Chemical Management and Supply Chain Communication in the Automotive Industry

Tools and Processes

Timo Unger
European Auto Industry is the “engine” of Europe

An industry crucial for economy...

- 16.2 million vehicles produced in 2013
- Over €32.3 billion in R&D spending, largest private investor
- €95 billion of net trade contribution
- €388.8 billion of tax revenues (EU 15)

... and employment

- 12.7 million direct and indirect jobs
The vehicle is a very special product

- Most regulated by authorities
  - > 75 product laws directly influence characteristics
  - > 300 indirect laws
- Most advanced state of the art processes
  - For Global Engineering and R&D
  - For purchasing (e.g. purchasing guidelines, terms and conditions, supplier evaluation, supplier quality control, vendor tooling)
  - For Quality (e.g. release process for production/PPAP)
  - For logistics (e.g. supply risk management,
  - For production (e.g. closed loop/no waste for landfill, solar power supply etc.)
  - For end of life management
- Most complex product (> 1,000 functionalities)
Phase out of Lead, Chromium (VI), Cadmium and Mercury

triggered by

- technology
- functional changes
- innovations
- economics and
- law (2000/53/EC)

July 2003 heavy metal ban started

Without Battery, because of closed-loop recycling

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CrVI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pb (without battery)

Start Heavy Metal ban

1st revision annex II

2nd revision annex II

3rd revision annex II

4th revision annex II

5th revision annex II

6th revision annex II

7th revision annex II

8th revision annex II

ELV Directive with 1st annex II started

today Pb→ 0
Features of IMDS

- All involved parties can use IMDS via internet.
- IMDS is free of charge for the supply chain.
- Data security is ensured by user and transaction-related security architecture.
- Within the supply chain, material data can be forwarded in real-time according to authorization rights.
- The material data remains in possession of the creator who grants using rights to specific receivers.
- The system undergoes continuous improvements and enhancements to fulfil new requirements.
How many parts a vehicle contains?

Depending on the complexity, there are between 4,000 & 9,000 different main components contained in a vehicle platform (without multiple entries for one specific part).

- e.g. The vehicle platform of one OEM contains 8,400 components (=28,000 incl. common parts) from 1,800 suppliers!

- Up to 75% of a car are pre-manufactured by supply chain

Total number of components assembled to one vehicle: up to 28,000 (example: 1 tire = 1 part reference number; number of tires per vehicle = 4)

Products from other industries may be even more complex! (e.g. aerospace, engineering industry)
How many parts a vehicle contains?

- A car radio is counted as one main component...

Considering all parts contained in all components and sub-components, we come to many **tens/hundreds of thousands** of articles per vehicle!
Other interesting figures...

- How many different part numbers a vehicle manufacturer has in its warehouse? **up to 500,000**
- How many parts supplier (Tier 1) does a vehicle manufacturer have? **1,500 to 4,500**
- and how many Tier 2 suppliers the Tier 1 has in average? **500 to 1,500**
- How many Tier 1 suppliers are coming from outside Europe? **20% to 30% (from European Vehicle Manufacturers) 50% to 80% (from non-EU Vehicle Manufacturers)**
- How many levels the supply chain in the Automotive Industry has? **3-7 levels**
Using this data and adding some conservative assumptions a number of several billion possible substance communications for the tens of thousands of parts per vehicle are generated.

Achieving 100% complete data is impossible
In 1999, VDA BOD decided to develop one common collection tool.

**From Paper to Electronic Data**

**Challenges**
- Efficient management of a huge amount of data
- Easy overview on chemicals in parts
- Quick feedback and effective communication between suppliers and OEMs

**Target**
- Fulfillment of legal & quality requirements with lowest effort

**IMDS** *(International Material Data System)*

- Web based
- Standardized
- Computerization
- Quantitative report
www.mdsystem.com
Furthermore, the IMDS is managing today:

- 344,000 registered users
- 96,000 active users
- on average 1,600 concurrent users
- 51,000,000 Material Data Sheets
- 11,000 Substances reported
Helpdesk per Region since 2008

Number of HD Cases

- HD EMEA
- HD America
- HD Japan
- HD Korea
- HD China

Source: HP / IMDS SC
How the IMDS is managed?

**Tasks:**
- Strategy & Costs
- Operational Execution

**Definition of Responsibles (Spokesman):**
- Spokesman
- EDS
- Sponsors
- Groupe
- Managers
- Steering Committee (Experts)
- Order
- Service Provider
- Suppliers
- Requests, Remarks

**Implementation and Operation:**
- Japanese Steering Committee
- North American Steering Committee
- Implementation and Operation
The principle of IMDS

Main Principle of Data Collection

Within the whole supply chain, each supplier has to enter the substance & material information for his component and send it to the IMDS-account of his customer.

At the end, a more or less complex “Material Data Sheet” will be sent from the Tier 1 Supplier to the car manufacturer (OEM).

The OEM is using the data to check compliance of the purchased parts and substances for internal requirements as well as legal obligations.

- Each level of the chain can (and is) using the data to check and proof compliance.
- Data ownership (and responsibility) is on data creator site. Data cannot be modified by the receiver (without generating a new version (Data ID)).
- By granting up to 10% Jokers in the reported data, CBI protection is achieved and fully accepted by the global chemical Industrie. (coverage of secret amounts of the recipie).

- Key to success: No accepted IMDS Data = No parts approval = No payment = No production.
A data flow throughout the full supply-chain

Send Material Data Sheets (MDS) to:

- IMDS Address of Raw Material supplier
- IMDS Address of Tier n supplier
- IMDS Address of Tier 2 supplier
- IMDS Address of Tier 1 supplier
- IMDS Address of the Car Manufacturer

Proofing, Linking with own data and Sending new Material Data Sheets to:

- IMDS Address of Tier n supplier
- IMDS Address of Tier 2 supplier
- IMDS Address of Tier 1 supplier

Proofing, Linking with own data and Sending new Material Data Sheets to:

- IMDS Address of the Car Manufacturer

Proofing of MDS and using Data for internal benefit

Example:

PP

Insert

Doortrim Carrier

Doortrim

Complete Car

Time

(2-6 month*)

* Estimate of a real data collection. Depending on the complexity of the part & the strategy of the vehicle manufacturer (PPAP).
From drawings to IMDS data

Real Part

Data in IMDS

- Structure of a part (according to BOM)
- Used materials (incl. material categories)
- Weights of the components and materials
- Substances (esp. all substances of concern)
- Concentration of the substances within materials
Not included in IMDS

In IMDS, only substances have to be reported that are contained in the final part and that exceed the impurity threshold of 0.1%/0.01%.

**IMPORTANT:**

No other substances, e.g. used for:

- Production
  - e.g.: Release Agents, Cleaning Agents
- Packaging
  - e.g.: Transport Boxes, Paper, Plastic Foil
- Transport
  - e.g.: Fuel, Containers

...have to be entered into the IMDS (except they are still available on the final part)

e.g.: No Polyol and no Isocyanate but only Polyurethane (PUR)
Since many years a standard process within the Automotive Industry

The general process of CiP reporting in the AI

Supply Chain

IMDS
Communication of substance information

GADSL*
One reference list for declarable substances

* Global Automotive Declarable Substance List:

Tier 1

IMDS
Communication of substance information

GADSL
One reference list for declarable substances

Car Manufacturer

• The whole reporting and analysis is based on CAS numbers
• **Golden Rule:** If a substance is listed on GADSL, it must not be hidden (Jokers) in the IMDS reporting / substance declaration
## GADSL – A short insight

- The sources to analyze, evaluate and finally decide are:
  - The know how of the GASG Group (Decades of experiences!!!)
  - In addition and with minor impact, information from IMDS (has this substance already been used within a vehicle)

### GADSL today includes:

- 2703 Substances (CAS numbers) in
- 132 Substance Groups

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS-No.</th>
<th>Classifi- cation</th>
<th>Reason Code</th>
<th>Source (Legal requirements, regulations)</th>
<th>Generic examples</th>
<th>Reporting threshold (0.1% unless otherwise stated)</th>
<th>First added</th>
<th>Last Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaldehyde</td>
<td>75-07-0</td>
<td>D</td>
<td>FI</td>
<td>Reg. (EC) No 1272/2008</td>
<td>Emitted substance from polymer components</td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>10-Jan-05</td>
</tr>
<tr>
<td>Acetamide</td>
<td>60-35-5</td>
<td>D</td>
<td>FI</td>
<td>Reg. (EC) No 1272/2008</td>
<td>Solvent additive, stabilizer for softening agents</td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>10-Jan-05</td>
</tr>
<tr>
<td>Acetamide, N-methyl-</td>
<td>79-16-3</td>
<td>P</td>
<td>FI</td>
<td>Reg. (EC) No 1272/2008 Classified as toxic to reproduction class 2</td>
<td></td>
<td>0,10%</td>
<td>1-Feb-10</td>
<td>1-Feb-10</td>
</tr>
<tr>
<td>Acetonitrile</td>
<td>75-05-8</td>
<td>D</td>
<td>FI</td>
<td>Reg. (EC) No 1272/2008</td>
<td>Component in high-capacity capacitors</td>
<td>0,10%</td>
<td>1-Feb-08</td>
<td>1-Feb-08</td>
</tr>
<tr>
<td>Acrylamide</td>
<td>79-06-1</td>
<td>D</td>
<td>FI</td>
<td>Reg. (EC) No 1272/2008</td>
<td>Production of polyacrylamide (residual monomer)</td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>10-Jan-05</td>
</tr>
<tr>
<td>Acrylonitrile</td>
<td>107-13-1</td>
<td>D</td>
<td>FI</td>
<td>Reg. (EC) No 1272/2008</td>
<td>Production of plastics, resins and rubbers eg. ABS (residual monomer)</td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>10-Jan-05</td>
</tr>
<tr>
<td>Amines, carcinogenic, which are formed from Azo-dyes, selected</td>
<td></td>
<td></td>
<td></td>
<td>Reg. (EC) No 552/2009</td>
<td></td>
<td>0,10%</td>
<td>1-Feb-08</td>
<td>1-Feb-08</td>
</tr>
<tr>
<td>2,4,5-Trimethylaniline</td>
<td>137-17-7</td>
<td>P</td>
<td>LR</td>
<td>TRGS 614</td>
<td></td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>29-Jan-08</td>
</tr>
<tr>
<td>2-Naphthylamine</td>
<td>91-09-8</td>
<td>P</td>
<td>LR</td>
<td></td>
<td></td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>10-Jan-05</td>
</tr>
<tr>
<td>3,3'-Dichlorobenzidine</td>
<td>91-58-1</td>
<td>P</td>
<td>LR</td>
<td></td>
<td></td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>10-Jan-05</td>
</tr>
<tr>
<td>3,3'-Dimethylaniline</td>
<td>119-92-7</td>
<td>P</td>
<td>LR</td>
<td></td>
<td></td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>10-Jan-05</td>
</tr>
<tr>
<td>4,4'-Methylene-bis-(2-chloroaniline)</td>
<td>101-14-4</td>
<td>P</td>
<td>LR</td>
<td></td>
<td></td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>10-Jan-05</td>
</tr>
<tr>
<td>4,4'-Methyleneedianiline</td>
<td>101-77-0</td>
<td>P</td>
<td>LR</td>
<td></td>
<td></td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>10-Jan-05</td>
</tr>
<tr>
<td>4-Aminoazobenzol</td>
<td>60-09-3</td>
<td>P</td>
<td>LR</td>
<td></td>
<td>in dyes for textiles etc.</td>
<td>0,10%</td>
<td>1-Feb-09</td>
<td>1-Feb-09</td>
</tr>
<tr>
<td>Amines, which can form carcinogenic Nitrosamines, selected</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,10%</td>
<td>1-Feb-09</td>
<td>1-Feb-09</td>
</tr>
<tr>
<td>4-Methoxy-m-phenylenediamine</td>
<td>615-05-4</td>
<td>P</td>
<td>LR</td>
<td></td>
<td></td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>10-Jan-05</td>
</tr>
<tr>
<td>4-Aminodialdehyde</td>
<td>99-54-8</td>
<td>P</td>
<td>LR</td>
<td></td>
<td></td>
<td>0,10%</td>
<td>10-Jan-05</td>
<td>10-Jan-05</td>
</tr>
</tbody>
</table>

**Substance CAS-No.**: A list of substances included in GADSL today, along with their class, reason code, and source. The table also includes generic examples and reporting thresholds for each substance. The substances are categorized by their classification and reason code, with sources and regulations noted for each entry. The last revised date is also provided for each substance, indicating when the information was last updated.

**GADSL today includes**:

- 2703 Substances (CAS numbers)
- 132 Substance Groups
Considering the following criteria:

- Substance is to be expected in automobile part or vehicle (NOT in the production process and not outside the Automotive Industry!)
- Substance is regulated or projected to be regulated
- Reportable threshold levels will be based on the lowest level required by regulation or scientific evaluation.
IMDS & Confidentiality

- IMDS allows manufacturers of materials (Polymers, Greases, ...) to keep a certain amount of their formulation (max. 10%) confidential by providing:
  - Jokers/Wildcards, (e.g. “further additives”, “miscellaneous, not to declare, ...)

- However, this option must only be used if the core rule of IMDS is fulfilled
  - No substances listed on GADSL must be hidden in a wildcard
  - In case of a GADSL update (new “legal” requirement (e.g. new substances on the ROI, new Annex XV Dossier for restriction, amended ELV Annex II, ...)) the supplier has to check ALL of its MDS and if needed re-submit those were the new GADSL substance was covered by a joker.

NOTE: If the supplier does not follow this rule he is violating both, his legal requirement (e.g. REACH Art 33) AND the contracts with his customers
IMDS Security Management at HP

Secure HP Infrastructure

- Regulatory Compliance — HP is accredited by regulatory bodies to achieve compliance and support our clients meeting their compliance responsibilities
- Physical Security — examples are control access to facilities, security badges, and escorted visitors
- Virtual Security — examples are controlled system access, server auditing/scanning, and firewall management

Additional Services are tailored to needs

- Identity and Access Management — enables entitlement-based access to enterprise online applications and resources
- Threat and Vulnerability — employs a layered strategy to securing IT infrastructure and data assets
- IT Security Management — manages, monitors, captures, tracks, stores, and resolves security events from a centralized SIM repository
- IT Security Compliance — provides a proactive risk management program that supports client regulatory and policy directives
- Secure Communications — enables secure access to information and tools across the enterprise
- Secure Content — protects confidential corporate information and data assets through encryption of data on disks, attached devices, and backup media

→ ensures system security and protection of users’ IP
Strong and weak points of these processes and tools

• Well established process in the whole automotive sector (Global Standard)
  - Suppliers can address many customers with the same solution
• Well trained supply chain
• Broadly accepted by chemical industry (CBI protection)
• Comprehensive overview on substances used in cars
• Known and accepted by global legislators (Simplified Compliance Audits)
• Reporting by the one with most knowledge (Substance, Material or Part producer)
• Cost free for supply chain
• ...
### 1. KNOW

<table>
<thead>
<tr>
<th>Basic</th>
<th>Additional</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Create or use a CoC List</td>
<td>• Acceptable chemicals lists</td>
</tr>
<tr>
<td>• Supplier contracts to stipulate reporting</td>
<td></td>
</tr>
<tr>
<td>• Create a CiP information system</td>
<td>• Inventory of ALL chemicals</td>
</tr>
<tr>
<td>• Prepare safe handling, use and disposal docs</td>
<td></td>
</tr>
<tr>
<td>• Provide supplier and company internal trainings</td>
<td></td>
</tr>
<tr>
<td>• Publish Internal point of contact</td>
<td></td>
</tr>
</tbody>
</table>

- [x] Develop expanded CoC list
- [x] Identify pathways of critical impurities
- [ ] Receive from supplier SoC Inventories
- [ ] Inform downstream users about SoCs
## 2. DISCLOSE

<table>
<thead>
<tr>
<th>Basic</th>
<th>Additional</th>
<th>High Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Issue Corporate statement on disclosing CiP Infos</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>• Publish Chemicals of Concern List</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>• Disclosure Gov. &amp; DUs and final consumers about CoCs in products</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>• Point of contact for inquiries</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>• Disclosure of waste handling information</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>• Disclose Expanded Chemicals of Concern list</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>• Transparency of process and evidence</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>• Disclosure of all chemicals in final product</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
### 3. ENSURE

#### Basic
- Update CoC List as often as possible – **✔**
- Laboratory verification of supplier reporting’s – **✘**
- Ensure that hazard and risk information can be understood by a lay person – **✔**

#### High Level
- Conduct spot checks for compliance – **✔**

### CONCLUSION:
- All industries are different
  => Things working in our world can fail in others...
- There are CiP objectives which are achievable.
  => But there are also others which –if insisted in- can result in an industry boycott...
- Prerequisite for success: Common agreement on the CiP objectives
Collection of CiP Information is a challenge

...if it continuous to be visionable, it will remain a vision

but if it´s made workable, it will work!!!