

White Paper

September 2009

Compliance Management for OEM-Specific RoHS/REACH SVHC Requirements

IBM ES 46G3772 and IBM Product Content Declaration (PCD)

Complying with OEM-specific declaration requirements has become complex, especially for subassembly and module manufacturers.

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Preface

Complying with environmental and OEM-specific requirements has become much more difficult over the past several years, especially for subsystem or module manufacturers. It is no longer adequate to collect YES/NO status and certificates of compliance from suppliers. The declaration demands have increased significantly, especially for OEM-specific requirements. And as OEM-specific requirements and other regulations (such as RoHS and REACH SVHC) change, managing compliance is like shooting a moving target. The best solution is to manage declarations by collecting, whenever possible, full disclosure material information for all components on subsystems or board-level modules.

This article describes the best practice of environmental compliance management on subsystems or modules to comply with IBM Engineering Specification 46G3772. The article also suggests using a software tool to systematically validate compliance and produce the data necessary to complete IBM's Product Content Declaration (PCD) form. This combination of (1) collecting full disclosure material information and (2) managing the data with a powerful software tool provides a long-term solution to compliance management.

The Era of Full Disclosure Material Declaration

Maintaining environmental compliance with RoHS and REACH SVHC for your products means constantly monitoring changes to the regulations. In June 2009, RoHS was updated with 6 more exemptions; in addition, some exemptions have expired and more will expire later this year. In Q4 of 2009, a second set of substances is expected to be added to the REACH SVHC list. OEM-specific requirements are updated every so often as well. For example, the latest update of IBM ES 46G3772 (dated Feb 25, 2009) differs from its previous release on Aug 8, 2008. Several restricted substances have been added in certain categories of components or areas of application.

For these reasons, it no longer makes sense to be reactive instead of proactive in managing environmental compliance. It's a flawed strategy to ask suppliers to provide certificates and lab test reports on a fixed set of substances several times a year when regulations change and customer requirements are updated. It also doesn't make sense to spend valuable internal resources to collect data, consolidate documents, and perform compliance validation every time regulations or customer requirements change. It is time to rethink your entire strategy on how to manage environmental compliance for products.

Substance name	CAS number	EC number
2,4-Dinitrotoluene	121-14-2	204-450-0
Anthracene oil	90640-80-5	292-602-7
Anthracene oil, anthracene paste, distn. Lights	91995-17-4	295-278-5
Anthracene oil, anthracene paste, anthracene fraction	91995-15-2	295-275-9
Anthracene oil, anthracene-low	90640-82-7	292-604-8
Anthracene oil, anthracene paste	90640-81-6	292-603-2
Diisobutyl phthalate	84-69-5	201-553-2
Aluminosilicate, Refractory Ceramic Fibres		(650-017-00-8)
Zirconia Aluminosilicate, Refractory Ceramic Fibres		(650-017-00-8)
Lead chromate	7758-97-6	231-846-0
Lead chromate molybdate sulfate red (C.I. Pigment Red 104)	12656-85-8	235-759-9
Lead sulfochromate yellow (C.I. Pigment Yellow 34)	1344-37-2	215-693-7
Acrylamide	79-06-1	201-173-7
Tris(2-chloroethyl)phosphate	115-96-8	204-118-5
Coal tar pitch, high temperature	65996-93-2	266-028-2

Figure 1: The second group of REACH SVHC is expected in Q4 2009. This the proposed list of additions.

GreenSoft has been providing RoHS and REACH data collection services to electronics manufacturers for more than eight years. Over the past two years, we have seen acceleration in the number of suppliers that provide full disclosure material declaration data on their components. For purposes of illustration, a typical Bill of Materials (BOM) may contain 70% commodity parts and 30% customized parts. Today we are able to collect full disclosure material declaration data on 50-70% of the components immediately. Another 15-30% may come within 30 to 60 days; the remaining 5-15% are usually customized parts which may take a bit longer. Like subassembly or module manufacturers, component suppliers are experiencing the same pressure to provide full disclosure material declaration from all their customers. Conducting the same lab test multiple times for different sets of substances is impractical.

It took the industry 3 years (from July 2006 to June 2009) to achieve 95+% coverage of RoHS status on all parts inside a BOM. We expect suppliers to provide full disclosure material declaration even faster. There is a greater awareness of RoHS/REACH/SVHC and suppliers know that making full disclosure material declaration is the most practical solution to providing compliance data.

Company-Wide Best Practice: Establish a Product DNA

In order to know what chemical substances are in your products, you will need to know what chemical substances are included in the components that come from your suppliers. This means establishing a company-wide component chemical substance database. Once this database is established, you can aggregate substances and establish material disclosure for your subsystems or modules. We call this aggregation a product's DNA. You can then validate the Product DNA against all requirements, from regional regulations to customer-specific requirements.

Establishing a Product DNA involves multiple parts of a company:

1. The **Procurement** group may have already requested RoHS compliance status/markings and RoHS certification from suppliers with each shipment. Make

it the norm to add a request for a Full Disclosure Material Declaration to the requested list to suppliers. (Be sure to ask for the document describing the material composition of the *shipped* components.) Start this process now. The return rate may initially be low, but you will soon see a growing number of suppliers come back with material composition data on components.

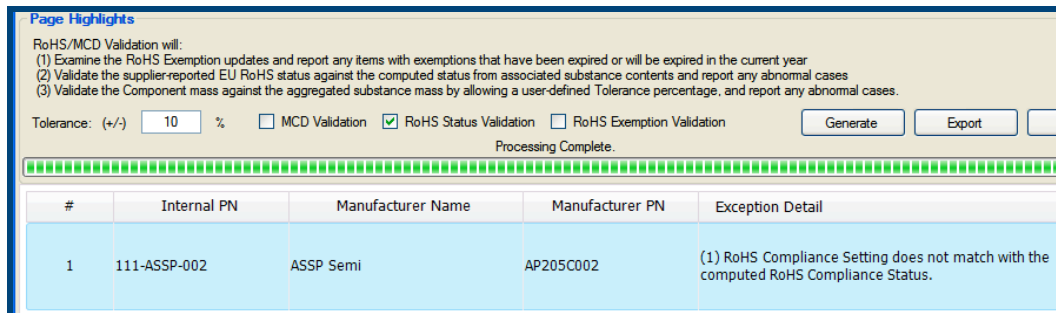
2. **Designers** will only design products with components that are in compliance with the required environmental regulations and customer-specific requirements. With an established company-wide component chemical substance database, you can easily achieve that by providing the required compliance status to Designers.
3. **QA/CE** are responsible for validating collected data from Procurement, establishing component compliance guidelines for Designers, and generating product-level compliance reports.

Data Validation

This paper will illustrate data validation performed by the software tool **GreenData Manager-REACH (GDM-REACH)** from GreenSoft. GDM-REACH can help to validate RoHS data and exemptions, examine CAS numbers, and qualify substance data submitted from suppliers.

Validation of RoHS Status versus RoHS Substance Data

To manage RoHS compliance, the normal procedure is to obtain from suppliers the RoHS compliance status and lab test report describing the quantity of 6 RoHS substances in ppm or weight. GDM-REACH provides a feature that validates the RoHS status against the RoHS substance in ppm and reports any abnormality.



Page Highlights

RoHS/MCD Validation will:

- (1) Examine the RoHS Exemption updates and report any items with exemptions that have been expired or will be expired in the current year
- (2) Validate the supplier-reported EU RoHS status against the computed status from associated substance contents and report any abnormal cases
- (3) Validate the Component mass against the aggregated substance mass by allowing a user-defined Tolerance percentage, and report any abnormal cases.

Tolerance: (+/-) % MCD Validation RoHS Status Validation RoHS Exemption Validation

Processing Complete.

#	Internal PN	Manufacturer Name	Manufacturer PN	Exception Detail
1	111-ASSP-002	ASSP Semi	AP205C002	(1) RoHS Compliance Setting does not match with the computed RoHS Compliance Status.

Figure 2: Validate the given RoHS compliance status against the computed RoHS compliance from the RoHS substance data.

RoHS Exemptions Update Alert

RoHS exemptions get updated once every few years: exemptions are added to the list and some exemptions expire. GDM-REACH examines the RoHS exemptions on all parts and reports components that use expired exemptions or soon-to-be expired exemptions. This allows you to see which BOMs or products use these components.

RoHS/REACH Compliance Management for OEM-Specific Requirements

Page Highlights
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(3) Validate the Component mass against the aggregated substance mass by allowing a user-defined Tolerance percentage, and report any abnormal cases.

Tolerance: (+/-) % MCD Validation RoHS Status Validation RoHS Exemption Validation

Processing Complete.

#	Internal PN	Manufacturer Name	Manufacturer PN	Exception Detail
1	111-ASSP-002	ASSP Semi	AP205C002	(1) The item uses Exemptions that are already expired or about to be expired.

Figure 3: Validate updated RoHS exemptions on all parts.

Validation of CAS Number

One common mistake suppliers make when they provide substance data is to use an invalid substance CAS number. GDM-REACH validates the substance CAS number provided by the suppliers and reports components and BOMs contain invalid substance CAS numbers.

Substance Weight versus Subpart Weight and Component Weight

Another common mistake that suppliers make when they provide substance data is that the aggregated total weight of a component based on substance data can deviate significantly from the actual component weight. Similarly, the total weight of the substances under a subpart can deviate from the subpart weight. GDM-REACH allows the user to set the deviance toleration and will report components that have a deviation exceeding the tolerance level.

Exception Details: Select Tolerance and click on Generate. Review the exceptions and double-click on a row to edit the Item Details. Export

Tolerance: (+/-) %

Processing Complete.

#	Internal PN	Manufacturer Name	Manufacturer PN	Exception Detail
2	0030-10781-22	ATMEL	AT24C02B-TSU-T	(1) Subpart mass is not within the allowable tolerance limits for one or more subparts.

Figure 4: Examining the total weight of substances versus the component weight or subpart weight.

Environmental Compliance Guidelines for Design

Establishing environmental compliance guidelines for Designers is another important task for QA/CE to accomplish. Designers must know whether the components they intend to use in product design are in compliance with the necessary regional compliance standard or specific customer requirements. GDM-REACH provides an instant view of compliance validation on all components used in a BOM. In addition, GDM-REACH provides the status roll-up on subassemblies and BOMs, as shown below.

RoHS/REACH Compliance Management for OEM-Specific Requirements

Rule Selection Panel

R1: EU RoHS Include 2nd Source

R2: Norwegian POHS

R3: China RoHS

R4: Halogen Free

OK

BOM Details

Legend: ● OK/Passed ● Not Ready/Failed ● Invalid Entry/Incomplete ● Document Expired ● Passed with Exemption ● Subject Info Incomplete ● Sub

Level	BOM ID/IPN	MFG Name	MPN	2nd Source	BOM Name/Description	Match Status	Completion Status	EU RoHS Status	R2 Status	R3 Status	R4 Status
0	800-001175-01				Control Board B8011	●	●	●	●	●	●
1	__1001-150					●	●	●	●	●	●
2	__0022-15002-05	EPEC	N10253F		8MAD PCB (8MA W/DIMMING)	●	●	●	●	●	●
2	__0022-10036-005	STMICROELECT...	STM811TW16F		IC,MPU RESET,3.08V TRIP,...	●	●	●	●	●	●
2	__0022-10036-005	MAXIM INTEGR...	MAX811TEUS+T	Y	IC,MPU RESET,3.08V TRIP,...	●	●	●	●	●	●
2	__0022-10036-02	VENKEL	C0603C0G500-220...		CAPACITOR, CERAMIC, 50V,...	●	●	●	●	●	●

Figure 5: GDM-REACH displays validation against four different compliance requirements simultaneously.

On regulations that require the compliance at the "Article" or product level, GDM-REACH provides another level of detail to show the product compliance. Below is a REACH SVHC compliance report and product level compliance report for China RoHS.

Page Highlights

BOM SVHC Report: Generates an SVHC report for the selected BOM. You could then export the report to Excel. Double-click a row to generate the Substance Analysis Report.

Action Panel

BOM Profile:

BOM ID: 888-001175-01
 BOM Name: Control Panel B715
 Revision:
 Mass (g): 15.9693200

* Mass has been calculated by aggregation.

Item No	Substance Name	CAS Number	EC Number	Above Threshold	Concentration (ppm)	Weight (mg)
1	4,4'-methylenedianiline	101-77-9	202-974-4	No	0.000	0.0000000
2	Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	204-211-0	No	11.898	0.1900000
3	Dibutyl phthalate (DBP)	84-74-2	201-557-4	No	563.581	9.0000000
4	Diarsenic pentoxide (Arsenic pentoxide)	1303-28-2	215-116-9	No	0.000	0.0000000
5	Diarsenic trioxide	1327-53-3	215-481-4	No	0.000	0.0000000
6	Sodium dichromate	10588-01-9	234-190-3	No	0.000	0.0000000
7	Alkanes, C10-13, chloro	85535-84-8	287-476-5	No	0.000	0.0000000
8	1,2,5,6,9,10-hexabromocyclodecane	3194-55-6	221-695-9	No	0.000	0.0000000
9	5-tert-butyl-2,4,6-trinitro-m-xylene	81-15-2	201-329-4	No	0.000	0.0000000
10	Benzyl butyl phthalate (BBP)	85-68-7	201-622-7	No	0.000	0.0000000
11	bis(tributyltin)oxide,hexabutylstannoxane...	56-35-9	200-268-0	No	0.000	0.0000000
12	Anthracene	120-12-7	204-371-1	No	0.000	0.0000000
13	triethyl arsenate	15606-95-8	427-700-2	No	0.000	0.0000000
14	Cobalt dichloride	7646-79-9	231-589-4	No	0.000	0.0000000
15	lead hydrogen arsenate	7784-40-9	232-064-2	No	0.000	0.0000000

Figure 6: GDM-REACH validates BOM ID# 888-001175-01 against REACH SVHC.

In presenting product-level compliance for China RoHS, GDM-REACH first presents the product-level compliance result with aggregated ppm and weight for the 6 RoHS substances. To drill down to the BOM or assembly level, double-click on the row of interest. Export the result to Excel and establish a China RoHS reporting table.

RoHS/REACH Compliance Management for OEM-Specific Requirements

Page Highlights
BOM Compliance Report: Generates a compliance report for the selected Rule. You could then export the report to Excel. Double-click a row to generate the Substar

Action Panel
BOM Profile: * Mass has been calculated by aggregation. Rule Profile:
 BOM ID: 888-001175-01 Rule Name: China RoHS
 BOM Name: Control Panel B715 Rule Type: Homogeneous Level
 Revision: Category:
 Mass (g): 15.9693200 Exclusion Category:
 Rule Description: [6 Substance Groups]

Generate
Export
 Include 2nd So

Item No	Type	Substance Name	Threshold	Units	Compliance Status	Concentration (ppm)	Weight (mg)
1	Group	Cadmium/Cadmium Compou...	100.000	ppm	Passed	0.000	0.00000000
2	Group	Hexavalent Chromium/Hexa...	1000.000	ppm	Passed	0.000	0.00000000
3	Group	Lead/Lead Compounds	1000.000	ppm	Failed	1800.290	28.7494000
4	Group	Mercury/Mercury Compounds	1000.000	ppm	Passed	0.000	0.00000000
5	Group	Polybrominated Biphenyls (P...	1000.000	ppm	Passed	0.000	0.00000000
6	Group	Polybrominated Diphenyleth...	1000.000	ppm	Passed	0.000	0.00000000

Figure 7: GDM-REACH presents product-level details of compliance with China RoHS.

Report Type: BOM Substance Analysis Report
Date of Report: 8/24/2009 7:50:20 AM
BOM ID: 888-001175-01
BOM Name: Control Panel B715
Revision:
Number of Items shipped/year: 1
Substance Name: Lead/Lead Compounds
CAS Number:
EC Number:
 --- Drill down from rule ---
Rule Name: China RoHS
Rule Type: Homogeneous Level
Category:
Exclusion Category:
Rule Description: [6 Substance Groups]

Level	BOM ID/Internal PN	Qty	UOM	Unit Mass (g)	Type	Substance Name	Compliance Status	Substance Present?	Aggregate (ppm)	Aggregate Mass (g)	Tonnage
0	888-001175-01	1	each	15.96932	Group	Lead/Lead Compounds	Failed	Present	1800.290	0.0287494	0.0000000287
1	1001-150	1	each	4.4955	Group	Lead/Lead Compounds	Failed	Present	6220.265	0.0279632	0.0000000280
1	1001-250	1	each	11.47382	Group	Lead/Lead Compounds	Failed	Present	68.521	0.0007862	0.0000000008

Figure 8: GDM-REACH presents the product and Assembly level details at compliance with China RoHS

GDM-REACH also presents product-level compliance in full disclosure mode by aggregating each unique substance from components to assemblies to the final product. A list of unique substances is presented in a table as a product-level disclosure report. In other words, Product DNA.

RoHS/REACH Compliance Management for OEM-Specific Requirements

Page Highlights
 Product Level Disclosure: Generates Product Level Full Disclosure for the selected BOM. Export the report to Excel or to IPC-1752 Class-5 XML.

Product Profile
 BOM ID: 888-001175-01 [Backup BOM](#)
 BOM Name: Control Panel B715
 Revision:
 BOM Mass (g): 15.96932 * Mass has been calculated by aggregation.
 EU RoHS Status: Passed with Exemption
 Exemptions: 5, 7c, 7a [Exemption Report](#)
 REACH SVHC Status: Passed
 Exceptions: None [Exception Report](#) [Other Substances List](#)

Supplier Information
 Name: ABC
 Contact: bob
 Phone: 323
 Email: bob@ABC.com

#	Substance Name	CAS Number	Mass (g)	Concentration (ppm)
10	Palladium	7440-05-3	0.0002036	12.749
11	Silica, vitreous	60676-86-0	0.2738168	17146.428
12	Gold	7440-57-5	2.0023600	125387.931
13	Lead monoxide	1317-36-8	0.0012500	78.275
14	Copper	7440-50-8	6.3467414	397433.416
15	Aluminium oxide	1344-28-1	0.0286488	1793.990
16	Epoxy Resin	61788-97-4	0.1034688	6479.224
17	Aluminium hydroxide	21645-51-2	0.0014420	90.298
18	Phenol, polymer with formaldehyde	9003-35-4	0.0043200	270.519
19	Potassium	7440-09-7	0.0046150	288.992
20	Diantimony trioxide	1309-64-4	0.0050480	316.106
21	Arsenic	7440-38-2	0.0000030	0.188
22	Zinc	7440-66-6	0.0002444	15.304

Figure 9: GDM-REACH presents the product-level disclosure report, or Product DNA.

In addition to presenting the compliance status for each component or product level with GDM-REACH software, the status can also be transmitted to company-wide ERP or PLM systems through Web services from GreenSoft.

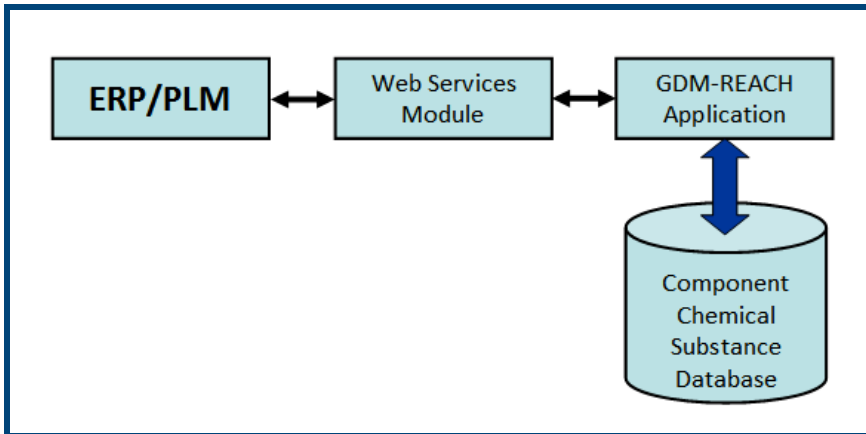


Figure 10: GDM-REACH provides an ERP/PLM interface through Web services.

Managing Compliance with Customer Specific Requirements: IBM Product Content Declaration (PCD) following IBM ES 46G3772

The IBM Product Content Declaration (PCD) which follows IBM Engineering Specification 46G3772 focuses on four areas: (1) Banned substances, (2) Reportable substances, (3) RoHS report, and (4) SVHC report.

1. Banned Substances

The most important task in complying with IBM ES 46G3772 is to make sure products do not contain banned substances, either in certain component categories or in certain applications. A subsystem or module manufacturer must pay special attention to both component categories and applications. A good **first step** is to make a category/application table for these banned substances. This will help quickly locate the condition of substance limitation.

Category Description	Category Name	Major Category	Affecting Substance(s)
1 Battery-Zinc Carbon	Battery-Zinc Carbon-all sizes	Battery	Lead, Mercury
2 Battery-Zinc Carbon-Size R6, R14, R20	Battery-Zinc Carbon-Size R6, R14, R21	Battery	Cadmium
3 Battery-Alkaline or Zinc Manganese	Battery-Alkaline or Zinc Manganese	Battery	Cadmium, Lead, Mercury
4 Battery-Non removable batteries or accumulators	Battery-Non removable batteries or accumulators	Battery	Cadmium, Lead
5 Battery-Nickel-Cadmium	Battery-Nickel-Cadmium	Battery	Cadmium
6 Button Cell batteries or batteries compose of button cell	Button-Cell Battery	Battery	Mercury
7 Battery-All other types	Battery-All other types	Battery	Cadmium
8 such as Mouse cable	Frequently Handle Cables-Surface Layer	Cable	Lead
9 Contained in Products or Parts as a gas	Gas	Gas	PFCs
10 Lamp-fluorescent lamp	Fluorescent lamp	Lamp	Mercury
11 Lamp-Cold Cathode Fluorescent Lamps(CCFL)-tube length	CCFL - Len<500nm	Lamp	Mercury
12 Lamp-Cold Cathode Fluorescent Lamps(CCFL)-tube length	CCFL - Len between 500nm and 1500nm	Lamp	Mercury
13 Lamp-Cold Cathode Fluorescent Lamps(CCFL)-tube length	CCFL - Len>1500nm	Lamp	Mercury
14 Lamp-All other types of lamp	All other types of lamp	Lamp	Mercury
15 paint, varnish, color pigment, dye, stabilizer in plastic or alloy applications, decorative laminate, adhesives, inks, inked related products like ink ribbon, molded plastic	Special Applications-paints, inks, adhesives, etc	Paint and Others	Toluene, Phenol, Arsenic, Cadmium, Hexa
16 Plating or Surface Coating	Plating or Surface Coating	Plating	Cadmium
17 Computer Plastic Housing	Plastic Housing	Enclosure	DecaBDE
18 System Enclosure	System Enclosure	Enclosure	TBBA, PVC

Figure 11: Category table for mapping banned substances with categories of components

Once you have completed mapping banned substances to categories of components, the **second step** is to assign categories to the components used in each product or BOM. GDM-REACH supports the category assignment on each component, as shown below.

RoHS/REACH Compliance Management for OEM-Specific Requirements

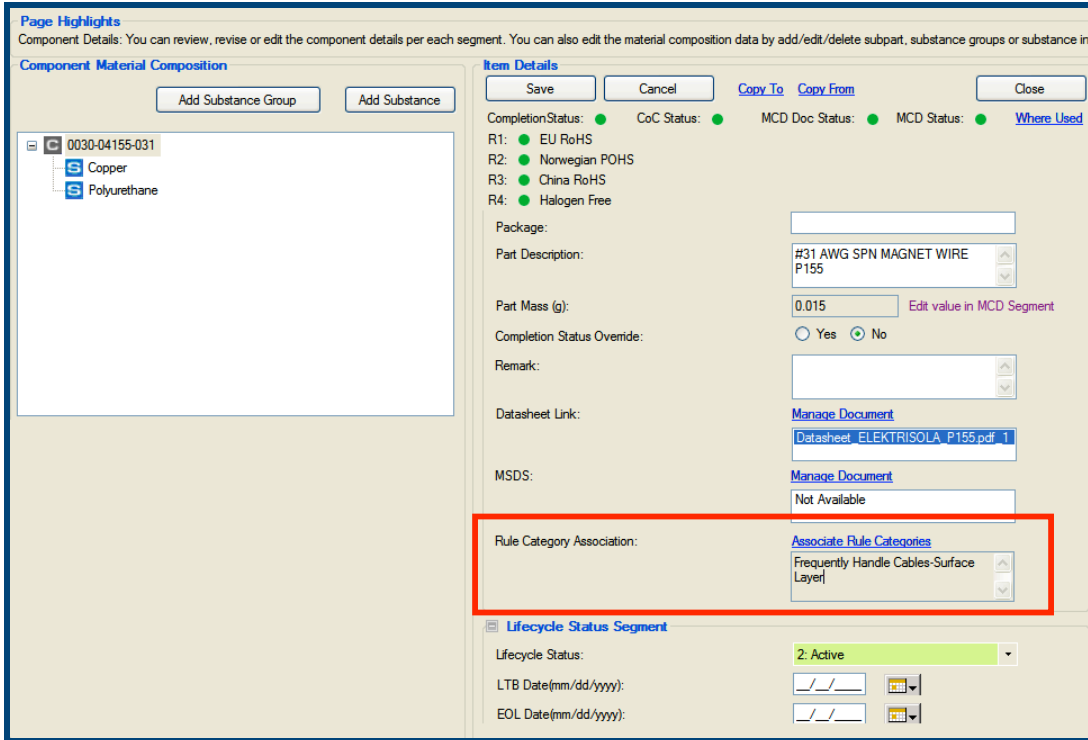


Figure 12: Assignment of categories for banned substances to the components

Each component can be mapped to multiple categories if needed. After completely mapping all components in the Item Master, it can be used for all BOMs or products. After you are done mapping components to categories, you can then set the limits for each banned substance. GDM-REACH enables this **third step** to set limits on banned substances.

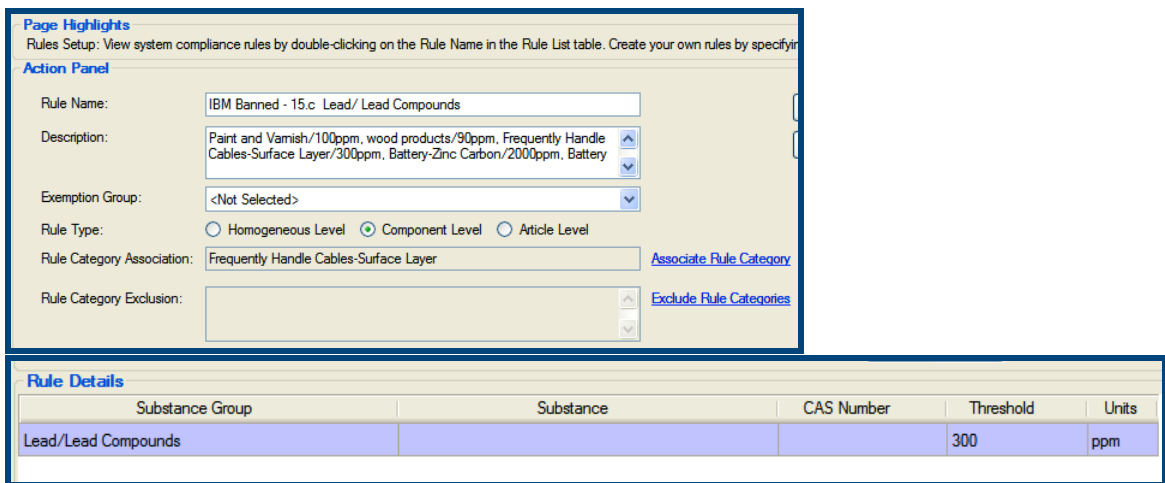


Figure 13: Setting up rule for banned substances on certain categories

With the rules defined and categories assigned, the **fourth step** is to examine product compliance against the IBM Banned substances list. GDM-REACH can calculate multiple rule sets at a time and generate a high level status report, as shown below.

RoHS/REACH Compliance Management for OEM-Specific Requirements

Page Highlights
Customer Compliance Report: Generates a compliance report for the set of Rules. You could then export the report to Excel. Double-click a row to generate the Product Co Report for the selected Rule.

Action Panel
BOM Profile: * Mass has been calculated by aggregation.
BOM ID: 888-001175-01
BOM Name: Control Panel B715
Revision:
Mass (g): 15.9693200

Customer Compliance Profile:
Compliance Name: IBM Banned
Compliance Notes:
Generate
Export
 Include 2nd Source

Item No	Rule Name	Compliance Status
1	IBM Banned - 12 Hexachlorobutadiene	Passed
2	IBM Banned - 13 Hexachloroethane	Passed
3	IBM Banned - 15.a Lead/ Lead Compounds	Passed
4	IBM Banned - 15.b Lead/ Lead Compounds	Passed
5	IBM Banned - 15.c Lead/ Lead Compounds	Passed
6	IBM Banned - 15.d Lead/ Lead Compounds	Passed
7	IBM Banned - 15.e Lead/ Lead Compounds	Passed
8	IBM Banned - 15.f Lead/ Lead Compounds	Passed
9	IBM Banned - 4 Benzidine	Passed
10	IBM Banned - 5 Benzo[a]pyrene	Passed
11	IBM Banned - 6.a Cadmium and Cadmium Compounds	Passed
12	IBM Banned - 6.b Cadmium and Cadmium Compounds	Passed
13	IBM Banned - 6.c Cadmium and Cadmium Compounds	Passed
14	IBM Banned - 6.d Cadmium and Cadmium Compounds	Passed
15	IBM Banned - 6.e Cadmium and Cadmium Compounds	Passed
16	IBM Banned - 6.f Cadmium and Cadmium Compounds	Passed
17	IBM Banned - 6.g Cadmium and Cadmium Compounds	Passed
18	IBM Banned - 6.h Cadmium and Cadmium Compounds	Passed
19	IBM Banned - 7 Creosote, coal tar, tar oils and anthracene substances	Passed
20	IBM Banned - 9.a Formaldehyde	Passed

Figure 14: GDM-REACH supports customer compliance reporting, in this case IBM ES 46G3772.

2. Reportable Substances

The IBM PCD lists only 15 reportable substances, but 46G3772 actually specifies 22 different substances; some have constraints at the homogeneous material level. GreenSoft suggests taking all 22 substances into account and managing those accordingly. The 15 reportable substances in the IBM PCD should be a subset of the total list of reportable substances.

The **first step** in managing the IBM Reportable substances list is to set up the rules for these reportable substances, as shown below in GDM-REACH.

Page Highlights
Rules Setup: View system compliance rules by double-clicking on the Rule Name in the Rule List table. Create your own rules by specifying...

Action Panel

Rule Name: IBM Reportable - 1 Antimony/Antimony Compounds

Description: 1000ppm - per IBM ES 46G3772 Dated 022509

Exemption Group: <Not Selected>

Rule Type: Homogeneous Level Component Level Article Level

Rule Category Association: <Not Selected> [Associate Rule Category](#)

Rule Category Exclusion: [Exclude Rule Categories](#)

Rule Details

Substance Group	Substance	CAS Number	Threshold	Units
Antimony/Antimony Compounds			1000	ppm

Figure 15: Setting up a rule for IBM Reportable substances in GDM-REACH.

RoHS/REACH Compliance Management for OEM-Specific Requirements

Once the rules for IBM Reportable substances are set up properly, GDM-REACH can create a compliance report on IBM Reportable substances, as shown below:

Page Highlights
Customer Compliance Report: Generates a compliance report for the set of Rules. You could then export the report to Excel. Double-click a row to generate the Product Compliance Report for the selected Rule.

Action Panel
BOM Profile: * Mass has been calculated by aggregation.
Customer Compliance Profile:
BOM ID: 888-001175-01
BOM Name: Control Panel B715
Revision:
Mass (g): 15.9693200
Compliance Name: IBM Reportable
Compliance Notes:
Generate
Export
 Include 2nd Source

Item No	Rule Name	Compliance Status
1	IBM Reportable - 1 Antimony/Antimony Compounds	Failed
2	IBM Reportable - 2 Arsenic/Arsenic Compounds	Passed
3	IBM Reportable - 3 Beryllium/Beryllium Compounds	Failed
4	IBM Reportable - 4 Beryllium Oxide	Passed
5	IBM Reportable - 5 Bismuth/ Bismuth Compounds	Failed

Figure 16: GDM-REACH reports the high-level compliance status on IBM Reportable substances.

GDM-REACH will flag IBM Reportable substances that are above allowable limits. GDM-REACH can also display the BOM to identify trouble components and subparts and show the exact failed substances and their CAS numbers.

Level	BOM ID/Internal PN	Manufacturer N...	Manufacturer PN	Unit Mass (g)	Substance Name	Compliance Status	Substance Prese...	Aggregate (ppm)	Aggregate Mass (g)
0	888-001175-01			15.96932	Antimony/Antimony Compo...	Failed	Present	264.044	0.0042166
1	___1001-150			4.4955	Antimony/Antimony Compo...	Failed	Present	897.831	0.0040362
2	___0022-10036-02	VENKEL	C0603C0G500-220JNP	0.0047	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-10	AVX	TAJA106K010R	0.0314	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-005	STMICROELECTR...	STM811TW16F	0.010322	Antimony/Antimony Compo...	Failed	Present	8738.617	0.0000902
2	___0022-10036-005	MAXIM INTEGRA...	MAX811TEUS+T	0.0092822	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-12	ON SEMI	15MB170AT3G	0.10145	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-18	NICCOMP	NMC0805NPO1023100...	0.00807	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-20	ROHM	RLS4148TE11C	0.02431	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-24	SAMTEC	SMM-132-02-S-S	0.64595	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-32	SAMTEC	TSM-110-01-L-DV-P	0.91603	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-54	ON SEMI	1N4935G	0.25082	Antimony/Antimony Compo...	Failed	Present	11280.998	0.0028295
2	___0022-10036-56	DIODES INC	1N4006G-T	0.34	Antimony/Antimony Compo...	Passed	Present	896.176	0.0003047
2	___0022-10034-22	ON SEMI	TL431AIDG	0.072	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
1	___1001-250			11.47382	Antimony/Antimony Compo...	Failed	Present	15.723	0.0001804
2	___0039-111			10.9	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
3	___0049-111			10	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
4	___111-ASSP-001	ASSP Semi	AP205C001B	1	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
4	___111-ASSP-001	ASSP Semi	AP205C001	1	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
3	___0049-222			0.9	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
4	___111-ASSP-002	ASSP Semi	AP250C002B	0.9	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
4	___111-ASSP-002	ASSP Semi	AP205C002	0.9	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
2	___0030-00150-001	VENKEL	CR0402-16W-6042FT	0.000624	Antimony/Antimony Compo...	Passed	Not Present	0.000	0.0000000
2	___0030-00150-001	ROHM	MCR01MZPF6042	0.000696652	Antimony/Antimony Compo...	Passed	Present	0.000	0.0000000

Figure 17: GDM-REACH reports the failed substance of Antimony in a BOM.

In addition to quickly identifying trouble components and subparts, GDM-REACH also applies the metal conversion ratio to the calculation of substance aggregation for metal compounds. In the example below, the substance is "Diantimony Trioxide," which is a substance within Antimony Compounds. It has a metal conversion ratio of 0.83536313.

In the sample BOM shown above, the following information must be reported in the PCD:

- Reportable Substances: Antimony/Antimony Compounds
- Manufacturer part number: STM811TW16F
- CAS number: 1309-64-4

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- Substance amount: 0.0000902 (g)
- Location: Encapsulation

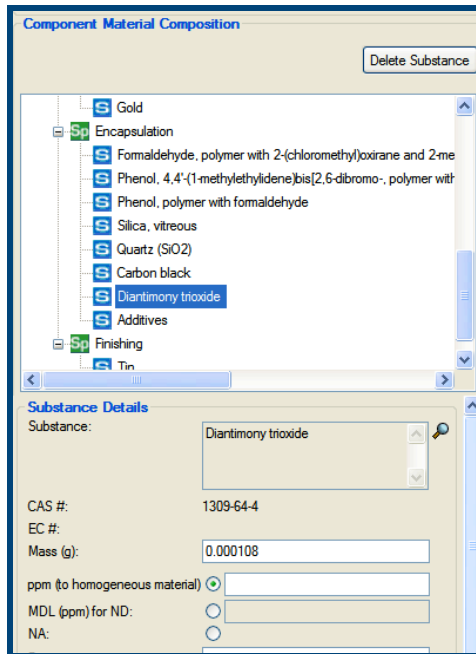


Figure 18: GDM-REACH reports the failed substance of Antimony in a component.

3. RoHS Report

To report RoHS substances in the IBM PCD, GDM-REACH quickly identifies failed cases and allows for drilling down to the component and subpart level. This enables you to report failed part numbers and substance CAS numbers, along with the substance amount in grams and the location of the failed substance within the component.

Item No	Type	Substance Name	Threshold	Units	Compliance Status	Concentration (ppm)	Weight (mg)
1	Group	Cadmium/Cadmium Compounds	100.000	ppm	Passed	0.000	0.0000000
2	Group	Hexavalent Chromium/Hexavalent Chromiu...	1000.000	ppm	Passed	0.000	0.0000000
3	Group	Lead/Lead Compounds	1000.000	ppm	Failed	1800.290	28.7494000
4	Group	Mercury/Mercury Compounds	1000.000	ppm	Passed	0.000	0.0000000
5	Group	Polybrominated Biphenyls (PBBs)	1000.000	ppm	Passed	0.000	0.0000000
6	Group	Polybrominated Diphenylethers (PBDEs)	1000.000	ppm	Passed with Exemption	0.000	0.0000000

Figure 19: GDM-REACH reports the failed substance within RoHS for a BOM

In the example above, by taking 2nd source parts into consideration, the BOM fails because of excessive lead. By drilling down further, it becomes clear that one component (a 2nd source part) exceeds the allowable limit for lead. Drill down further to see the component details.

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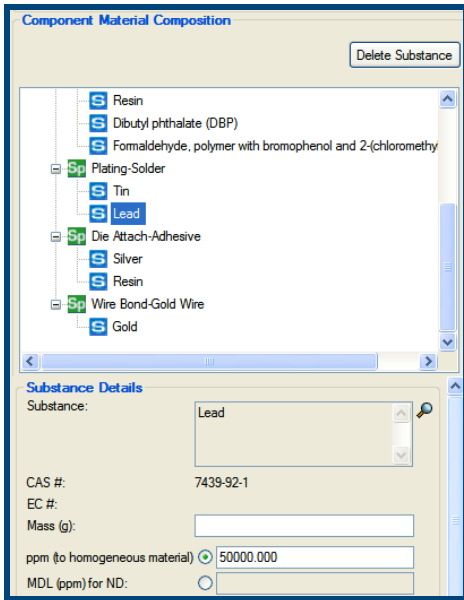


Figure 20: Component Details within GDM-REACH reveals excessive lead in plating solder.

From the component point of view, you can quickly identify the troubled subpart and the troubled substance, as shown below. The RoHS report within IBM PCD will contain the following:

- Manufacturer part number: AP205C001
- CAS number: 7439-92-1
- Total lead in the component: 0.005 (g)
- Location of the excessive lead: Plating – Solder

Level	BOM ID/Internal PN	Manufacturer ...	Manufacturer PN	Znd...	Substance Name	Compliance Status	Substance Present?	Aggregate (ppm)	Aggregate Mass (g)
0	888-001175-01				Lead/Lead Compo...	Failed	Present	1800.290	0.0287494
1	___1001-150				Lead/Lead Compo...	Passed with Exemption	Present	6220.265	0.0279632
2	___0022-10036-02	VENKEL	C0603COG500-220JNP		Lead/Lead Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-10	AVX	TAJA106K010R		Lead/Lead Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-005	STMICROELEC...	STM811TW16F		Lead/Lead Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-005	MAXIM INTEGR...	MAX811TEUS+T	Y	Lead/Lead Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-12	ON SEMI	15MB170AT3G		Lead/Lead Compo...	Passed with Exemption	Present	31455.890	0.0031912
2	___0022-10036-18	NICCOMP	NMC0805NPO102J10...		Lead/Lead Compo...	Passed with Exemption	Present	14522.924	0.0011172
2	___0022-10036-20	ROHM	RLS4148TE11C		Lead/Lead Compo...	Passed with Exemption	Present	251805.841	0.0061214
2	___0022-10036-24	SAMTEC	SMM-132-02-S-S		Lead/Lead Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-32	SAMTEC	TSM-110-01-L-DV-P		Lead/Lead Compo...	Passed	Not Present	0.000	0.0000000
2	___0022-10036-54	ON SEMI	1N4935G		Lead/Lead Compo...	Passed with Exemption	Present	30224.862	0.0075810
2	___0022-10036-56	DIODES INC	1N4006G-T		Lead/Lead Compo...	Passed with Exemption	Present	3788.824	0.0012882
2	___0022-10034-22	ON SEMI	TL431AIDG		Lead/Lead Compo...	Passed	Not Present	0.000	0.0000000
1	___1001-250				Lead/Lead Compo...	Failed	Present	68.521	0.0007862
2	___0039-111				Lead/Lead Compo...	Failed	Present	8.716	0.0000950
3	___0049-111				Lead/Lead Compo...	Failed	Not Present	0.000	0.0000000
4	___111-ASSP-001	ASSP Semi	AP205C001B		Lead/Lead Compo...	Passed	Not Present	0.000	0.0000000
4	___111-ASSP-001	ASSP Semi	AP205C001	Y	Lead/Lead Compo...	Subpart Failed	Present	5000.000	0.0050000
3	___0049-222				Lead/Lead Compo...	Passed	Present	105.556	0.0000950
4	___111-ASSP-002	ASSP Semi	AP250C002B		Lead/Lead Compo...	Passed	Present	105.556	0.0000950
4	___111-ASSP-002	ASSP Semi	AP205C002	Y	Lead/Lead Compo...	Passed	Present	105.556	0.0000950
2	___0030-00150-001	VENKEL	CR0402-16W-6042FT		Lead/Lead Compo...	Passed with Exemption	Present	35737.179	0.0000223

Figure 21: GDM-REACH reports the failed substance for lead in a component.

4. SVHC Report

To report on REACH SVHC for IBM PCD, you must perform a compliance check on the 15 SVHC substances on your BOMs or products. GDM-REACH offers a one-click feature to examine the SVHC substances inside your BOM or product. If certain SVHC substances exist within your BOM, you may want to advise your supplier to remove

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the substance before future purchases. Or you may want to identify a replacement part immediately. GDM-REACH allows you to quickly find the trouble component and if and where it is used in other products or BOMs.

Action Panel
 BOM Profile:
 BOM ID: 888-001175-01
 BOM Name: Control Panel B715
 Revision:
 Mass (g): 15.9693200

* Mass has been calculated by aggregation.

Item No	Substance Name	CAS Number	EC Number	Above Threshold	Concentration (ppm)	Weight (mg)
1	4,4'-methylenedianiline	101-77-9	202-974-4	No	0.000	0.0000000
2	Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	204-211-0	No	11.898	0.1900000
3	Dibutyl phthalate (DBP)	84-74-2	201-557-4	No	563.581	9.0000000
4	Diarsenic pentoxide (Arsenic pentoxide)	1303-28-2	215-116-9	No	0.000	0.0000000
5	Diarsenic trioxide	1327-53-3	215-481-4	No	0.000	0.0000000
6	Sodium dichromate	10588-01-9	234-190-3	No	0.000	0.0000000
7	Alkanes, C10-13, chloro	85535-84-8	287-476-5	No	0.000	0.0000000
8	1,2,5,6,9,10-hexabromocyclodecane	3194-55-6	221-695-9	No	0.000	0.0000000
9	5-tert-butyl-2,4,6-trinitro-m-xylene	81-15-2	201-329-4	No	0.000	0.0000000
10	Benzyl butyl phthalate (BBP)	85-68-7	201-622-7	No	0.000	0.0000000
11	bis(tributyltin)oxide,hexabutylstannoxane...	56-35-9	200-268-0	No	0.000	0.0000000
12	Anthracene	120-12-7	204-371-1	No	0.000	0.0000000
13	triethyl arsenate	15606-95-8	427-700-2	No	0.000	0.0000000
14	Cobalt dichloride	7646-79-9	231-589-4	No	0.000	0.0000000
15	lead hydrogen arsenate	7784-40-9	232-064-2	No	0.000	0.0000000

Figure 21: GDM-REACH generates a REACH SVHC compliance check for a BOM.

Other Requirements from ES 46G3772

IBM ES 46G3772 also includes regulations like California Prop65, restrictions on packaging and others. Many of these regulations are built in to GDM-REACH. You can perform compliance validation with one click and generate reports in a few minutes instead of analyzing substance data in Excel, Word or a PDF.

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Action Panel
BOM Profile: * Mass has been calculated by aggregation.
BOM ID: 800-001175-01
BOM Name: Control Board B8011
Revision:
Mass (g): 38.3626220

Rule Profile:
Rule Name: California Proposition 65
Rule Type: Component Level
Category:
Exclusion Category:
Rule Description: [10 Substance Groups + 715 Substances]
Reference: Proposition 65 - Safe Drinking Water Act of 1986.
<http://www.oehha.org/prop65/law/P65law72003.html>

Include 2nd Source

Item No	Type	Substance Name	CAS Number	Threshold	Units	Compliance Status
1	Substance	Asbestos	1332-21-4	0.000	ppm	Passed
2	Substance	4-aminoazobenzene; 4-phenylazoaniline	60-09-3	0.000	ppm	Passed
3	Substance	4,4'-Methylene-bis-(2-chloro-anilene)	101-14-4	0.000	ppm	Passed
4	Substance	4,4'-methylenedianiline	101-77-9	0.000	ppm	Passed
5	Substance	4,4'-Oxydianiline	101-80-4	0.000	ppm	Passed
6	Substance	4-chloroaniline	106-47-8	0.000	ppm	Passed
7	Substance	3,3'-dimethoxybenzidine	119-90-4	0.000	ppm	Passed
8	Substance	4,4'-bi-o-toluidine	119-93-7	0.000	ppm	Passed
9	Substance	6-methoxy-m-toluidine	120-71-8	0.000	ppm	Passed
10	Substance	4,4'-Thiodianiline	139-65-1	0.000	ppm	Passed
11	Substance	4-methoxy-m-phenylenediamine	615-05-4	0.000	ppm	Passed
12	Substance	4,4'-methylenedi-o-toluidine	838-88-0	0.000	ppm	Passed
13	Substance	O-anisidine	90-04-0	0.000	ppm	Passed
14	Substance	2-Naphthylamine	91-59-8	0.000	ppm	Passed
15	Substance	3,3'-dichlorobenzidine	91-94-1	0.000	ppm	Passed
16	Substance	biphenyl-4-ylamine	92-67-1	0.000	ppm	Passed
17	Substance	Benzidine	92-87-5	0.000	ppm	Passed
18	Substance	O-toluidine	95-53-4	0.000	ppm	Passed
19	Substance	4-Chloro-o-toluidine	95-69-2	0.000	ppm	Passed
20	Substance	4-Methyl-m-phenylenediamine	95-80-7	0.000	ppm	Passed

Figure 22: GDM-REACH reports product level compliance on California Prop 65.

Managing Change

One critical aspect of managing environmental compliance is managing change from a variety of sources. Changes can occur as regulatory updates, such as new RoHS exemptions or REACH SVHC updates, BOM updates from your design team, or component versioning provided by suppliers.

1. Regulations Updates

Regulations from different authorities are updated frequently. Normally, these changes are within scope, and typically involve adding substances with specific constraints and eliminating exemptions on certain substances with specific constraints. GreenSoft continually tracks changes to regulations, adapts GDM-REACH rule sets to reflect these changes, and hosts the revised rule sets on its servers. GreenSoft notifies GDM-REACH users of any pertinent changes and new rule sets are quickly integrated into the software.

2. BOM Updates

An environmental compliance system must accommodate design changes or BOM updates. Normally, design changes are also within scope since new designs have to implement new parts from an approved list. The task is to identify new parts that do not have material declaration data so that the procurement group can source the information from the supplier immediately. GDM-REACH can quickly identify parts that do not have material declaration information and export the list as an Excel file.

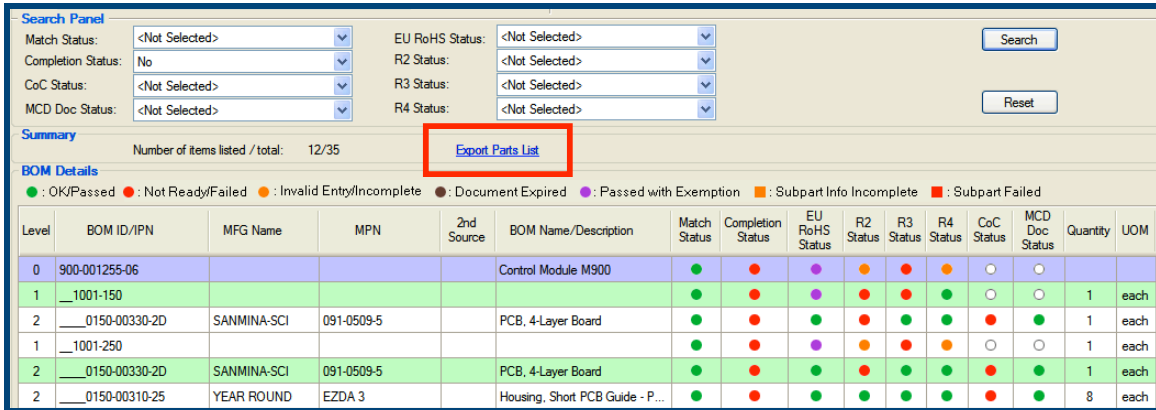


Figure 23: GDM-REACH reports parts without material declaration data. Export to Excel for further processing.

3. Component Versioning

Components are revised, which sometimes involves changing the material used to create the component. In that instance, GreenSoft recommends two methods of handling this information:

- a) **Edit the original part number.** Change the manufacturer’s part number system to reflect changes in the materials used for a component. Sometimes the overall product-level compliance with certain regulations or some customer-specific requirements may be altered with a material change. So when parts change, keep the same Internal PN but change the manufacturer PN and make the changed part the 2nd source for the original part. Then validate compliance by considering 2nd source parts. In this way, you can then quickly identify whether the changes will affect the product-level compliance or customer-specific requirements. If no impact is observed, you can then replace the primary parts with the newly updated component based on the real inventory.
- b) **Back up old BOMs.** Before replacing data on old parts with data on new parts, back up the BOMs with old parts. GDM-REACH can back up products in the Product Declaration report feature. This will back up the whole BOM including 2nd source parts and all associated component substance data and documents. This enables you to recreate compliance reports for the BOM at any time in the future. Essentially, you have placed a time tag on the Product DNA.

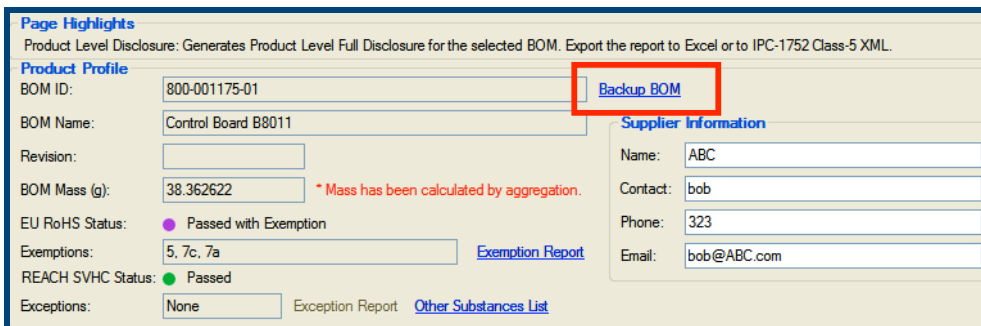


Figure 24: GDM-REACH supports BOM Backup for storing the Product DNA at a specific date and time.

Conclusion

A shift has clearly taken place in the disclosure requirements of many OEMs. For many subsystem and board level manufacturers, therefore, it is no longer adequate to collect just RoHS certificates. Collecting full disclosure material information, whenever possible, is the best way to anticipate changes in the regulatory and declaration environment. GreenSoft believes that full disclosure will become the standard for declaration up the supply chain within just a couple of years, so it is best to begin collecting and organizing this data as soon as possible.

Software specifically designed to manage data in this new environment, like GreenData Manager-REACH, is a time saving and cost-effective way to manage and analyze full disclosure material data. This off-the-shelf solution is preferable to expensive customization of PLM or ERP systems, especially for mid-sized companies. In addition, GDM-REACH can assist in adapting to changes in design and component versioning.

The IBM Engineering Specification (ES 46G3772) and Product Content Declaration (PCD) form are the property of IBM. GreenSoft is responsible for any representations about the specification and declaration form in this white paper.