, Kodak can state the following:

- It appeared that the MDW could be used in other parts of the company, and is scalable.
- The MDW's report indicated the compliance/non-compliance status of each unique product by the use of the universal red/green lights.
- Login and password requirements and other security features supported data integrity.

The MDW was built in response to the requirements of the RoHS Directive and the draft JIG, and is intended to facilitate worldwide material composition declaration. The reports, therefore, fit well into the proposed scheme, identifying compliance or non-compliance with the thresholds using red-green stop light charts. The status of each unique product in the product library built was apparent for each of the indicators, e.g., it was quite clear whether the products were compliant or non-compliant with the JIG's A or B list, or with the RoHS Directive. Also indicated in the report was whether there were any substances identified from the library of optional 'C' list substances, and whether the product composition had been certified as correct.

A complete report is provided in Appendix B.

Results
Jabil Circuit Pilot of Compliance X-Sight™

Software Used

Data collection & exchange	• Compliance Connect™ (Centor Software)
Data Analysis & Reporting	• Compliance X-Sight™ (Centor Software)

Data Collection & Exchange

Jabil has been using the Centor software with its suppliers for more than a year for data collection and analysis required by EU End-of-Life Vehicle legislation. Given suppliers' familiarity with the Compliance Connect data collection tool, a two-part approach to data collection was used for the NEMI pilot. First, in order to assess the experience of a new user to the data collection process, Jabil took the data from the NEMI pilot BOM and entered it into the data collection spreadsheet. Jabil was familiar with the regulations and their requirements, and is involved with NEMI in this pilot, but the particular Jabil user implementing the pilot had not actually used the data collection tool before. Second, a limited group of suppliers was surveyed with the questions in the NEMI pilot questionnaire. These questions were intended to elicit information about their experiences with the data collection tool Compliance Connect. Supplier responses to the survey questions are summarized below. Complete survey results are found in Appendix C.

- 75% of suppliers found the tool "somewhat easy" while 25% felt it was difficult to use.
- Comments were made that it was initially cumbersome (complexity of requirement), but became easier with use.
- The following issues were raised: revision levels; breakdown of part tree, intelligent spreadsheet imposing discipline; supplier code consistency (Jabil issue).
- Suppliers reported a range of five minutes to one hour for completing the spreadsheet.
- The following suggestions were raised: umbrella specs, free training, limit data collection to banned substances only.

Data Analysis and Reporting

The pilot BOM was loaded into the Jabil ERP system and this BOM was exported into the Centor Compliance X-Sight tool. The simulated data was imported from the Compliance Connect data collection tool. The Compliance X-Sight tool was used to analyze the data and generate reports. The tool was found to report the results with 100%

accuracy. Both data entry and use of the Compliance X-Sight™ tool were by a first-time user.

Jabil's experience with this pilot can be summarized as follows:

- Data integrity is ensured by embedded intelligence (supplier compliant) and data are certified by the supplier or not accepted by the tool.
- Suppliers reported requiring more than one hour to complete the survey; however, Jabil was able to complete the survey in less than one hour.
- The overall pilot was found to be easy.
- No major issues were raised. Minor issues were resolved quickly via a third party relationship. Suggestions for improvement include synergy with Jabil requirements for efficiency and value.

A complete report is provided in Appendix C.

Phase 1 Conclusions

All three of the materials declaration tools piloted:

Centor's Compliance Connect™ and Compliance X-Sight™

Synapsis Technology's EMARS™ (Environmental Materials Aggregation and Reporting System)

The Goodbye Chain Group's Materials Declaration Wizard

are recommended for reporting to the Joint Industry Materials Declaration Guide Annex A, and capable of reporting the Annex B list of substances and substance amounts.

Some OEM customers may demand a report of substance amounts and of non-regulated materials, as listed in Annex B, but unwilling to pay for the information. The OEM will need to collaborate with its supply base on an appropriate response/report to the customer. It is recommended that the standard drafting committee for the Joint Industry Guide consider:

- A realistic list of substances to be reported on.
- Threshold values for those substances.
- Compliance criteria.

Recommendations for Phase 2

For Phase 2, we recommend conducting a pilot with "real" material information from a few suppliers (rather than predefined data, which was used in Phase 1). It is recommended to pilot:

1. The Joint Industry Guide / upcoming standard.
2. The proposed IEC materials declaration standard.
3. PDX 2.0 standard for materials declaration data exchange.
4. RosettaNet standard for materials declaration data exchange.

We recommend collecting actual data at the threshold and substance level [4]. We will explore and include WEEE Directive reporting requirements as they relate to materials declaration. We will connect with other efforts (e.g., Environmental Life Cycle Information Management and Acquisition — ELIMA), as appropriate.

We recommend converging on an industry-standard data collection, reporting and exchange process and format.

References

1) Materials Declarations Project Statement of Work, version 1.2, April 8, 2004 (see Appendix F).

2) Draft Joint Industry Guide: Material Composition Declaration Guide (draft) - EIA (U.S.), EICTA (Europe) and JGPSSI (Japan), September 19, 2003 http://www.eia.org/resources/2003-09-19.10.pdf

3) RosettaNet (www.rosettanet.org)

4) ERA Technology Report 2004-0134: Possible Compliance Approaches for Directive 2002/95/IEC (The RoHS Directive), April 2004. http://www.regconnect.com/docs/eu_ROHS_Compliance.pdf

Appendix A: Motorola Pilot Report
EMARS™ / Synapsis Technology

In January 2004, Motorola volunteered to conduct a material declaration pilot using EMARS (Environmental Materials Aggregation and Reporting System) from Synapsis Technology, Inc.. The objective of the pilot was to verify that the software being evaluated was capable of the following:

- Importing/collecting material declarations from suppliers.
- Assessing the material content of supplier parts against JIG Annex.
- Generating material declaration reports for Motorola products.

The pilot was performed using a bill of material (BOM) and part material content specified by the NEMI project team.

Motorola invited six (6) suppliers to participate in the pilot. Each supplier was asked to supply material declaration data to Motorola based on the NEMI pilot BOM, using either the Centor's AIAG Compliance Connect™ (CC) or EDS' International Material Data System (IMDS) web-based tool, as specified by Motorola. Suppliers were also asked to complete an evaluation questionnaire at the end of the material declaration reporting exercise.

Below are the profiles of the suppliers that participated in the Motorola pilot. All supplier names were withheld. They were renamed to anonymous names per our initial survey agreement with them. Supplier B did not respond to our request.

- Supplier B – US-based connector manufacturer, 2003 revenues in excess of US $2 billion.
- Supplier D – Japanese-based passives manufacturer, 2003 revenues of approximately US $10 billion.
- Supplied F – US-based capacitors manufacturer with revenues in excess of US $400 million.
- Supplier H – US-based semiconductor manufacturer, 2003 revenues of approximately US $2 billion
- Supplier X – US-based mechanical component manufacturer.
- Supplier Z – Taiwanese-based privately held PCB manufacturer.

Table 1 provides a summary and ranking by Motorola of the supplier survey responses based on the NEMI questions and evaluation criteria (7: Excellent; 5: Pass; 3: Marginal; 1: Fail). The cells in yellow indicate that the supplier did not provide an answer, so a median score was assigned.

Table 1. Summary of Supplier Rankings

Ranking	Supplier Exchange Evaluation D	F	H	X	Z
How easy was the tool?	5	5	7	7	7
Help feature and clarity of instruction?	5	5	5	5	7
Installation experience?	5	3	5	5	7
Data entry experience?	5	1	5	3	3
Data exchange experience?	5	3	5	5	7
What issues did you run into and how did you resolve them?	5	3	5	5	3
What was total time to populate the information into the tool? (Assumes data is available to load)	7 (CC)	1 (IMDS)	7 (CC)	5 (CC)	5 (CC)
Suggestions and improvements?					

In general, the suppliers that participated in the pilot indicated a general satisfaction with the Compliance Connect™ tool, but cited upgrade compatibility as an issue. The supplier utilizing IMDS to disclose material content indicated issues with system response time and preferred the use of Compliance Connect.

The second part of this evaluation dealt with the Motorola evaluation on the EMARS™ application. This application provides the ability to manage supplier part compliance, selectively aggregate materials content information and generate product material declaration reports. Table 2 provides a compiled summary of EMARS scores

Table 2. Summary of Scores

Ease of Use	Motorola
What were the cost, effort and time to run the pilot? (consider the data collection, data validation, and data reporting)	7
How easy was the tool to use? (e.g., user-friendly, instructions, help, efficiency, automatic, reporting, security)?	5
What were the pitfalls and issues you ran into?	7
Scalability	
Data aggregation capability?	7
Results	
How well do the results comply with JIG Annex A?	7
How well do the results comply with internal requirements?	5
How well do the results comply with our customer requirements?	7
How well do the results comply with current regulations?	7
Data Integrity Capability	
How accurate are the results? How was the data integrity ensured?	7

7: Excellent; 5: Pass; 3: Marginal; 1: Fail

Motorola conducted the pilot using the system in our automotive group, which provides electronic products to the automotive industry. There was minimal effort involved to load and report the NEMI standard BOM. EMARS is fairly easy to use and we found its user

interaction flow to be very intuitive. Motorola was able to complete the pilot activities with no issues. The only recommendation was that it would be nice to have some additional help features available to new users.

EMARS™ can perform aggregation at any level specified by the user. Users can select to either rollup the entire BOM as a single item, the PCB only or do no rollup at all. In performing the rollup, EMARS is capable of computing the worst case material and substance breakdown for multi sourced components rolled up at the Motorola Item Level.

EMARS was configured to comply with Motorola's internal requirements and with all its current customer and regulatory requirements in both the automotive and electronics industries. The automotive sector is using EMARS for their production reporting and the remaining Motorola sectors will go into production with EMARS in summer 2004.

EMARS provides a very flexible data model that allows Motorola to configure it for JIG Annex A, Annex A&B or any customer standard. EMARS is configured to grade and qualify the supplier part material content against the internal Motorola W18 specification which has the same controlled substance list as JIG Annex A.

The tool and processes established contain validation checks at all data transfer stages. The collection tools have checks to validate the integrity of the data format and that reporting requirements are met by suppliers. Data is then reviewed by a technical expert prior to upload for compliance to internal requirements. The upload utility further verifies that the data complies with the necessary parameters for it to load into Motorola's system.

In addition, product aggregation reports and worst-case analysis calculations were validated by scientists at Motorola Labs. Worst case analysis reports also present tolerance percentages for each value. The final integrity is further guaranteed by comparing the computed weight against the measured weight of the products.

In conclusion, we believe the NEMI pilot for EMARS was a success. Motorola's automotive group has been running EMARS in production for approximately one year. The remaining sectors within Motorola have deployed the import and qualification of the Environmental Solution and will implement the additional functionality of EMARS throughout the remainder of 2004. Within the short period since Environmental Solution was deployed at an enterprise level, declarations from 66 suppliers with over 3000 manufacturer part numbers (non-inclusive of automotive sector) were successfully loaded into the system. Since EMARS is fully integrated into Motorola's item master (i2 eXplore) and BOM management systems (Oracle ERP), no data migration was required and the information is available to users of the existing systems.

Figure 1. Part Compliance - Data Collection Flow

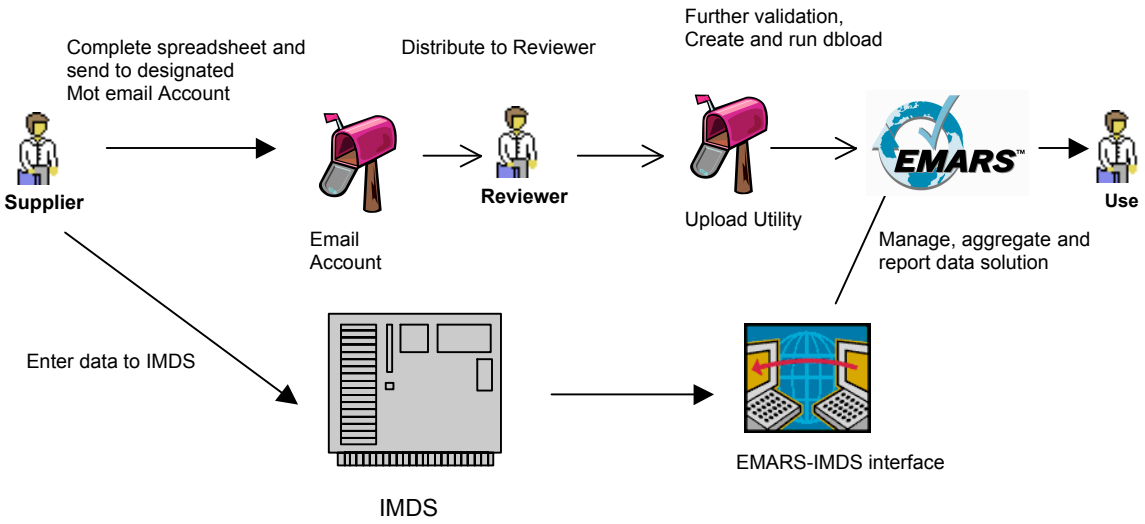


Figure 2. Part Compliance - Process Flow

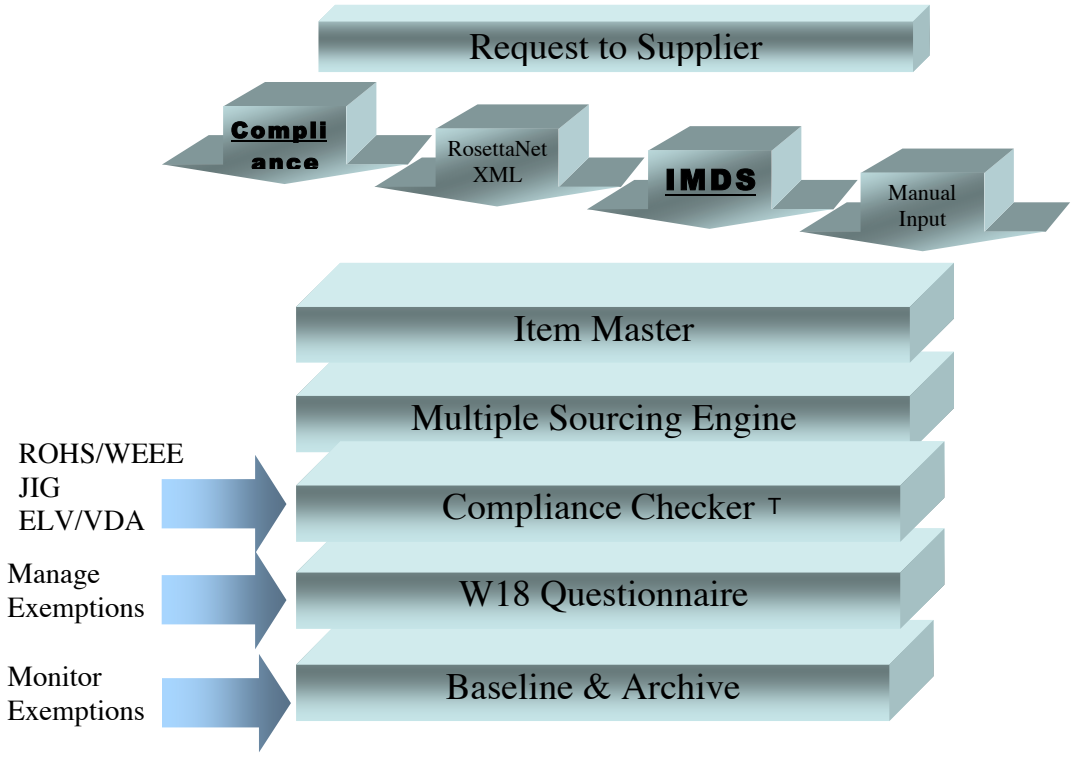


Figure 3. Product Aggregation and Reporting - Process Flow

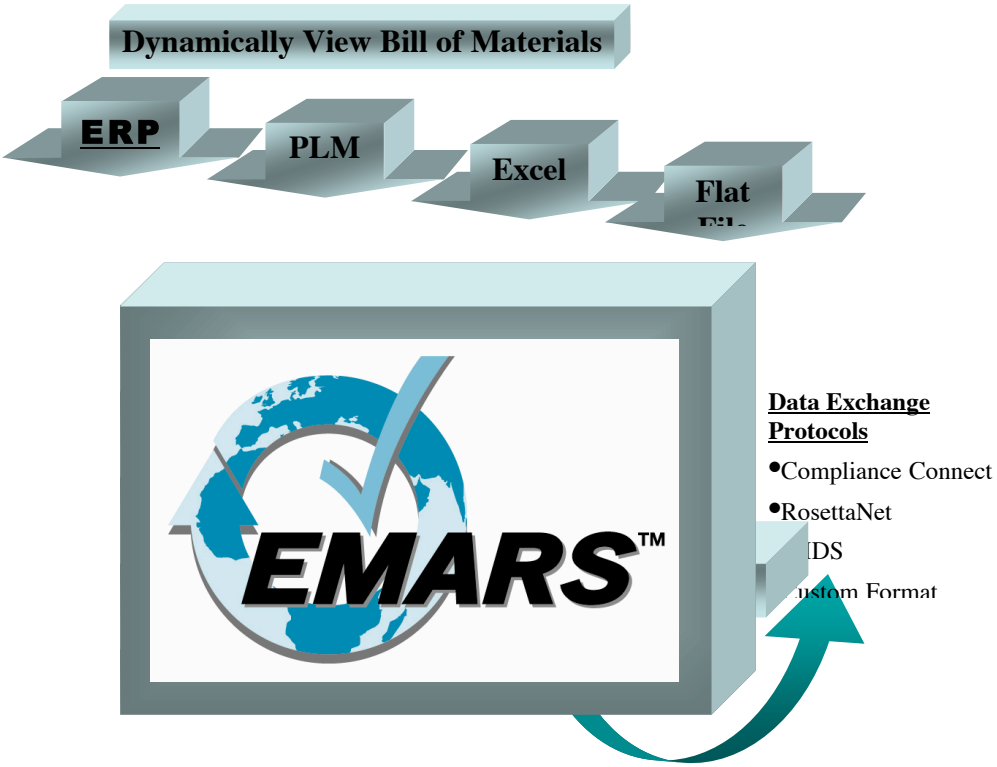


Table 3. Product Reporting Functionality

Product Reporting Functionality	EMARS	Comments
Search by		
Motorola or Customer Part Number	X	
Customer	X	
Product Information		
Retrive BOM Data from existing Systems	X	Single system used for pilot.
View Product Reporting History	X	N/A for pilot
View Single Level BOM Rollup	X	
View Multi Level BOM Rollup	X	
View Compliance Status for each item on the BOM	X	
Product Aggregation		
Complete or Selective Aggregation	X	
Worst case analysis for multi-sourced items	X	
Report per multiple standards/data formats	X	
Supplier Part Functionality	**EMARS**	**Comments**
Search by		
Supplier or Motorola Part Number	X	
Compliance Status	X	
Supplier (Name or ID)	X	
Date Material Declaration Received	X	
Controlled Substance	X	
Part Compliance		
View Material Breakdown	X	
Calculate/view Compliance Status for Multiple Standards	X	
View Compliance Report	X	
Support for Compliance Exemptions	X	
Notifications		
Notify when new part data is added	X	
Notify prior to exemption expiration	X	N/A for pilot

Appendix B: Eastman Kodak Pilot Report
Material Declaration Wizard / The Goodbye Chain Group

Overview/Summary

Kodak utilized the Goodbye Chain Group's Material Declaration Wizard (MDW), v.2.5, having taken the role of both a sender and receiver of information, without involving actual suppliers. We used both the installed desktop and the CD versions.

We found the MDW to be a tool that could be used for collection of data such as provided by the NEMI BOM, for managing the data with accuracy and integrity, and most of all, for the reporting of substances specifically targeted by the European Union's RoHS Directive, and the Draft Joint Industry Material Declaration Guide or "Joint Industry Guide" (JIG). Test data were entered both manually and electronically, and the reporting format used followed that described in the JIG. Further, in accordance with the requirements of the pilot evaluation matrix, we could state the following:

- The MDW was exceptionally easy to use, and required no advance training.
- Help was given in the form of sample forms populated with data, or through the MDW Advisor which, functioning as an expert system, gave content information on the appropriate legislative or regulatory requirements, depending on the activity/need.
- It appeared that the MDW could be used in other parts of the company, and is scalable.
- The MDW was capable of being populated with composition data while maintaining data integrity.
- Parts-per-million (ppm) calculations were done automatically, and could always be queried for on the product composition screen.
- The MDW's report indicated the compliance/non-compliance status of each unique product by the use of the universal red/green lights.
- Login and password requirements and other security features supported data integrity.

Background

Material declaration, and a tool to facilitate the process, has been considered obvious outgrowths of the European Union's Restriction of Hazardous Substances (RoHS) Directive. Aimed at the ultimate reduction of hazardous waste entering the environment with the discard of electrical and electronic equipment, the RoHS Directive has a reporting requirement that drives the elimination of these hazardous substances or the strict accounting of their presence in a product.

Objectives

The stated objectives of the pilot were i) to test the tool's ability to exchange predefined information and ii) to receive feedback from five suppliers on the tool's capabilities.

Kodak made the decision to involve our suppliers only at the point where we could make a recommendation for a tool that could be integrated across systems that describe the life cycle of our products. Therefore, in our application of the pilot, we reviewed the Goodbye Chain Group's Material Declaration Wizard (MDW) and its capability much as a supplier would, by (i) manually loading the predefined data from the NEMI BOM into the system and (ii) importing data from an outside source or other supplier into the system. The Goodbye Chain Group was the "other supplier" who exported data from their system.

Features of the MDW

The MDW is a "standards-based" application, built for providing compliance scenarios against industry standards. The industry standards in question were the substances and thresholds of the RoHS Directive, and more specifically, the Joint Industry Guide (JIG), a draft document authored by a coalition of electronic industry associations in the US (EIA), the EU (EICTA), and Japan (JGPSSI). The regulatory scope also included reference to the IPC-JEDEC standards for lead-free solder and assembly.

Mainly, the MDW has its architectural framework built on the population of the mandatory and optional data fields proposed in the draft JIG, as shown in Figure 1. The functions included an "MDW Advisor" service for updating the user on the legislative or regulatory requirements that apply to the substances being declared, and a tracking system for identifying those regulated and/or targeted substances (see Figure 2). There was a logical decision tree which took input from component to subpart to material to substance (Figure 3), and the expert system calculated and tracked compliance with the standards at the ppm level (Figure 4), for appropriate substances. The option of not declaring existed, if no RoHS substances were present.

A separate Material Declaration Form (MDF) is created for each unique product number, and a compliance summary for each product was added to the product library (Figure 5). The MDF could be edited once created, except after a product declaration had been certified.

Use of the MDW

Kodak used the tool over the course of a 15-day trial period, first with the desktop installation of the product, and also with the CD version. Data from the NEMI BOM were loaded manually in each case, following the logic tree of subpart to material to substance (Figure 3). The MDW processes included (i) choosing the product for declaration and loading unique product details (name, total mass, etc), (ii) building the product structure ultimately with unique substances from a family of substances, and (iii) being able to certify the product and export the data to outside sources. Additional data sent by electronic mail were also imported into the product library (Figure 5) and all data

were aggregated automatically and assessed for compliance with the appropriate industry standards, through the use of the MDW Advisor and the automatic ppm calculator (Figure 4).

All of the data fields suggested by the draft JIG were used, whether they were mandatory or optional. Each of the data fields in the product library (Figure 5) had search capability.

Results

Ease of Use. The MDW was exceptionally easy to use, and required no advance training. Manual input into the system was tedious, but this was not a function of the tool itself. From the outset, help was available through the MDW Advisor (Figure 2), a feature that would give a novice the capability of identifying substances and materials belonging to the draft JIG's A or B lists (Figure 6), or not. With knowledge of the component's logic tree, each screen's input focused on the attributes of a subpart, or a material, or a substance. While mass was conveniently given in grams, ppm calculations were done automatically to compare with the thresholds of the draft JIG. The "Calculate ppm" function was always available on the product composition screen (Figure 3).

Scalability. The CD version of the MDW was used in the pilot as well. This was evaluated by other personnel, in departments with interest in product composition data. There seemed to be ready applicability to other systems that relied on product composition data.

Reporting Scheme. Kodak did not evaluate the MDW based on the End-of-Life Vehicle Directive. Again, the MDW was built in response to the requirements of the RoHS Directive and the draft JIG intended to facilitate worldwide material composition declaration. The reports, therefore, fit well into the proposed scheme, identifying compliance or non-compliance with the thresholds dictated by RoHS and JIG, using the universal red-green stop light charts. The status of each unique product in the product library built was apparent for each of the indicators — e.g., it was quite clear whether the product were compliant or non-compliant with the JIG's A or B list, or with the RoHS Directive. Also indicated in the report was whether there were any substances identified from the library of optional 'C' list substances (Figure 7), and whether the product composition had been certified as correct (Figure 8).

Analytical. A unique mass number was required for each product, as well as for each branch in the logic tree of the assembly, as the MDW did not allow for overrides on this issue. The MDW could also be queried for the total amount of a given substance in a product. If cadmium were present in more than one subpart that comprised a single product, a ppm calculation for cadmium would aggregate the mass from each subpart.

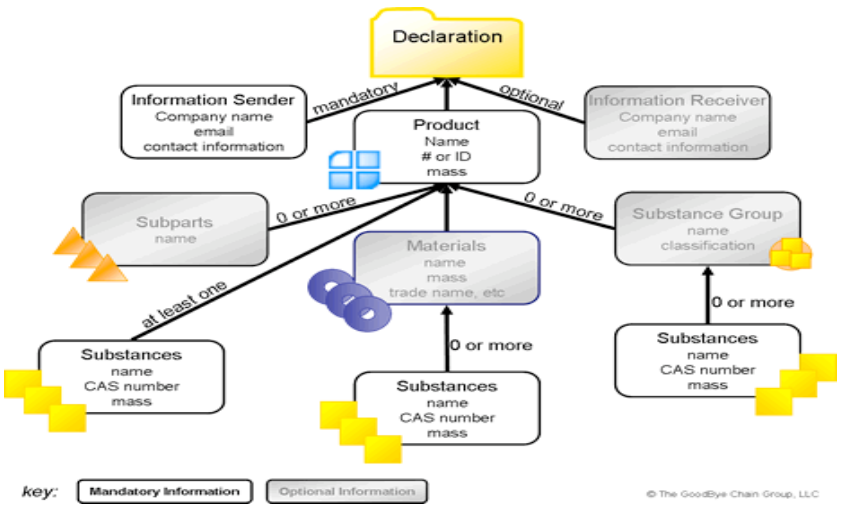
Data Integrity. The MDW was protected by a login user name and password, and only authorized users could declare the composition of a product (see Figure 9). Additionally, as mentioned above, there was a product certification screen (see Figure 8), a feature that helped to assure data integrity, and created an audit trail to the person certifying the product declaration.

Summary

The rankings for the use of the MDW have been included in Figure 10. We found that the MDW was capable of being populated with composition details for a variety of unique components, and could keep the integrity of the hierarchy of the logic tree from product to subpart to material to substance within the product details. The tool was easy to install, and could not be transferred to another location, giving security and ownership to the declaration.

The MDW actually functioned as an expert system, providing not only substance lists for incorporation into the composition declaration, but also the legislative and regulatory requirements for further information, with appropriate current thresholds for targeted substances. The ensuing reports from the manual loading of the NEMI BOM were successful declarations of the composition of each product.

Figure 1. Mandatory and Optional Data Fields of JIG*



*Joint Industry Guide

Figure 2. Trigger for Regulatory Compliance

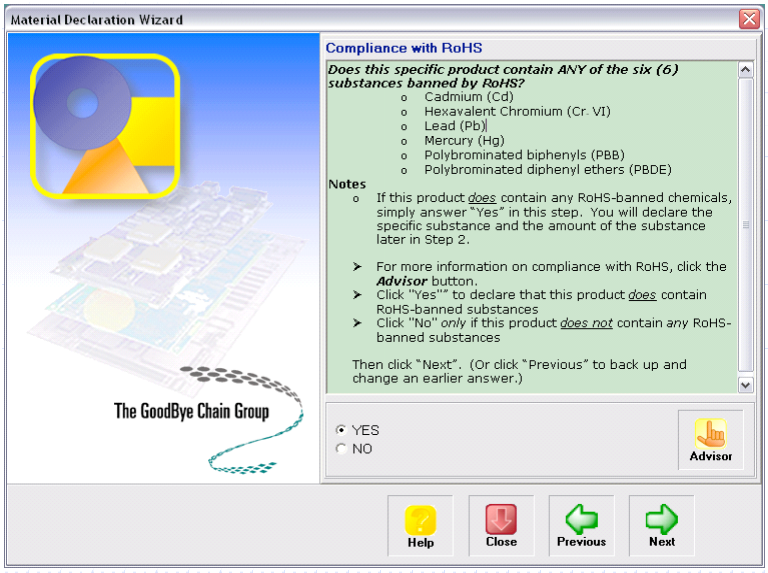


Figure 3. Decision Tree for Product Composition

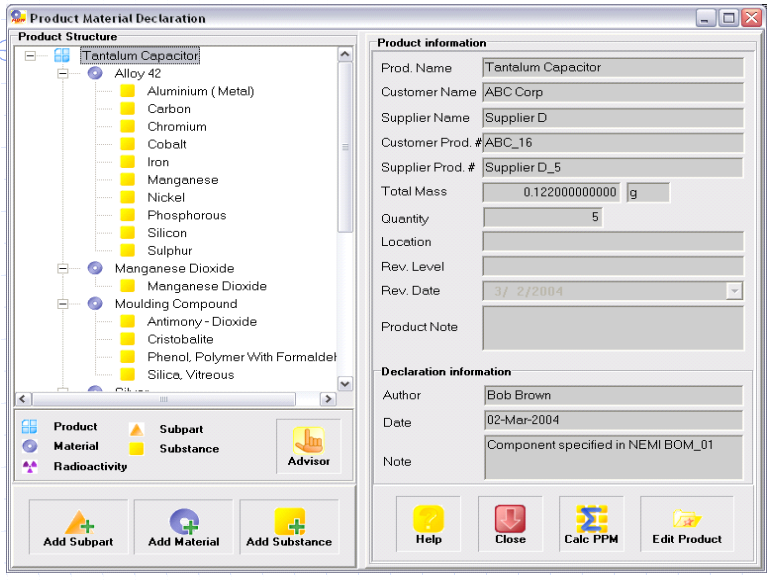


Figure 4. Calculation of Substance Mass in ppm. Stop-Light colors indicate compliance/non-compliance

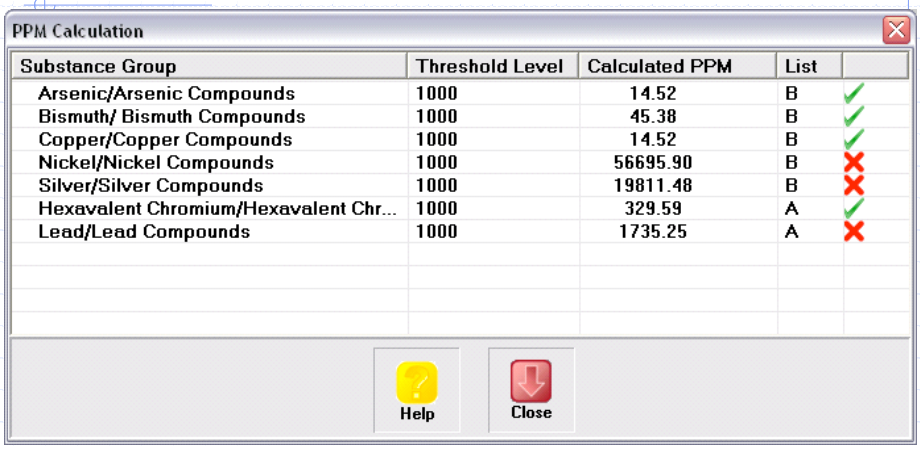


Figure 5. Summary of Products for Material Declaration

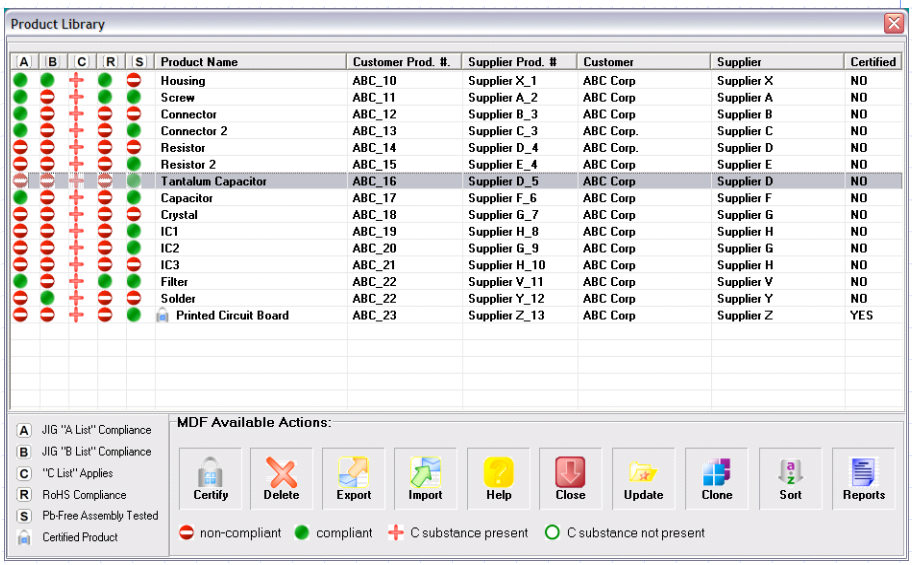


Figure 6. Draft JIG's List A of Regulated Substances

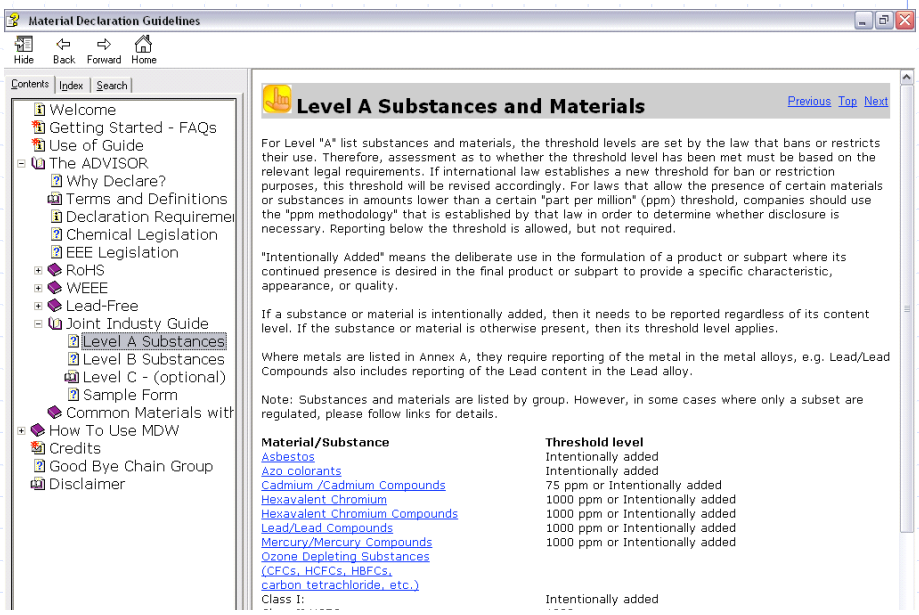


Figure 7. Optional Category of "C" List Substances Could Be Augmented by Substance Unique to Customer

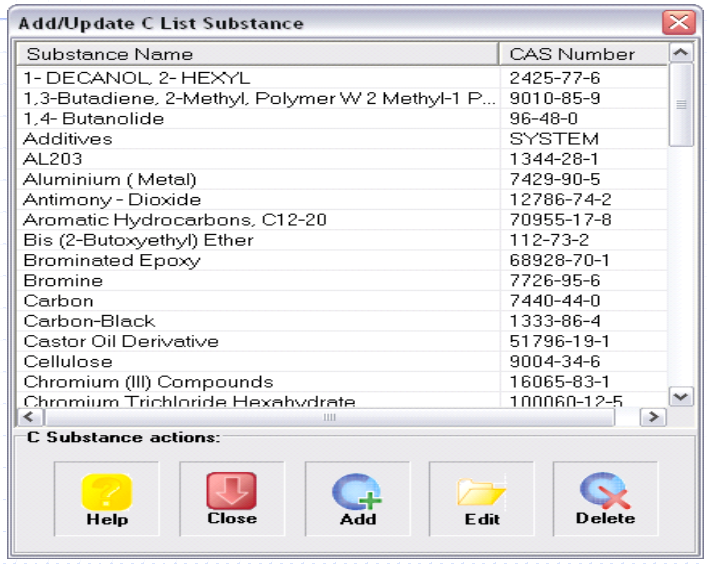


Figure 8. Product Certification Form

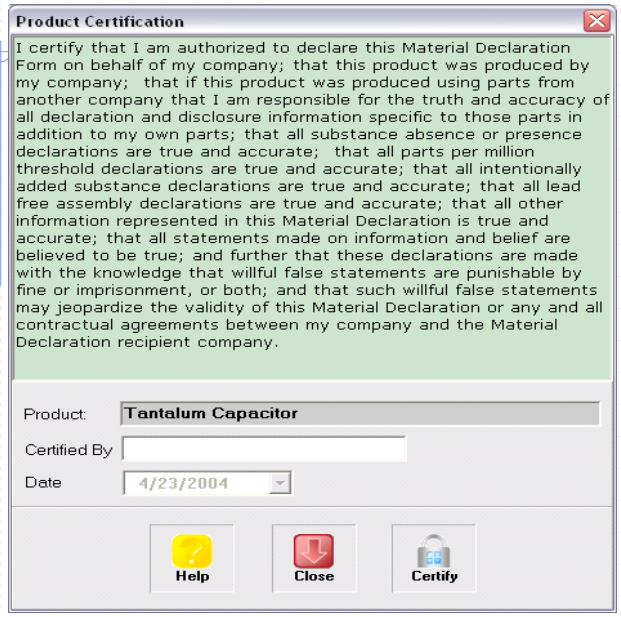


Figure 9. Unique Sender and Receiver Information for Product Declaration

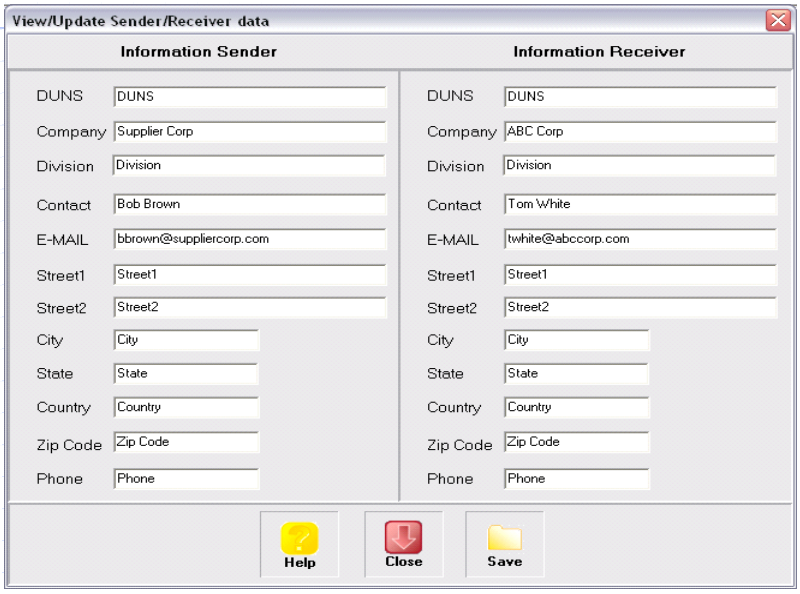


Figure 10. Kodak / Material Declaration Wizard Pilot Results

				Material Declarations Pilot						
				Pilot Evaluation (Data Exchange Software)						
Revision	1									
Last Updated	30-Mar-04									
Software	**Supplier Exchange Evaluation**	**Pilot Evaluation**	**Total Score**							
A	41	45	86							
B	43	51	94							
C	33	42.9	75.9							
D MDW	57.6	59.4	117							
E										
Evaluation of Responses										
***Ranking**	**1**	**3**	**5**	**7**						
*Team Review of Responses	Fail	Marginal	Pass	Excellent						
Equivalent Y/N Ranking	N	NA	Y	NA						
						Supplier Exchange Evaluation				
Ease of Use	Ranking					**A**	**B**	**C**	**MDW**	**E**
1	How easy was the tool?					3	3	3	6	
2	Help feature and clarity of instruction?					5	5	3	5	
3	Installation experience?					5	5	3	5	
4	Data entry experience ?					3	3	3	3	
5	Data exchange experience?					3	3	3	5	
6	What issues did you run into and how did you resolve them?					5	5	3	5	
7	What was total time to populate the information into the tool?					7	7	3	7	
	(Assumes data is available to load)									
8	Suggestions and Improvements?									
	1	3	5	7		3	7	7	7	
	Signs of Fail	Several	few	None						
Scalability										
1	What barriers do you see in adopting the tool across your company?					7	5	5	5	
Sub-Total						41	43	33	48	
	*Qualifying Weight : How many times have you used this tool?					1	1	1.2	1.2	
		< 10								
		1.2								
Supplier Eval. Total						**41**	**43**	**39.6**	**57.6**	

						Pilot Company Evaluation				
Ease of Use						**A**	**B**	**C**	**MDW**	**E**
1	What was the cost, effort and time to run the pilot?					3	3	3	5	
	(consider the data collection, data validation, and data reporting)									
2	How easy was the tool to use?					3	5	3	6	
	(e.g. user-friendly, instructions, help, efficiency, automatic, reporting, security)?									
3	What were the pitfalls and issues you ran into					5	5	5	5	
	1	3	5	7						
	Signs of Fail	Several	few	None						
Scalability										
1	Data aggregation capability?					7	7	3	7	
Results										
1	How well do the results comply with JIG Annex A?					5	7	5	7	
2	How well do the results comply with internal requirements?					5	5	5	7	
3	How well do the results comply with our customer requirements?					7	7	5	7	
4	How well do the results comply with current regulations?					5	7	5	5	
Data Integrity Capability										
1	How accurate are the results? How was the data integrity ensured?					5	5	5	5	
Sub Total						45	51	39	54	
	*Qualifying Weight : How many times have you used this tool?					1	1	1.1	1.1	
		< 10	10+							
		1.1	1							
Pilot Evaluation Total						**45**	**51**	**42.9**	**59.4**	

Appendix C: Jabil Circuit Pilot Report
Compliance Connect™ & Compliance X-Sight™ / Centor Software

Jabil has been using the Centor software with its suppliers for more than a year for data collection and analysis required by EU End-of-Life Vehicle legislation. Given suppliers' familiarity with the Compliance Connect data collection tool, a two-part approach to data collection for the NEMI pilot was used. First, in order to assess the experience of a new user to the data collection process, Jabil took the data from the NEMI pilot BOM and entered it into the data collection spreadsheet himself. Jabil was familiar with the regulations and their requirements, and is involved with NEMI in this pilot, but the user performing the pilot had not actually used the data collection tool before. Second, a limited group of suppliers were surveyed with the questions in the NEMI pilot. The results of this survey are found in Figure 1 at the end of this Appendix.

The pilot BOM was loaded into the Jabil ERP system and this BOM was exported into the Centor Compliance X-Sight tool. The simulated data was imported from the Compliance Connect data collection tool. The Compliance X-Sight tool was used to analyze the data and generate reports. The tool was found to report the results with 100% accuracy. Both data entry and use of the Compliance X-Sight tool were by a first-time user.

Supplier Survey Results

Supplier responses to the survey questions are summarized below. These questions were intended to elicit information about their experiences with the data collection tool Compliance Connect.

- User Interface Questions (1&2)
  - 75% of suppliers found the tool "somewhat easy" while 25% felt it was difficult to use.

- Tool Experience Questions (3-5)
  - 75% of suppliers' responses were positive while 25% reported the tool was difficult / cumbersome. Comments were made that it was initially cumbersome (Complexity of Requirement), but becomes easier with use.

- Issues
  - The following issues were raised: revision levels; breakdown of part tree, intelligent spreadsheet imposing discipline; supplier code consistency (Jabil issue).

- Timing (Question 8)
  - Suppliers reported five minutes to one hour to complete the spreadsheet.

- Suggestions & Improvements
  - The following suggestions were raised: umbrella specs, free training, limit data collection to banned substances only.

- Barriers to Company Adoption
  - Timing and resources.

Jabil's experience with this pilot is summarized below. These comments indicate their experience with the data analysis and reporting tool Compliance X-Sight.

- How Accurate?
  - Data integrity is ensured by embedded intelligence (supplier compliant) and data are certified by the supplier or not accepted by the tool.

- Cost
  - Suppliers reported requiring more than one hour to complete; however, Jabil was able to complete the survey in less than one hour.

- How easy?
  - The overall pilot was found to be easy.

- Issues & Pitfalls
  - No major issues were raised. Minor issues were resolved quickly via third party relationship. Suggestions for improvement include synergy with Jabil requirements for efficiency and value.

Figure 1. Jabil / Compliance Connect™ / Compliance X-Sight™ Pilot Results

NEMI Material Declaration Pilot
Features Matrix

Part Functionality	EMARS	Compliance X-Site	MDW
Search by	□	□	□
Supplier or Internal Part Number	r	r	□
Part Compliance Status	r	r	□
Supplier (Name or ID)	r	r	□
Date Material Declaration Received	r	r	□
Substance	r	r	□
□	□	□	□
Par Information	□	□	□
View Material Breakdown	r	r	□
Calculate/view Compliance Status for Multiple Standards	r	r	□
View Compliance Report	r	r	□
Manage Compliance Exemptions	r	r	
□	□	□	□
Notifications	□	□	□
Notify when new part data is added	r	r	
Notify prior to exemption expiration	r	□	□

Product Reporting Functionality	EMARS	Compliance X-Site	MDW
Search by	□	□	□
Internal or Customer Part Number	r	r	□
Customer	r	r	□
□	□	□	□
Product Information	□	□	□
Retrive BOM Data from existing Systems	r	r	□
View Product Reporting History	r	r	□
View Single Level BOM Rollup	r	r	□
View Multi Level BOM Rollup	r	r	□
View Compliance Status for each item on the BOM	r	r	□

Product Aggregation and Reporting	□		
Complete or Selective Aggregation	r	r	□
Worst case analysis for multi-sourced items	r	r	□
Report per multiple standards/data formats	r	r	

System Configuration	**EMARS**	**Compliance X-Site**	**MDW**
Hardware & Software	□	□	□
Standard Desktop Config.	□	r	□
Standard Office Software Config.	□	**NA**	□
Web Based	□	r	□
Additional Features Required	□	r	□
□	□	□	□
Database Configuration	□	□	□
Edit Capabilities	□	r	□
User Controled Rules Based Config	□	r	□
□	□	□	□
Support	□	□	□
Training	□	r	□
Help Desk	□	r	□
□	□	□	□
Available Solutions (Cost & Scaleability)	□	□	□
Low	□	r	□
Moderate	□	r	□
High	□	r	□
□	□	□	□

Appendix D: Sample BOM

Component Information							Material Information			Substance Information			
Description	Part Number	Qty	Unit	Supplier Name	Mass	Unit	Material	Amount (%)	Mass (g)	Substance	CAS #	Amount (%)	Mass (g)
Housing	**1**	1	EA	Supplier X	100.000	G	AL ALLOY 303	100	100	MANGANESE	7439-96-5	0.1	0.1
										MAGNESIUM	7439-95-4	2.6	2.6
										SILICON	7440-21-3	0.25	0.25
										COPPER	7440-50-8	0.1	0.1
										CHROMIUM(III) COMPOUNDS	16065-83-1	0.15	0.15
										ALUMINIUM (METAL)	7429-90-5	96.3	96.3
										IRON	7439-89-6	0.4	0.4
										ZINC (METAL)	7440-66-6	0.1	0.1
Screw	**2**	4	EA	Supplier A	0.786	G	SILICA	0.0001	7.86E-07	SILICIC ACID, SODIUM SALT	1344-09-8	100	7.86E-07
							TRIVALENT CHROMIUM	0.0001	7.86E-07	CHROMIUM TRICHLORIDE HEXAHYDRATE	10060-12-5	100	7.86E-07
							STEEL	94.1498	0.740017	MANGANESE	7439-96-5	0.54	0.0039961
										COPPER	7440-50-8	99.23	0.7343193
										IRON	7439-89-6	0.23	0.001702
							ZINC	5.85	0.045981	ZINC	7440-66-6	100	0.045981
Connector	**3**	1	EA	Supplier B	12.300	G	PPA	37.32	4.59036	PPA	-	100	11.860714
							TIN/LEAD	0.68	0.08364	TIN	7440-31-5	90	0.0756
										LEAD	7439-92-1	10	0.0084
							BRASS	40	4.92	ZINC	7440-66-6	33.0618	0.1452358
										TIN	7440-31-5	0.0053	2.328E-05
										LEAD	7439-92-1	0.0069	3.031E-05
										COPPER	7440-50-8	66.9	0.2938821
										SULFIDE	18496-25-8	0.0006	2.636E-06
										IRON	7439-89-6	0.0254	0.0001116
							PA	22	2.706	GLASS FIBRE	-	15	1.215
										POLYAMIDE	25038-74-8	83	6.723
										CARBON-BLACK	1333-86-4	2	0.162
				Supplier C	13.950	G	PLATED, TIN	0.002	0.000279	TIN	7440-31-5	100	0.0003479
							PLATED, NICKEL	0.002	0.000279	NICKEL	7440-02-0	100	0.0003479
							NYLON 6/6	54	7.533108	PA6/6T	25086-53-7	85	6.4190651
										FIBROUS-GLASS-WOOL	65997-17-3	15	1.1327762

							BRASS	45.996	6.416534	ZINC	7440-66-6	29.9	0.0101943
										LEAD	7439-92-1	0.05	1.705E-05
										COPPER	7440-50-8	70	0.0238662
										FE	7439-89-6	0.05	1.705E-05
Resistor	**4**	10	EA	Supplier D	0.051	G	MARKING INK	0.1	5.12E-05	URETHANE POLYMERS	9009-54-5	25	2.561E-11
										TITANIUM DIOXIDE (RUTILE)	1317-80-2	75	7.682E-11
							PLATED PUNCHED STRIP	99.5	0.050954	TIN	7440-31-5	1.2	0.0005748
										CHROMIUM	7440-47-3	12.8	0.0061312
										ALUMINIUM	7429-90-5	1.3	0.0006227
										NICKEL	7440-02-0	35.7	0.0171003
										LEAD	7439-92-1	0.8	0.0003832
										COPPER	7440-50-8	48.2	0.0230878
							COATING	0.4	0.000205	POLYESTER-COPOLYMER	66027-02-9	19.8	2.156E-06
										ADDITIVES	SYSTEM	80.2	8.734E-06
								100	0.05121				
				Supplier E	0.051	G	PLATED PUNCHED STRIP	93.536419	0.0958	TIN	7440-31-5	1.2	0.0005748
										CHROMIUM	7440-47-3	12.8	0.0061312
										ALUMINIUM	7429-90-5	1.3	0.0006227
										NICKEL	7440-02-0	35.7	0.0171003
										LEAD	7439-92-1	0.8	0.0003832
										COPPER	7440-50-8	48.2	0.0230878
							COATING	0.0212654	2.18E-05	POLYESTER-COPOLYMER	66027-02-9	19.8	2.156E-06
										ADDITIVES	SYSTEM	80.2	8.734E-06
							MARKING INK	0.0000002	2.05E-10	URETHANE POLYMERS	9009-54-5	25	2.561E-11
										TITANIUM DIOXIDE (RUTILE)	1317-80-2	75	7.682E-11
Tantalum Capacitor	**5**	5	EA	Supplier D	0.122	G	ALLOY 42	13.185	0.016086	SULPHUR	7704-34-9	0.025	4.021E-06
										COBALT	7440-48-4	0.5	8.043E-05

Component Information							Material Information			Substance Information			
Description	**Part Number**	**Qty**	**Unit**	**Supplier Name**	**Mass**	**Unit**	**Material**	**Amount (%)**	**Mass (g)**	**Substance**	**CAS #**	**Amount (%)**	**Mass (g)**
										PHOSPHORUS	7723-14-0	0.025	4.021E-06
										SILICON	7440-21-3	0.3	4.826E-05
										NICKEL	7440-02-0	43	0.0069169

										IRON	7439-89-6	54.95	0.0088391
										MANGANESE	7439-96-5	0.8	0.0001287
										ALUMINIUM	7429-90-5	0.1	1.609E-05
										CARBON	7440-44-0	0.05	8.043E-06
										CHROMIUM	7440-47-3	0.25	4.021E-05
							SILVER EPOXY COMPOSITION	0.7377049	0.0009	SILVER	7440-22-4	73	0.000657
										GAMMA-BUTYROLACTONE	96-48-0	27	0.000243
							TANTALUM	20.081967	0.0245	TANTALUM	7440-25-7	100	0.0245
							SILVER	1.442623	0.00176	SILVER	7440-22-4	100	0.00176
							SOLDER LAYER	1.815	0.002214	ZINC	7440-66-6	0.005	1.107E-07
										ARSENIC	7440-38-2	0.08	1.771E-06
										TIN	7440-31-5	90	0.0019929
										ALUMINIUM	7429-90-5	0.005	1.107E-07
										LEAD	7439-92-1	9.56	0.0002117
										COPPER	7440-50-8	0.08	1.771E-06
										BISMUTH	7440-69-9	0.25	5.536E-06
										IRON	7439-89-6	0.02	4.429E-07
							MANGANESE DIOXIDE	8.204918	0.01001	MANGANESE DIOXIDE	1313-13-9	100	0.01001
							MOLDING COMPOUND	54.532787	0.06653	PHENOL, POLYMER WITH FORMALDEHYDE	9003-35-4	10	0.006653
										ANTIMONY-DIOXIDE	12786-74-2	0.998	0.000664
										SILICA, VITREOUS	60676-86-0	88.161	0.0586535
										CRISTOBALITE	14464-46-1	0.841	0.0005595
Capacitor	**6**	10	EA	Supplier F	0.510	G	Electrolyte	9.8	0.04998	1,4-BUTANOLIDE	96-48-0	100	0.05
							Plastic Platform	15.35	0.078285	POLY(THIOPHENYLENE)	9016-75-5	100	0.0783
							Lead Wire	2.03	0.010353	TIN	7440-31-5	7.8	0.0008112
									0	COPPER	7440-50-8	19.6	0.0020384
									0	LEAD	7439-92-1	0.25	2.6E-05
									0	FE	7439-89-6	72.35	0.0075244
							Electrolytic Paper	6.78	0.034578	CELLULOSE	9004-34-6	100	0.0346
							Nylon Aluminum Case	25.1	0.12801	ALUMINIUM (METAL)	7429-90-5	97.3	0.1261008
									0	NYLON 6	25038-54-4	2.7	0.0034992
							Affixing	0.545	0.00278	POLY(THIOPHENYLENE)	9016-75-5	100	0.0028
							Aluminum Foil	14.665	0.074792	ALUMINIUM (METAL)	7429-90-5	100	0.0731
							Rubber End Seal	24.71	0.126021	1,3-BUTADIENE, 2-METHYL-, POLYMER WITH 2-METHYL-1-PROPENE	9010-85-9	100	0.1301

							Aluminum Tab	1.02	0.005202	ALUMINIUM (METAL)	7429-90-5	100	0.0083
Crystal	**7**	1	EA	Supplier G	0.191	G	CONDUCTIVE ADHESIVE	0.3659174	0.0007	SILICONE MODIFIED EPOXY RESIN	218163-11-2	25	0.000175
										POLYIMIDE RESIN	25036-53-7	38	0.000266
										SILVER	7440-22-4	62	0.000434
							ALMINUM CERAMICS	78.201777	0.1496	RE	-	65	0.09724
										CHROMIUM	7440-47-3	2.27	0.0033959
										ALUMINIUM	7429-90-5	20.55	0.0307428
										SILVER	7440-22-4	1.35	0.0020196
										COBALT	7440-48-4	2.46	0.0036802
										FE	7439-89-6	6.93	0.0103673
										SILICA	7631-86-9	1.44	0.0021542
							IC	0.6795609	0.0013	SILICON	7440-21-3	100	0.0013
										GOLD	7440-57-5	54	0.000702
										SILICA	7631-86-9	46	0.000598
							KOVAR	9.9320439	0.019	RE-METAL	-	0.42	7.98E-05
										NICKEL	7440-02-0	29.6	0.005624
										COBALT	7440-48-4	16.56	0.0031464
										FE	7439-89-6	53.42	0.0101498
							METALIZED TUNGSTEN	10.663879	0.0204	TUNGSTEN	7440-33-7	61.95	0.0126378

Component Information							Material Information			Substance Information			
Description	**Part Number**	**Qty**	**Unit**	**Supplier Name**	**Mass**	**Unit**	**Material**	**Amount (%)**	**Mass (g)**	**Substance**	**CAS #**	**Amount (%)**	**Mass (g)**
										NICKEL	7440-02-0	34.86	0.0071114
										GOLD	7440-57-5	3.19	0.0006508
							QUARZ	0.1568218	0.0003	QUARTZ (SIO2)	14808-60-7	100	0.0003
				Supplier D	0.171	G	LID	11.668611	0.02	COBALT	7440-48-4	100	0.02
							IC	0.5250875	0.0009	SILICON	7440-21-3	100	0.0009
							CRYSTAL	1.2835473	0.0022	QUARTZ (SIO2)	14808-60-7	100	0.0022
							CERAMIC PKG	86.347725	0.148	TUNGSTEN	7440-33-7	4.7	0.006956
										NICKEL	7440-02-0	4.2	0.006216
										QUARTZ (SIO2)	14808-60-7	9.8	0.014504
										GOLD	7440-57-5	1.3	0.001924
										AL2O3	1344-28-1	80	0.1184

							GLUE	0.1750292	0.0003	URETHANE	51-79-6	54	0.000162
										SILVER	7440-22-4	46	0.000138
IC1	**8**	2	EA	Supplier H	0.070	G	CHIP	3.3714286	0.00472	ALUMINIUM	7429-90-5	0.6	1.416E-05
										SILICON	7440-21-3	99.4	0.0023458
							DIE ATTACH ADHESIVE	0.3857143	0.00054	SILVER	7440-22-4	75	0.0002025
										EPOXY RESIN	-	25	6.75E-05
							EXTERNAL LEAD FINISH	2.6285714	0.00368	TIN	7440-31-5	85	0.001564
										LEAD	7439-92-1	15	0.000276
							LEADFRAME 1 SO, PLCC, SOT	29.371429	0.04112	ZINC	7440-66-6	0.12	2.467E-05
										PHOSPHORUS	7723-14-0	0.03	6.168E-06
										COPPER	7440-50-8	97.45	0.0200357
										IRON	7439-89-6	2.4	0.0004934
							WIRES	0.1142857	0.00016	GOLD	7440-57-5	100	8E-05
							ENCAPSULANT 1 SO	63.871429	0.08942	ANTIMONY OXIDE (SB2-O3)	1309-64-4	2	0.0008942
										EPOXY RESIN	-	28	0.0125188
										BROMINE	7726-95-6	0.74	0.0003309
										SILICON DIOXIDE	7631-86-9	69.26	0.0309661
							INTERNAL LEAD FINISH	0.2571429	0.00036	SILVER	7440-22-4	100	0.00018
IC2	**9**	1	EA	Supplier G	0.070	G	CHIP	3.3714286	0.00236	ALUMINIUM	7429-90-5	0.6	1.416E-05
										SILICON	7440-21-3	99.4	0.0023458
							INTERNAL LEAD FINISH	0.2571429	0.00018	SILVER	7440-22-4	100	0.00018
							LEADFRAME 1 SO, PLCC, SOT	29.371429	0.02056	ZINC	7440-66-6	0.12	2.467E-05
										PHOSPHORUS	7723-14-0	0.03	6.168E-06
										COPPER	7440-50-8	97.45	0.0200357
										IRON	7439-89-6	2.4	0.0004934
							WIRES	0.1142857	8E-05	GOLD	7440-57-5	100	8E-05
							ENCAPSULANT 1 SO	63.871429	0.04471	ANTIMONY OXIDE (SB2-O3)	1309-64-4	2	0.0008942
										EPOXY RESIN	-	28	0.0125188
										BROMINE	7726-95-6	0.74	0.0003309
										SILICON DIOXIDE	7631-86-9	69.26	0.0309661
							DIE ATTACH ADHESIVE	0.3857143	0.00027	SILVER	7440-22-4	75	0.0002025
										EPOXY RESIN	-	25	6.75E-05
							EXTERNAL LEAD FINISH	2.6285714	0.00184	TIN	7440-31-5	85	0.001564
										LEAD	7439-92-1	15	0.000276
IC3	**10**	1	EA	Supplier H	0.061	G	WIRE	0.001	6.1E-07	GOLD	7440-57-5	100	6.1E-07

							MOLD COMPOUND	48.289	0.029456	SILICON DIOXIDE	14808-60-7	85	0.0250378
										EPOXY RESIN	-	15	0.0044184
							FRAME	40.86	0.024925	ZINC	7440-66-6	0.12	2.991E-05
										PHOSPHORUS	7723-14-0	0.03	7.477E-06
										COPPER	7440-50-8	97.5	0.0243015
										IRON	7439-89-6	2.35	0.0005857
							DIE	6	0.00366	SILICON	7440-21-3	100	0.00366
							EXTERNAL PLATING	2.32	0.001415	TIN	7440-31-5	85	0.0012029
										LEAD	7439-92-1	15	0.0002123
							INTERNAL PLATING	1.01	0.000616	SILVER	7440-22-4	100	0.0006161

Component Information							Material Information			Substance Information			
Description	Part Number	Qty	Unit	Supplier Name	Mass	Unit	Material	Amount (%)	Mass (g)	Substance	CAS #	Amount (%)	Mass (g)
							ADHESIVE	1.52	0.000927	TIN	7440-31-5	5	4.636E-05
										SOLVENT NAPHTHA (PETROLEUM), HEAVY AROM.	64742-94-5	20	0.0001854
										URETHANE	51-79-6	33	0.000306
										MISC.	SYSTEM	40	0.0003709
										SILVER	7440-22-4	75	0.0006954
										RESIN: EPOXY	-	25	0.0002318
										LEAD	7439-92-1	95	0.0008808
										SILICON NITRIDE	12033-89-5	67	0.0006212
										OTHER INGREDIENTS	SYSTEM	10	9.272E-05
Filter	**11**	1	EA	Supplier V	0.046	G	WIRE	0.4	0.000185	GOLD	7440-57-5	100	0.000183
							TERMINATION UNDERPLATING	1.9	0.000877	NICKEL	7440-02-0	100	0.00088
							ALUMINA	46	0.021229	AL2O3	1344-28-1	100	0.0212
							ASTM F15	19.7	0.009091	NICKEL	7440-02-0	29	0.0026417
										COBALT	7440-48-4	17	0.0015486
										MISC.	SYSTEM	1	9.109E-05
										FE	7439-89-6	53	0.0048279
							BRAZE	0.97	0.000448	COPPER	7440-50-8	28	0.0001204
										SILVER	7440-22-4	72	0.0003096
							PHOSPHOR NICKEL PLATING	0.96	0.000443	PHOSPHORUS	7723-14-0	11	4.914E-05
										NICKEL	7440-02-0	89	0.0003976

							ADHESIVE	0.15	6.92E-05	POLYDIMETHYL-SILOXANE	9016-00-6	100	6.959E-05
							LITHIUM TANTALATE	14.5	0.006692	MISC.	SYSTEM	100	0.006699
							TERMINATION PLATING	0.5	0.000231	GOLD	7440-57-5	100	0.00023
							TERMINATION BASE METAL	14.62	0.006747	TUNGSTEN	7440-33-7	100	0.0069
							DIE METALLIZATION	0.3	0.000138	AL	7429-90-5	100	2.01E-06
Solder	**12**	0.0007	L	Supplier Y	4300	G/L	SOLDER PASTE	100	3.01	CASTOR OIL DERIVATIVE	51796-19-1	1.5	0
										TIN	7440-31-5	32.5	32.5
										LEAD	7439-92-1	55	55
										SILVER	7440-22-4	2.5	2.5
										COLOPHONY	8050-09-7	4.5	4.5
										1-DECANOL, 2-HEXYL	2425-77-6	1.5	1.5
										BIS(2-BUTOXYETHYL) ETHER	112-73-2	2.5	2.5
Printed Circuit Board	**13**	1	EA	Supplier Z	50	G	DIELECTRIC	54.91	27.455	BROMINATED EPOXY	68928-70-1	45	12.35475
										FIBROUS-GLASS-WOOL	65997-17-3	55	15.10025
							COPPER	42.4	21.2	COPPER		100	21.2
							PERMANENT SOLDERMASK	2.12	1.06	AROMATIC HYDROCARBONS, C12-20	70955-17-8	28.8	0.30528
										EPOXY RESIN	-	10.3	0.10918
										RUBBER MODIFIED EPOXY RESIN	68610-73-1	31.6	0.33496
										SILICA	7631-86-9	29.3	0.31058
							solder	0.57	0.285	LEAD	7439-92-1	37	0.10545
										TIN	7440-31-5	63	0.17955

Appendix E: NEMI Questionnaire Matrix

Material Declarations Pilot

Pilot Evaluation Matrix (Data Exchange Software)

Revision Draft

	Ease of Use		Scalability		Reporting Scheme		Analytical Processing		Data integrity		Results	
	Supplier Interface	Tier Interface	Supplier Interface	Tier Interface	Supplier Interface	Tier Interface	Supplier Interface	Tier Interface	Supplier Interface	Tier Interface	Supplier Interface	Tier Interface
A												
B												
C												

Ease of Use: (Ranking ?)
1 Time to Complete (*Note* Assumes composition data if available to complete)
2 Help Text
3 Tool Familiarity
4 Tracking & Quick Status Capability

Scalability: (Y/N)
1 Adoptable across company? (Y/N)
2 Support small to large scale?

Reporting Scheme: (Y/N)
1 Can support legislative requirements (*Note* Assume ELV Legislation as Basis)
2 Meets minimal collection criteria = part to material to substance scheme

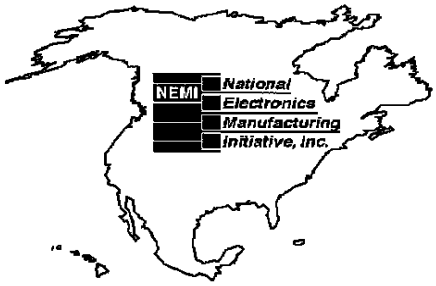
Analytical: (Y/N)
1 Support "homogenous" identification (*Note* example platting/terminal finish)
2 Support concentration level identification based on component and homogenous level

Data Integrity (Y/N)
1 Drives Data accuracy
2 Supports Audit Trail Capabilities
3 Security

Results (Y/N)
1 Data exchanged in electronic format
2 Capable of PDX exchange
3 Successful declarations of pilot BOM (Identifying SoC to determine compliancy @ component level and system level)
a Component Level Detail
b System Level Detail

Appendix F: Project Phase 1 Statement of Work

ftp://nemi.org/webdownload/projects/ese/Matls_Dec_SOWv1.2.pdf



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Statement of Work

NEMI Materials Declaration Sub Working Group
part of the
Lead Free Transition Task Group
Project Name: Materials Declaration Pilot (MDP)

Version 1.2 April 8, 2004

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Purpose:
The purpose of this project is to make a recommendation on standard materials declaration process and toolset by running a set of pilot tests to identify issues that:

- Aligns with the EIA, EICTA and JGPSSI Material Composition Declaration Guide
- Focuses on the legally banned and restricted materials (i.e. Annex A in the above Guide), Annex B optional

Goals

- Automated reporting process
- Minimal supply chain cost impact

Background and Drivers:
Global efforts are underway to standardize how the IT industry will declare hazardous and other materials in products and components. OEM customers are already asking for this information, primarily from customers in Europe and Japan, and are starting in North America. A global impact is anticipated on all OEM products, particularly commercial products. OEM's ability to sell to certain major customers will be seriously affected if they are unable to provide materials declaration information. This is driven by regulatory

and market-based restrictions (e.g. European Union RoHS Directive, TCO, Blue Angel, etc.). Three major industry associations have been involved in this effort: Electronics Industries Alliance (EIA), European Industry Association (EICTA) and the Japan Green Procurement Survey Standardization Initiative (JGPSSI). The three years of work that has taken place both within and between these industry associations has resulted in a draft Material Composition Declaration Guide, http://www.eia.org/resources/2003-09-19.10.pdf.

EIA submitted the joint guide to its members for a vote. The vote was 28-4 to approve. The EIA steering committee voted to "conditionally approve" it, which means we approve it "as is" but that we will work through the JEDEC voting mechanism to immediately revise the guide. We are planning to initiate this process in January 2004.

Scope of Work and Proposed Schedule:

- Agree on materials list to pilot (e.g. Annex A list, not Annex B) – December 2, 2003
- Agree on tools to use (e.g. RosettaNet lite, Goodbye Chain, Centor, Synapsis, Excel, JGPSSI spreadsheet, Agile, Agere Systems, etc.) – end of December 2003
  - Have presentations made by tool suppliers – December 2003
    - Goodbye Chain – December 9th, 2003
    - Centor – January 6th, 2004
    - Synapsis – January 27th, 2004
    - Agere – February 3rd, 2004
    - Agile – February 24th, 2004
    - RosettaNet – March 23rd, 2004
    - JGPSSI - February 24th, 2004
- Agree on what types of products and/or components to test – December 16, 2003
  - The team agreed to focus on a PCA and add housing with metal and plastic parts
  - Motorola will provide the design
  - Agree on the BOM – January 13, 2004
- Get volunteers to run pilots, set up sender and receivers – January 20, 2004

Tool	**Pilot Teams**
Goodbye Chain	Orlean Thompson – Kodak
Centor	Eric Austerman – Jabil
Synapsis	Kurk Kan – Motorola
RosettaNet	Mike Young – Agilent?
Agile	Kara Thompson - Dell
Agere	
Excel	
Japanese solution	
Other	

- Decide how the information and results will be shared and communicated between team members and to outside parties – January 20, 2004

- Monitor EIA, EICTA, JPGSSI, JEDEC, IPC and other industry activity and standard development – on going
- Determine pilot test criteria – January 20, 2004
  Accuracy, cost, effort, time, ease of use, ease of data exchange, ease of internal communication, pitfalls/issues (see separate NEMI Sample Data spreadsheet for details)
- Run pilot tests – February 2004
  Centor and Synapsis complete
  Goodbye Chain and Agile - April
- Measure accuracy of results (grind and analyze products/components) – March - April 2004
- Analyze results (compare tools for accuracy, cost, effort, time, pitfalls/issues) – April 2004
- Report results – April 2004
- Recommend solution(s) and next steps – April 2004

Appendix G: Team Acknowledgement

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