REACH and RoHS 2:

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May 18, 2010
Agenda

• REACH & Substances of Very High Concern (SVHC)
  • New & Proposed SVHCs
  • Compliance Requirements
  • Results of SVHC Study
• RoHS & RoHS 2
  • Expanded Scope & Additional Substances
  • CE Marking and conformity assessment
• Carbon Footprint and Greenhouse Gas Emissions
  • What is Carbon Footprint?
  • Emerging Market and Regulatory Requirements
• Emerging Environmental Standards
Health and Environmental Services

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• Restricted substances: RoHS & REACH
• Substances of concern
• Life cycle assessment
• Design for the environment
• Carbon Footprint
• End of life/waste

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What is REACH?

Quick overview of the Regulation

Registration, Evaluation, Authorization and Restriction of Chemicals

- Regulation (EC) No 1907/2006,
  - Initial regulation was over 700 pages
  - Several thousand additional pages of guidance
- Administered by the European Chemical Agency (ECHA)

Requires industry to be responsible for the safe manufacture and use of chemical substances

- Manufacturers/Importers must Evaluate and Register substances
- Awareness of substances of very high concern (SVHC)
- Restrictions on chemicals posing unacceptable risk

Obligations for nearly all products, parts, substances and mixtures manufactured or imported in the EU
Substances of Very High Concern
SVHC Basics

SVHC = Substance of Very High Concern

REACH Definition

- Substances such as CMRs, PBTs, vPvBs and endocrine disruptors
- Responsibilities for products containing an SVHC:
  - Identification in MSDS documents
  - Communication obligations to customers (articles w/ >0.1%)
  - Notification obligations to ECHA
    - w/ >0.1%, over 1 tonne per year
  - Authorizations required to continue using after sunset date

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REACH SVHCs

How are the SVHC Candidate and Authorization Lists Created?

- October 28, 2008
  - Proposal for SVHC Restrictions (EU member states)
  - Consultation and Review
  - SVHC Candidate List
  - Consultation Review Prioritize
  - Draft Priority SVHC Substances
  - Consultation and Review
  - Authorization List (Priority Substances added to Annex XIV)
  - Consultation and Review
  - Sunset Date
    - January 14, 2009
    - April 14, 2009
    - June 1, 2009
    - 2012+

- Communicate Info on Candidate SVHCs to customers
- Notification of Candidate SVHCs to ECHA (June 1, 2011)
- Authorization to use Annex XIV SVHC after sunset date

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Current SVHC Candidate List

**Anthracene** – manufacture of dyes, pyrotechnics

* 4,4’- **Diaminodiphenylmethane (MDA)** – hardener for epoxy resins (possible use in PCBs), hardener in adhesives, intermediate in the manufacture of high-performance polymers, preparation of polyurethane

*  **Dibutyl phthalate (DBP)** - plasticizer (softener) in PVC, printing inks, paper and packaging coatings, etc...

*  **Benzyl butyl phthalate (BBP)** - plasticizer (softener) of PVC, acrylics, sealants, adhesives, inks, paints, etc.

*  **Bis (2-ethyl(hexyl)phthalate) (DEHP)** - plasticiser in polymer products, mainly PVC, blister packing

**Cobalt dichloride** - gas masks, humidity indicator, dye mordant for glass industry, drying agent in paints, lacquers, varnishes and printing inks, etc...

**Lead hydrogen arsenate** – Insecticides

**Prioritized substance (authorization)**

* **Diarsenic pentaoxide** - dying industry, printing, coloured glass, insecticide, metallurgy (to harden copper, lead or gold in alloys), etc...

* **Diarsenic trioxide** - decolorizing agent for glass and enamels, oxidizing agent special glass and lead crystal formulations, weed killers

* **Sodium dichromate** - metal finishing, aiding corrosion resistance, chrome-tanning of leather, coloured glass and ceramic glazes

* **5-tert-butyl-2,4,6-trinitro-m-xylene (musk xylene)** – fragrance, cosmetics and soap perfumes

* **Hexabromocyclododecane (HBCDD)** – Flame retardant used in HIPS, PS insulation and textiles

* **Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)** - plasticisers in PVC (cable)and rubber; flame retardant in plastics and textiles;

* **Bis(tributyltin)oxide** – biocide, antimicrobial – incorporated into polymers -- flooring, tiles and carpeting

**Triethyl arsenate** – intermediate for semiconductors
Fulfilling SVHC obligations?

Communication – REACH Article 33

Applies to ALL articles manufactured/imported to the EU

If SVHC present >0.1%

Manufacturers/Importers - Inform customers of (minimum):
  – Chemical Name
  – Information on safe use

Consumers may request information about the presence of SVHC in articles
  (must reply within 45 days)
Additional 15 SVHC Approved in 2009
(added to Candidate List on January 13, 2010)

- 2,4-Dinitrotoluene
- Anthracene oil
- Anthracene oil, anthracene paste, distn. Lights
- Anthracene oil, anthracene paste, anthracene fraction
- Anthracene oil, anthracene-low
- Anthracene oil, anthracene paste
- Diisobutyl phthalate
- Aluminosilicate, Refractory Ceramic Fibres
- Zirconia Aluminosilicate, Refractory Ceramic Fibres
- Lead chromate
- Lead chromate molybdate sulfate red (C.I. Pigment Red 104)
- Lead sulfochromate yellow (C.I. Pigment Yellow 34)
- Acrylamide *
- Tris(2-chloroethyl)phosphate
- Coal tar pitch, high temperature

* Acrylamide added March 30, 2010

Several of these substance may be used in Electrical/Electronic products
# Another 8 SVHC Proposed
(March 8, 2010)

<table>
<thead>
<tr>
<th>Substance Name</th>
<th>EC Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trichloroethylene</td>
<td>201-167-4</td>
</tr>
<tr>
<td>Boric acid</td>
<td>233-139-2 / 234-343-4</td>
</tr>
<tr>
<td>Disodium tetraborate, anhydrous</td>
<td>215-540-4</td>
</tr>
<tr>
<td>Tetraboron disodium heptaoxide, hydrate</td>
<td>235-541-3</td>
</tr>
<tr>
<td>Sodium chromate</td>
<td>231-889-5</td>
</tr>
<tr>
<td>Potassium chromate</td>
<td>232-140-5</td>
</tr>
<tr>
<td>Ammonium dichromate</td>
<td>232-143-1</td>
</tr>
<tr>
<td>Potassium dichromate</td>
<td>231-906-6</td>
</tr>
</tbody>
</table>
Authorization
Substances Listed in REACH Annex XIV

Annex XIV has List of Substances subject to Authorization

- Manufacturers/Importers/Downstream users must receive authorization to continue using these substances

Have until the “Sunset Date” to receive authorization

- Must be submitted at least 18 months before Sunset Date

- Authorization request requires details on which use(s) the authorization request covers
Risk Analysis
Analytical Test Methods

• Various analytical test methods for measuring SVHC substances
• Sample preparation and analytical test method is critical for achieving accurate test results.
  • Fully extract/dissolve substance from the base material
• Large number of substances so test strategy must be cost efficient.
  • Clever test strategies to maximize relevant information with minimum number of tests.
  • Techniques can also be used to eliminate the presence of certain SVHCs with the use of specific tests combined with deductive reasoning.
Sample Preparation

- REACH SVHC reporting threshold is based on the mass of the entire article
  - allows for grinding of the entire product
  - cost effective compared to testing individual parts or materials but
  - makes it difficult to isolate the specific part or material that contains the SVHC
- The product is partially disassembled prior to grinding
  - Removing volatile parts (such as batteries)
  - Separating metal pieces from other materials.
  - Each sample to be ground is separately weighted so that % of article can be subsequently calculated.
- After grinding, the material is prepared by solvent extraction, or digestion.
Organic compounds

- Organic compounds make up more than half of the initial list of 15 SVHCs,
- Often measured using gas chromatography - mass spectrometry (GC/MS).
  - GC/MS can accurately isolate specific substances and measure their concentration level.
- Extraction method is critical to the accuracy.
Inorganic compounds

• Specific inorganic compounds are often difficult and expensive to test.

• Can be screened by looking for key elements using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES).

• Optical Emission Spectrometry (Atomic Emission Spectroscopy (AES)) may be used to identify trace metals, such as Arsenic (As) as found in Diarsenic pentaoxide, Diarsenic trioxide, Triethyl arsenate and Lead hydrogen arsenate.
  • Absence of arsenic rules out the presence of all four SVHCs.

• A compound such as Sodium dichromate can be eliminated if either sodium or chromium are not present.
  • The check for sodium is important given that elemental or trivalent chromium is commonly found in similar applications.
Scan and Store

SCAN
- Article disassembly, weighing and grinding
- Sample preparation
- GC Mass Scan of a wide range of substances
- ICP Mass Scan of 15+ elements
- Quantification to ppm level of detected substance from ECHA published List

STORE
- Storage of raw data
- Storage of representative samples (powders)
## SVHC Testing

### Summary of Positive Test Results

<table>
<thead>
<tr>
<th></th>
<th>DEHP</th>
<th>SCCP</th>
<th>DBP</th>
<th>Cobalt dichloride&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Bis(tributyl)oxide</th>
<th>Anthracene</th>
<th>4,4'-Diaminodiphenylmethane&lt;sup&gt;a&lt;/sup&gt;</th>
<th>As&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Sodium dichromate&lt;sup&gt;a&lt;/sup&gt;</th>
<th>2,4,6-trinitro-m-xylene</th>
<th>HBCDD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occurrences above 0.1% threshold</td>
<td>137</td>
<td>12</td>
<td>15</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percent of total samples</td>
<td>7.73%</td>
<td>0.68%</td>
<td>0.86%</td>
<td>0.11%</td>
<td>0.17%</td>
<td>0.00%</td>
<td>0.06%</td>
<td>0.34%</td>
<td>0.06%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

**Notes**

a: Plastic are tested separately or mixed with other materials (fabric, leather, coating, glue, paper, wood, fabric, sponge, textile, foam, metal, PCB)

b: "As" includes 4 SVHC compounds Diarsenic pentaoxide, Diarsenic trioxide, Lead hydrogen arsenate, Triethyl arsenate.

c: Co, Cl are detected to confirm whether Cobalt dichloride under threshold, the result can be classified to "pass" & "inconclusive".

de: Organic tin is detected and further testing is needed to confirm whether it comes from Bis(tributyl)oxide.

g: Cr, Cr6+, Na+ are detected to confirm whether Sodium dichromate under threshold, the result can be classified to "pass" & "inconclusive".

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Summary

- REACH SVHC reporting for each article (packaging)
- Several SVHCs are found in electrical/electronic products.
  - Phthalate DEHP most frequent; DBP, SCCP and others also a concern
- Plastics are material most likely to contain an SVHC,
- Risk of SVHCs in specific parts and materials.
  - Engineering; Screening and Test methods to identify substances.
- Combination of supply chain information, judgment, and testing
  - strike an effective balance between compliance assurance and costs.
- Test strategy for multiple regulation.
- Test strategies such as “Scan and Store”
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RoHS Compliance and Next Steps

• Many EU Members States have been conducting regular enforcement campaigns
  • Non-compliance actions have been kept relatively low key except for a few media investigations.

• The EU Commission conducted an Impact Assessment of the RoHS Directive prior to the RoHS2 proposal
  • Up to 44% of EEE checked were not fully compliant in some Member States
  • Cost of compliance generally ranged from 1% to 10% of turnover

• On December 3, 2008, the EU Commission released is proposal to recast the RoHS Directive
Scope

Product scope is self-contained

- 10 product categories
- Clarification of some gray areas

Medical devices (category 8) and Monitoring and control instruments (category 9) are brought within scope of the Directive

Specifically excludes:

- “Equipment intended specifically for Military and national security purposes.”
- “Equipment which is specifically designed as part of another type of equipment that does not fall within the scope of this Directive and can fulfill its function only if it is part of that equipment.”
- “Equipment which is not intended to be placed on the market as a single functional or commercial unit.”
Medical Devices and Monitoring and Control Instruments

Medical devices (category 8) will be subject to the substance restrictions from January 1, 2014 except for

• in vitro diagnostic medical devices from January 1, 2016 and
• active implantable medical devices which the Commission will review whether to include by January 1, 2020.

Monitoring and control instruments (category 9) will be subject to the substance restrictions from January 1, 2014 except for

• industrial monitoring and control instruments from January 1, 2017.

Additional exemptions are proposed for medical devices and monitoring and control instruments

• There are several unique requirements for the restricted substances in these products. For example, Lead in shielding for ionising radiation

RoHS Conversion of Categories 8 and 9 will have a significant Impact on North American Electronics Manufacturing.
Exemptions

- Exemptions will continue to exist for specific applications of the restricted substances
- Exemptions have 4 years with the possibility of extension
- Exemption justification expanded to include:
  - Reliability of substitutes
  - Negative socio-economic impacts
- Exemptions under the RoHS Directive shall be considered exempted from the Authorization requirement of REACH SVHCs
New Substances

• The intention of the RoHS Directive is to continually include new substances

• Four substances identified for future consideration:
  • HBCCD, DEHP, DDP and DBP
  • Above substances included in REACH SVHC prioritization

• Broad range of additional substances proposed by MEP
  • Organobromine and organochlorine compounds
  • Carbon nanotubes and nanosilver
  • Arsenic and Beryllium
  • PVC

• Proposals to clarify definition of homogeneous material
Implementing Measures

EU Commission to adopt detailed rules for complying with the maximum concentration values

CEN/CENELEC Standards for testing
  • likely based on IEC62321

Other IEC standards under discussion for potential role
  • IEC/TR62476 “Guidance for evaluation of product with respect to substance-use restrictions in electrical and electronic products”
CE Marking and Conformity Assessment

- RoHS Directive would become a CE marking Directive.
  - The CE mark will attest product conformity to EU RoHS requirements
  - Conformity Assessment
- Significant impact for most EEE producers that are already RoHS compliant.
- Obligations for manufacturers, importers, and distributors
Conformity Assessment Procedures

Manufacturers will be required to carry out conformity assessment for RoHS compliance

• Internal production control procedure
• Technical documentation
  • makes it possible to assess the products’ conformity and includes an adequate analysis and assessment of the risk(s).
  • Shall specify the applicable requirements for design and manufacture of the product.

“ensures and declares on his sole responsibility that the products concerned satisfy the requirements of the legislative instrument that apply to them.”
EU Declaration of Conformity

The manufacturer must draw up and have available an EC Declaration of Conformity that states the product satisfies the requirements of the RoHS substance restrictions and that the fulfillment of these restrictions has been demonstrated.

“Where compliance of an EEE with the applicable requirements has been demonstrated by that procedure, manufacturers shall draw up an EC declaration of conformity and affix the CE marking.”

“Manufacturers shall keep the technical documentation and the EC declaration of conformity for ten years after the EEE has been placed on the market.”

“By drawing up the EC declaration of conformity, the manufacturer shall assume responsibility for the compliance of the EEE”
Presumption of Conformity

• “Member States shall presume electrical and electronic equipment bearing the CE marking as conforming to this Directive.”

• Electrical and electronic equipment, which have been tested in accordance with harmonized standards, shall be presumed to comply with all the relevant requirements of this Directive to which such standards relate.

Enforcement

• Stronger language for purposes of enforcement.
• Requires EU Member States to enforce the requirements of the Directive
• Requires economic operators to maintain documentation of conformity.
• Requires economic operators to identify suppliers and customers to market surveillance authorities if requested.
RoHS 2 Status

The European Commission, Parliament, and EU Council of Ministers must reach a Co-Decision after a number of readings and legislative mechanisms have been fulfilled.

European Parliament and the EU Council of Ministers

- Council of Ministers have drafted a revised proposal
- MEP have suggested 339 amendments
  - Being reviewed/consolidated in the Parliament ENVI committee

Timeline

- ENVI committee has just delayed their schedule.
  - amendments were to be reviewed during April 6, 2010 meeting, followed by a formal vote on May 4, 2010.
  - many of the amendments conflict
  - new date of June 3, 2010 for the committee vote
  - delays the planned vote in the EU Parliament plenary
- Number of readings in parliament???
Among the Members of the European Parliament, contention remains over several important issues including:

- Whether to expand the directive to all electronic products
  - Solar panels?
- Whether to conduct an impact assessment before expanding scope
- Whether to include all brominated and chlorinated flame retardants
- Whether to include polyvinyl chloride (PVC)
What to do?  
A Summary

• Still a “PROPOSAL”
• Re-assess product scope.
  • Stronger market surveillance mechanisms will provide enhanced enforcement on “grey area” products
• For Medical Devices and Monitoring and Control Instruments, begin to make conversion decisions and plans
• If you do not have restricted substance control (RSC) measures in place, they need to be created
• Existing RSC measures should be reviewed
• Consider RoHS requirements together with REACH SVHC obligations
• Investigate substitution options for the 4 substances currently under review.
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What is a Carbon Footprint?

A carbon footprint is "the total set of greenhouse gases (GHG) emissions caused by an organization, event or product" *

Greenhouse Gasses

- carbon dioxide (CO2),
- methane (CH4),
- nitrous oxide (N2O),
- hydrofluorocarbons (HFCs),
- perfluorocarbons (PFCs), and
- sulphur hexafluoride (SF6)

Global Warming Potential (GWP)

For simplicity of reporting, GHG emissions are often expressed in terms of the amount of carbon dioxide, or its equivalent of other GHGs, emitted.

CO2 equivalent (CO2-e)

“The universal unit of measurement to indicate the global warming potential (GWP) of each of the six greenhouse gases, expressed in terms of the GWP of one unit of carbon dioxide.”*

* source: WRI GHG Protocol Corporate Accounting Standard Revised

<table>
<thead>
<tr>
<th>Gas</th>
<th>Chemical Formula</th>
<th>GWP</th>
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<tbody>
<tr>
<td>Carbon dioxide</td>
<td>CO2</td>
<td>1</td>
</tr>
<tr>
<td>Methane</td>
<td>CH4</td>
<td>21</td>
</tr>
<tr>
<td>Nitrous oxide</td>
<td>N2O</td>
<td>310</td>
</tr>
<tr>
<td>Hydrofluorocarbons (HFCs)</td>
<td>e.g. CHF3</td>
<td>140-11,700</td>
</tr>
<tr>
<td>Perfluorocarbons (PFCs)</td>
<td>e.g. CF4</td>
<td>7000-9,200</td>
</tr>
<tr>
<td>Sulfur hexafluoride</td>
<td>SF6</td>
<td>23,900</td>
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</table>
Carbon Footprint Activities

GHG/Carbon Footprint Requirements

Carbon Footprint of Organizations / Facilities
- GHG Inventory (Corporate Accounting and Reporting)
- GHG Reduction Project
- Reductions based on Caps

Carbon Footprint of Products
- Create offsets
- Carbon footprint of Life Cycle Stages
GHG Emissions

Scope 1 – Direct emissions from sources owned or controlled by the company

Scope 2 – Indirect GHG emissions from purchased electricity

Scope 3 – Other Indirect GHG Emissions form the operation of the company

* source: WRI GHG Protocol Corporate Accounting Standard Revised
Carbon Footprint Drivers

Regulatory

• GHG Inventory Reporting for large emitters
• GHG Reductions based on Caps and Allowances
  • Reduction in caps over time

Voluntary Reporting

• Market leadership
• Customer requirements
• Preparedness
GHG Standards (ISO 14064)

ISO 14064 family of standards for Greenhouse Gas Emissions

ISO 14064-1 (Inventory)
- Greenhouse gases -- Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals

ISO 14064-2 (GHG Reductions)
- Greenhouse gases -- Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements

ISO 14064-3 (Validation and Verification)
- Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions
Carbon Footprint for Product (CFP)

GHG Emissions related to producing, using, disposing of the product

• Involves all Life Cycle Stages
  • Materials extraction
  • Supply chain emissions
  • Transportation
  • Product Use
  • End of Life Disposal / Recycling
CFP Standards

ISO 14067 (In Development)
  • ISO 14067-1 Carbon footprint of products — Part 1: Quantification
  • ISO 14067-2 Carbon footprint of products — Part 2: Communication

WBCSD/WRI (GHG Protocol Initiative)
  • Product Life Cycle Accounting and Reporting Standard

IEC/TC111
  • Considering Product Category Rules (PCR) for EEE
Market Requirements for CFP

Primarily driven by market
- Procurement requirements from retailers
- Market Leadership

Regulations beginning to emerge
- France – Product environmental labeling with carbon footprint
  - Support from several French retailers
  - Currently in political discussions
  - Proposed effective date of January 2011 (may be delayed)
- EU Commission also investigating several ecodesign initiatives, including carbon footprint.
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The Role of Standards in Environmental Compliance

Standards provide common definitions, framework, and method towards meeting requirements

Surge in environmental regulations + Gap in international standards for environmental compliance = Significant challenge for Industry

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Environmental Standardization

The International Electrotechnical Commission (IEC) established Technical Committee TC111 in 2004

- Mandate to create international standards and guidelines in the environmental area for electrical and electronic products and systems.
- Membership and voting is by Country

IEC/TC111: Environmental standardization for electrical and electronic products and systems
IEC/TC111 Work Program

Published

- IEC 62430: Environmentally Conscious Design
- IEC 62321: Analytical Test Methods
- IEC PAS 62596: Sampling Procedure – Guidelines
- IEC TR62476: Guidance for evaluation of product with respect to substance use restrictions in electrical and electronic equipment

In Development

- IEC 62474: Materials Declaration
- IEC/TS62542: Standardization of environmental aspects - Glossary of terms

Just Getting Started

- Recycling, Reuse, and Recovery
- Carbon Footprint for EEE Products
Thank You

Questions?

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# Our Solutions to Compliance

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<td>Customized Education: Trainings, Webinars, E-learning modules</td>
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<tr>
<td>Inventory Assessments</td>
<td>On site screening, instrumentation training</td>
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<tr>
<td>Third party testing, verification, auditing</td>
<td>Specialized global locations worldwide (example: specialized RoHS testing locations, CPSIA accredited facilities)</td>
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<tr>
<td>Ongoing compliance and control</td>
<td>Compliance Assurance Certification and Verification</td>
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