

Air
Land
Sea
Space
Cyberspace

Innovation. In all domains.

Substances in Products & Processes

Global Regulations and Supply Chain Considerations

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Raytheon

February 23, 2011

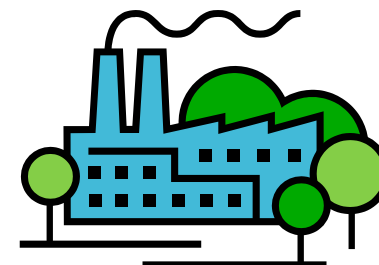
Audience Demographics

- Manufacturers
- Government
- Consulting
- Other??



Historical Chemical Use Considerations

- Government Agencies Regulate Use and Management
 - Recognize Chemical Hazards
 - Material Safety Data Sheet Information
- Chemical Use Governed by Worker Safety Standards
 - Ventilation
 - Protective Equipment
 - Training
- Waste/Releases of Chemicals Not Consumed nor Used in Production Governed by:
 - Gases: Emissions limits
 - Water: Discharge/Treatment Standards
 - Solids: Collection/Storage/Transport/Treatment



Today's Additional Global Considerations

- Regulate Use of Certain Hazardous Chemicals in Products
 - Register Use
 - Restrict General Use
 - Authorize Specific Uses
 - Ban all Uses

- Impact to Manufacturing and Products
 - Manufacturers Discontinuing Chemical Production or Use in Formulations
 - Chemicals Specified to Meet Quality/Performance Standards are Becoming Unavailable and Obsolete



Emerging Substance Management

Product Evolution

Chemical Compliance

Product and Packaging Compliance

Chemical Processing

Piece Parts

Sub - Assembly

End item



Track & compile the roll up of chemical compositions in products by CAS & EU Index #

Challenges

Substance Regulations

Risk Assessment

Data Sourcing

Data Systems

Growing Lists

REACH, Customer, TSCA ...

Assess New Chemicals
Qualitative & Quantitative
Iterative Analysis

Chemical Databases
Supply Chain
Functional Data

Multiple Data Sources
Global IT Solution ?

8. CAS No.	9. EU Index Number	10. Chemical Name
120-12-7	204-371-1	Anthracene
101-77-9	202-974-4	4,4'- Diaminodiphenylmethane (methylene dianiline)
84-74-2	201-557-4	Dibutyl phthalate
7546-79-9	231-589-4	Cobalt dichloride
1303-26-2	215-116-9	Diarsenic pentoxide
1327-53-3	215-481-4	Diarsenic trioxide
7789-12-0		Sodium dichromate, dihydrate
81-15-2	201-329-4	5-tert-butyl-2,4,6-trinitro-m-xylene (musk xylene)
117-81-7	204-211-0	Bis (2-ethyl(hexyl)phthalate) (DEHP)
25637-99-4	247-148-4	Hexabromocyclododecane (HBCDD)
85635-84-8	287-476-5	Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)
58-35-9	200-268-0	Bis(tributyltin)oxide
7784-40-9	232-064-2	Lead hydrogen arsenate
15606-95-8	427-700-2	Triethyl arsenate

Sodium dichromate



Accessibility of Data
Format
Detail
Data Exchange



Anticipate Increasing Regulation, Assessments, & Data Collection

Where is your product...

- Manufactured?
- Delivered?
- Used?
- Disposed and/or Recycled?



And..... Where are raw materials obtained?

Manufacturer Considerations in the Global Marketplace

Regional Directives, Global Impact

■ Europe

- Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH)
- Restriction of Hazardous Substances
- Waste Electrical and Electronic Equipment Directive



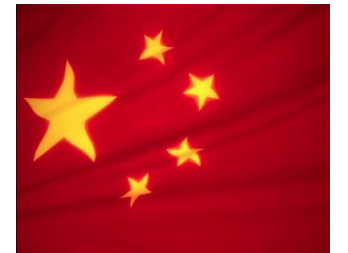
■ US

- Toxic Substances Control Act
- Clean Air Act
- Clean Water Act
- Resource Conservation and Recovery Act
- Lacey Act
- **Dodd-Frank Act – “Conflict Minerals”**



■ China

- Rare Earth Minerals



Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)

- EU legislation designed to improve the protection of the environment and human health by better regulation of chemicals
- Effective June 1st 2007
- Replaces 40 different pieces of chemical legislature already in existence in the EU
- Establishes the European Chemicals Agency (ECHA) in Helsinki



Based on the 'precautionary principle'

- Where harm is possible, harm is presumed until proven otherwise

Applies to all E.U. Member States

Austria	Latvia
Belgium	Lithuania
Bulgaria	Luxembourg
Cyprus	Malta
Czech Republic	The Netherlands
Denmark	Poland
Estonia	Portugal
Finland	Romania
France	Slovakia
Germany	Slovenia
Greece	Spain
Hungary	Sweden
Ireland	United Kingdom
Italy	



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REACH also applies to: Norway, Iceland and Liechtenstein

Green shaded countries are EU candidate countries – REACH doesn't currently apply, but may in the future

EU and Chemicals?

EU produces 29% of the world's chemicals - largest chemical industry in the world

A major market: currently 27 countries, around 497 million people (*the US population is 303 million*)

EU is setting global standards on the environment



The production and use of chemicals is controlled at the EU level, not within individual Member States

Covers ALL Substances

- **On their own**
- **Contained in preparations**
(mixture of at least two chemical substances *without* the formation of new substances)
- **Contained in articles**
(All "ingredients", raw materials, consumables, components, alloys and their constituents)



Registration

- **Compulsory for all substances:**
 - Imported into and/or manufactured in the EU
 - In quantities > one metric ton per year
 - Per legal entity
 - Intended to be released from an article
- **Primarily applies to chemical/metal manufacturers and importers**
- **Manufacturers and importers will need information from Downstream Users**
- ***US EPA and ECHA signed agreement to share registration data***



Large volume of registrations were due December, 2010
All substance registrations must be complete by May, 2013

The Evaluation in REACH

ECHA, with support from Member State authorities, will review the registration dossiers for completeness, accuracy, and compliance with the regulatory requirements



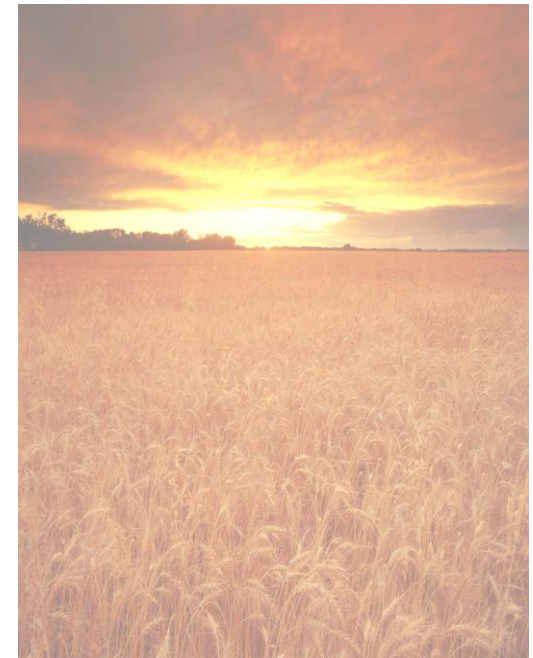
Authorization

European Chemicals Agency (ECHA) will publish restrictions and/or ban the most toxic substances

“Sunset dates” will prohibit manufacturing and use of substances unless covered by an ECHA authorization

Manufacturers/Importers will need to

- develop a substitute plan and move to alternatives when available / reasonable
- Create a ‘socio-economic analysis’ and substitute as soon as an alternative is available

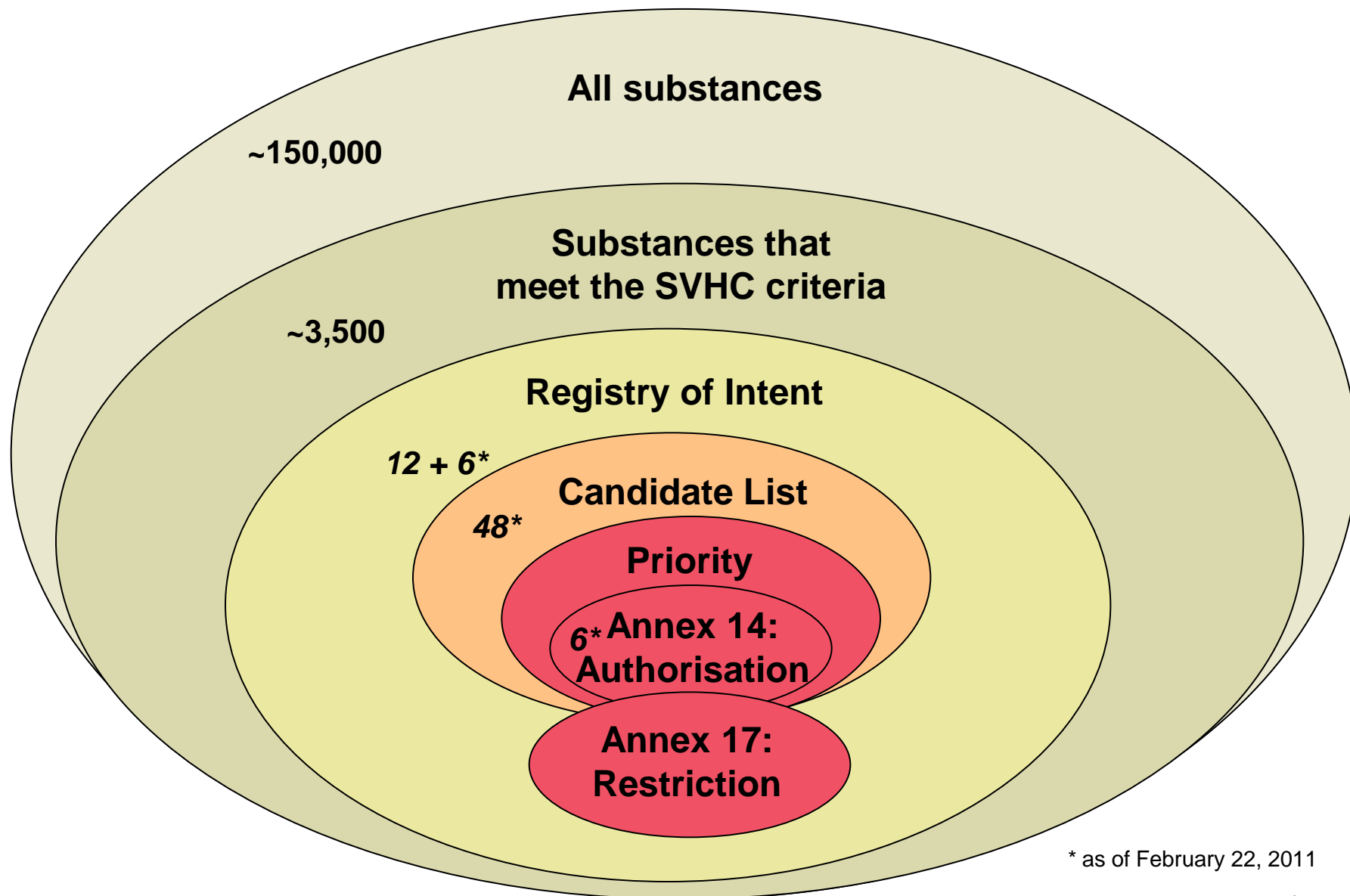


The Restriction in REACH

- Substances posing an unacceptable risk can be restricted in their manufacture, placement on the market or use
- Restrictions exist in EU law already
 - Existing restrictions include lead in paint and asbestos
- REACH simply brings this process together into one regulation



Chemical List - Order for REACH



Candidate List 10-28-2008

Substance name	EC No.	CAS No.	Reason for inclusion
4,4'- Diaminodiphenylmethane (MDA)**	202-974-4	101-77-9	Carcinogenic
5-tert-butyl-2,4,6-trinitro-m-xylene (musk xylene) **	201-329-4	81-15-2	vPvB
Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)	287-476-5	85535-84-8	PBT and vPvB
Anthracene	204-371-1	120-12-7	PBT
Benzyl butyl phthalate (BBP) **	201-622-7	85-68-7	Toxic for reproduction
Bis (2-ethylhexyl)phthalate (DEHP) **	204-211-0	117-81-7	Toxic for reproduction
Bis(tributyltin)oxide (TBTO)	200-268-0	56-35-9	PBT
Cobalt dichloride	231-589-4	7646-79-9	Carcinogenic
Diarsenic pentaoxide	215-116-9	1303-28-2	Carcinogenic
Diarsenic trioxide	215-481-4	1327-53-3	Carcinogenic
Dibutyl phthalate (DBP) **	201-557-4	84-74-2	Toxic for reproduction
Hexabromocyclododecane (HBCDD)* **and all major diastereoisomers identified: Alpha-hexabromocyclododecane Beta-hexabromocyclododecane Gamma-hexabromocyclododecane	247-148-4 and 221-695-9	25637-99-4 3194-55-6 (134237-50-6) (134237-51-7) (134237-52-8)	PBT
Lead hydrogen arsenate	232-064-2	7784-40-9	Carcinogenic and toxic for reproduction
Sodium dichromate	234-190-3	7789-12-0/ 10588-01-9	Carcinogenic, mutagenic and toxic for reproduction
Triethyl arsenate	427-700-2	15606-95-8	Carcinogenic

** substances added to Annex XIV 2/18/2011 requiring authorization, sunset dates for use

http://echa.europa.eu/chem_data/authorisation_process/candidate_list_en.asp

Candidate List Additions 01-13-2010

2,4-Dinitrotoluene	204-450-0	121-14-2	Carcinogenic
Aluminosilicate Refractory Ceramic Fibres			
<i>are fibres covered by index number 650-017-00-8 in Annex VI, part 3, table 3.2 of Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, and fulfil the two following conditions:</i>			
<i>a) Al₂O₃ and SiO₂ are present within the following concentration ranges:</i>			
<i>Al₂O₃: 43.5 – 47 % w/w, and SiO₂: 49.5 – 53.5 % w/w,</i>			
<i>or</i>			
<i>Al₂O₃: 45.5 – 50.5 % w/w, and SiO₂: 48.5 – 54 % w/w,</i>			
<i>b) fibres have a length weighted geometric mean diameter less two standard geometric errors of 6 or less micrometres (µm).</i>			
		Extracted from Index no.: 650-017-00-8	Carcinogenic
Anthracene oil	292-602-7	90640-80-5	Carcinogenic ¹ , PBT and vPvB
Anthracene oil, anthracene-low	292-604-8	90640-82-7	Carcinogenic ² , mutagenic ³ , PBT and vPvB
Anthracene oil, anthracene paste	292-603-2	90640-81-6	Carcinogenic ² , mutagenic ³ , PBT and vPvB
Anthracene oil, anthracene paste, anthracene fraction	295-275-9	91995-15-2	Carcinogenic ² , mutagenic ³ , PBT and vPvB
Anthracene oil, anthracene paste, distn. Lights	295-278-5	91995-17-4	Carcinogenic ² , mutagenic ³ , PBT and vPvB
Diisobutyl phthalate	201-553-2	84-69-5	Toxic for reproduction
Lead chromate	231-846-0	7758-97-6	Carcinogenic and toxic for reproduction
Lead chromate molybdate sulphate red (C.I. Pigment Red 104)	235-759-9	12656-85-8	Carcinogenic and toxic for reproduction
Lead sulfochromate yellow (C.I. Pigment Yellow 34)	215-693-7	1344-37-2	Carcinogenic and toxic for reproduction
Pitch, coal tar, high temp.	266-028-2	65996-93-2	Carcinogenic, PBT and vPvB
Tris(2-chloroethyl)phosphate	204-118-5	115-96-8	Toxic for reproduction
Zirconia Aluminosilicate Refractory Ceramic Fibres			
<i>are fibres covered by index number 650-017-00-8 in Annex VI, part 3, table 3.2 of Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, and fulfil the two following conditions:</i>			
<i>a) Al₂O₃, SiO₂ and ZrO₂ are present within the following concentration ranges:</i>			
<i>Al₂O₃: 35 – 36 % w/w, and</i>			
<i>SiO₂: 47.5 – 50 % w/w, and</i>			
<i>ZrO₂: 15 - 17 % w/w,</i>			
<i>b) fibres have a length weighted geometric mean diameter less two standard geometric errors of 6 or less micrometres (µm).</i>			
		Extracted from Index no. 650-017-00-8	Carcinogenic

Candidate List Additions 3-3* & 6-18-2010

Acrylamide*	201-173-7	79-06-1	Carcinogenic and mutagenic
Trichloroethylene	201-167-4	79-01-6	Carcinogenic
Boric acid	233-139-2 / 234-343-4	10043-35-3 / 11113-50-1	Toxic for reproduction
Disodium tetraborate, anhydrous	215-540-4	1303-96-4/ 1330-43-4/ 12179-04-3	Toxic for reproduction
Tetraboron disodium heptaoxide, hydrate	235-541-3	12267-73-1	Toxic for reproduction
Potassium dichromate	231-906-6	7778-50-9	Carcinogenic, mutagenic and toxic for reproduction
Ammonium dichromate	232-143-1	9/5/7789	Carcinogenic, mutagenic and toxic for reproduction
Potassium chromate	232-140-5	7789-00-6	Carcinogenic and mutagenic
Sodium chromate	231-889-5	11/3/7775	Carcinogenic, mutagenic and toxic for reproduction

Candidate List Additions 12-15-2010

Cobalt(II) sulphate	233-334-2	10124-43-3	15.12.2010	Carcinogenic and toxic for reproduction
Cobalt(II) dinitrate	233-402-1	10141-05-6	15.12.2010	Carcinogenic and toxic for reproduction
Cobalt(II) carbonate	208-169-4	513-79-1	15.12.2010	Carcinogenic and toxic for reproduction
Cobalt(II) diacetate	200-755-8	71-48-7	15.12.2010	Carcinogenic and toxic for reproduction
2-Methoxyethanol	203-713-7	109-86-4	15.12.2010	Toxic for reproduction
2-Ethoxyethanol	203-804-1	110-80-5	15.12.2010	Toxic for reproduction
Chromium trioxide	215-607-8	1333-82-0	15.12.2010	Carcinogenic and mutagenic
Chromic acid,	231-801-5	7738-94-5		
Oligomers of chromic acid and dichromic acid,	-	-		
Dichromic acid	236-881-5	13530-68-2	15.12.2010	Carcinogenic

Communication Requirements

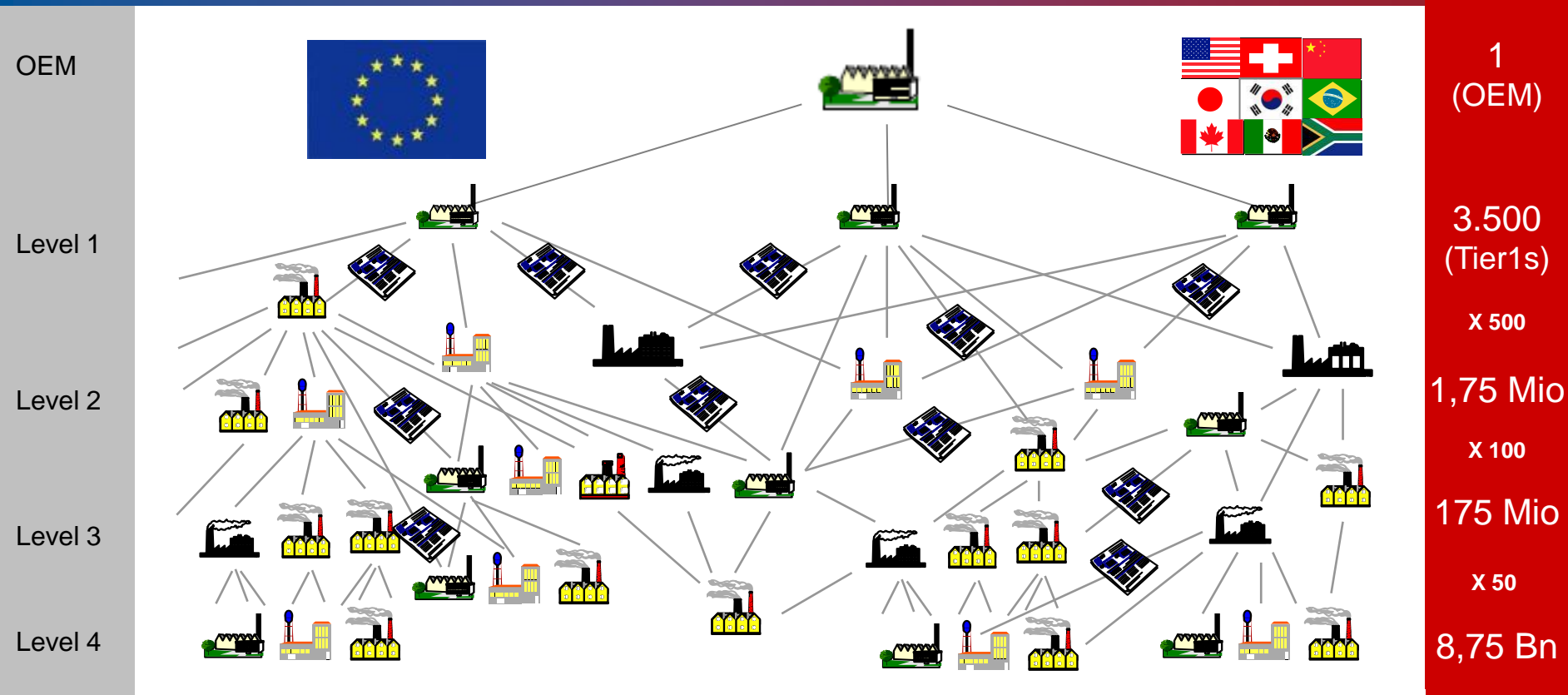
If an article is imported into or produced in the EU

- and the article contains a substance which is on the ***Candidate List***
- and the substance is present in a wt/wt concentration in the article at greater than 0.1%

then the substance must be communicated ***immediately*** to all **recipients** and ***within 45 days*** to any consumer who asks

Ref: Article 33.1-2 of the REACH Regulation

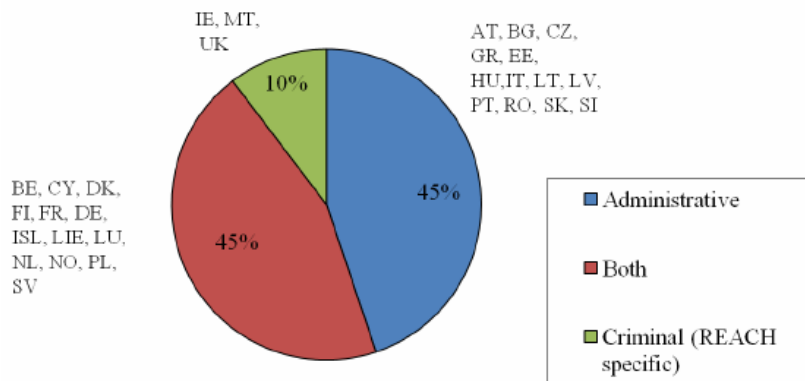
How complex is a typical supply chain?



Using this data and adding some conservative assumptions a number of several billion possible Candidate List communications for the tens of thousands of parts per vehicle are possible

Enforcement of REACH

Enforcement regimes



Presentation of the report
 ECHA's Third Stakeholders' Day
 (Helsinki, 7 December 2009)

Type of penalties

- **Administrative penalties**
 - Fines, in all countries
 - Complementary measures, in most countries, various types (Suspension of activity, closure of the premises, withdrawal of a permit, suspension or ban on use, suspension of placing on the market, destruction of substance, etc.)
- **Criminal penalties**
 - Fines
 - Imprisonment
 - Complementary measures (Closure of establishment, deprivation or suspensions of rights, confiscation or destruction, publication of the judgment)



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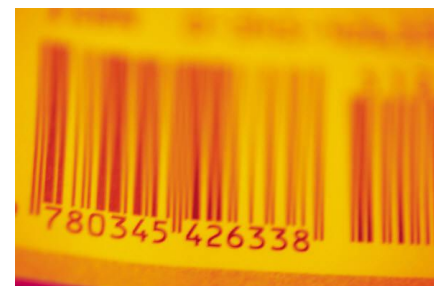


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Coordinating Enforcement Across Member States

Anticipated Effects on Manufacturers

- Product impacts due to authorizations and ban of substances on SVHC list
 - Availability of substances
 - Reliability concerns
 - Product lifecycle implications
- If substance not registered and not available, alternatives need to be identified to support product requirements
- Data management issues to collect, aggregate and report data on SVHC content



Rare Earth Elements

■ 17 Elements on the Periodic Table

- Scandium, Yttrium, Lanthanum, Cerium, Praseodymium, Neodymium, Promethium, Samarium, Europium, Gadolinium, Terbium, Dysprosium, Holmium, Erbium, Thulium, Ytterbium, Lutetium

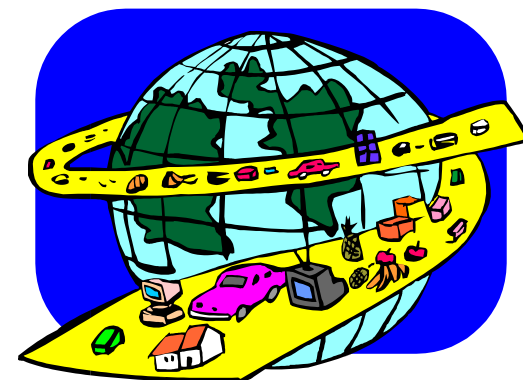
■ Used in High-Tech and Alternative Energy Applications

- Electronics (cell phones, DVD players, cameras...)
- Lasers
- Oxidizing/Reducing Agents
- Magnets
- Batteries (rechargeable , hybrid and electric automobiles),
- High Refractive Glass
- Precision Guided Munitions
- Wind Turbines



Rare Earths

- Increasing Demand for Rare Earth Materials in High-Tech and Energy Conserving Equipment and Devices
- Although Not “Rare”, Limited Alternative Sources
- China mines and processes approximately 97% of all REMs in the world
- Trade Concerns
 - Feb 18, 2011 WTO Interim Panel Report (to be released)
 - Report notes China’s export quotas for rare earth products have fallen steeply, with the total allocation for 2010 far below the 2007 level



Dodd-Frank Act of 2010

- Requires manufacturers and their customers to disclose steps to ensure products do not contain “**conflict minerals**” from the Democratic Republic of Congo and adjoining countries
 - Third Party Audits
 - Publically Report
- Proposed Rule for Requirements
 - Issued -12/15/2010, Comments due 1/31/2011
 - Comments Extension Granted, now due 3/2/2011
- Requires Supply Chain verifications of sources of materials in products
- EU discussing similar legislation

- Gold
- Tantalum
- Tungsten
- Tin

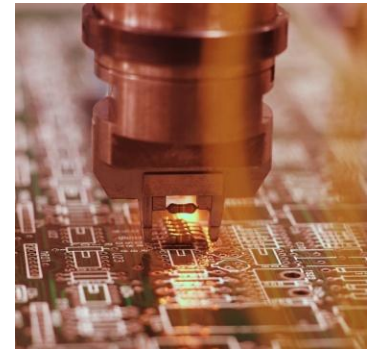
What's in the Black Box?

Suppliers will need to disclose “ingredient” information needed to support REACH and other compliance issues



As substances face restriction, will implemented alternatives be disclosed?

What requirements are needed for suppliers to provide information?



What about Intellectual Property?

Considerations

- Understand your compliance obligations
- Keep track of SVHCs and emerging contaminant issues
- Requires a multi-function approach and team effort
 - Environmental, Operations, Engineering, Quality, Contracts, Export Ops
- Supply chain and logistics play a key role
- Don't forget “packaging”
- Work with customers and industry groups

Thank you

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ECHA Website: http://echa.europa.eu/home_en.asp

REACH Candidate List of Substances of Very High Concern:

http://echa.europa.eu/chem_data/authorisation_process/candidate_list_en.asp