Preparing Supply Chains for the Disruption of Green Transitions

Tom Keyserlingk, IHS

Abstract
The European Union list of Substances of Very High Concern (SVHCs) published in the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulation, requires producers of Articles to provide a declaration regarding the presence of SVHCs to their customers within 45 days of request. To effectively communicate regulatory compliance, organizations require infrastructure and application development to incorporate 1752 and 9535 template standards.

Concurrently, a "green" movement is transitioning product design focus beyond regulatory and legislative compliance to market-driven, eco-friendly electronics. This is causing many supply chain partners to be pulled in the direction of green leaders with a serious impact on organizations dependent upon the same sources of supply, design standards, and supply chain constituents.

This session will review today's global manufacturing direction to eco-friendly products and its impact on electronic components and systems. It will explore compliance pressures and other very real concerns such as counterfeit parts, high reliability design, pursuit of Pb-free alternatives, supply volatility, and obsolescence.

From component manufacturer and OEM/EMS perspectives, it will also discuss PCN/EOL, data transfer, and published standards that are de facto communication methods but vary significantly in practice. Given complex BOM configurations and the nature of specialized, outsourced supply chains this presents a greater threat to lifecycle performance. A framework will outline preparatory product lifecycle actions and leading approaches taken to address the Green product development movement.

This Executive Briefing discusses the results of two benchmark studies conducted in 2008 by Supply & Demand Chain Executive, in conjunction with IHS, "Benchmarking Green Supply Chain Priorities" and "Benchmarking Product Lifecycles for Green Performance." Research of more than 300 companies demonstrates that Green is a disruptive market transition that has introduced supply chain volatility and unbalance without any apparent near term resolution.

This paper previews the most serious issues that impact supply chain stakeholders. Along with more comprehensive companion papers, it may serve as a guidebook to plan, prioritize and execute programs. Its central objective is to inform business leaders of both, direct and indirect, influences of Green marketplace behavior, and equip their organizations with strategies to maintain competitive performance, mitigate business risks, and ensure supply chain continuity.

It is a misconception that Green applies only to makers of eco-friendly products or those required to comply with regulations like RoHS, REACH and EuP.* Although industries like aerospace and defense or communications may seem once-removed from the issues, they cannot ignore the supply chain changes that Green imposes, and they are arguably at greater risk to its influences.
The bottom line: Green is a mainstream marketplace shift, the influence of which ultimately impacts and changes supply and demand dynamics. Regardless of regulatory compliance requirements, environmental product ambitions, or even short-term competitive gains, those who chose to ignore its impact may face dire consequences and run the risk of being left behind.

Top Concerns and Priorities
When reviewing the two benchmark studies, one can see how deeply rooted regulatory and social pressures are within supply chain concerns, priorities and enabling investments:

- **Fifty-eight percent say ownership resides at the VP level**. With 20 percent having C-level sponsorship, our study shows sourcing, procurement, and supply chain to own Green programs.
- **Sixty percent say budgets in economically challenging times are increasing**: Whether these were site level or enterprise budgets, 43 percent will exceed $100,000, while 20 percent say $1 million, and 11 percent say more than $10 million+.
- **Fifty-eight percent say RoHS is their No. 1 concern**: From July 2006, RoHS requires that EE equipment does not contain excess lead, mercury, cadmium, hexavalent chromium, PBBs or PBDEs.
- **Of second concern, 43 percent indicated RoHS II**: Expected to require compliance by January 2012, RoHS II adds medical device and industrial equipment to RoHS, as well as new substances.

- **Forty-three percent also indicated that REACH is a top concern**. The Registration, Evaluation, Authorization and Restriction of Chemicals, came into force June 2007, requiring registration and potential substitution of chemicals.
- **Twenty-nine percent say systems to track information are their top concern (No. 3):** Not a regulatory need, systems enable management of regulatory, product and supply chain data.
- **Data has been the top issue impacting cycle performance and supply chain continuity:** According to 38% of respondents, the time required to collect item level data is the least understood or properly scoped redesign activity.

Product Lifecycles, Regulations and Social Responsibility Must be Mastered Together

For over a decade, issues like global climate change, world trade balance, and consumer health and safety have manifested into various aspects that touch impact manufacturing:

- **Corporate social responsibility (CSR),** including ethical business conduct and corporate culture, e.g. policies on energy, the environment, and citizenship.
- **Governance, risk, and compliance**, including regulatory matters such as health and safety, national security, or environment policy e.g. RoHS, REACH, or ITAR/ EAR.
- **Product lifecycles**, including innovation, design and development activities over product lifespan, e.g. short lifecycle handheld mobile phones, or long-lifecycle medical equipment. Green business approaches possess elements of each. It is arguable whether Green origins itself are to a greater extent, driven by either regulatory mandates or social pressures, but it is inarguable that each have affected how companies plan and execute product lifecycle strategies. We contend that, although regulatory- and socially- oriented business practices have operated independent of one another that they are converging out of necessity within supply chains. Therefore, akin to other cross-functional processes like Sales & Operations Planning, the planning and execution of strategies to mitigate Green performance disruption will require Social, Regulatory and Product activities to be synchronized.

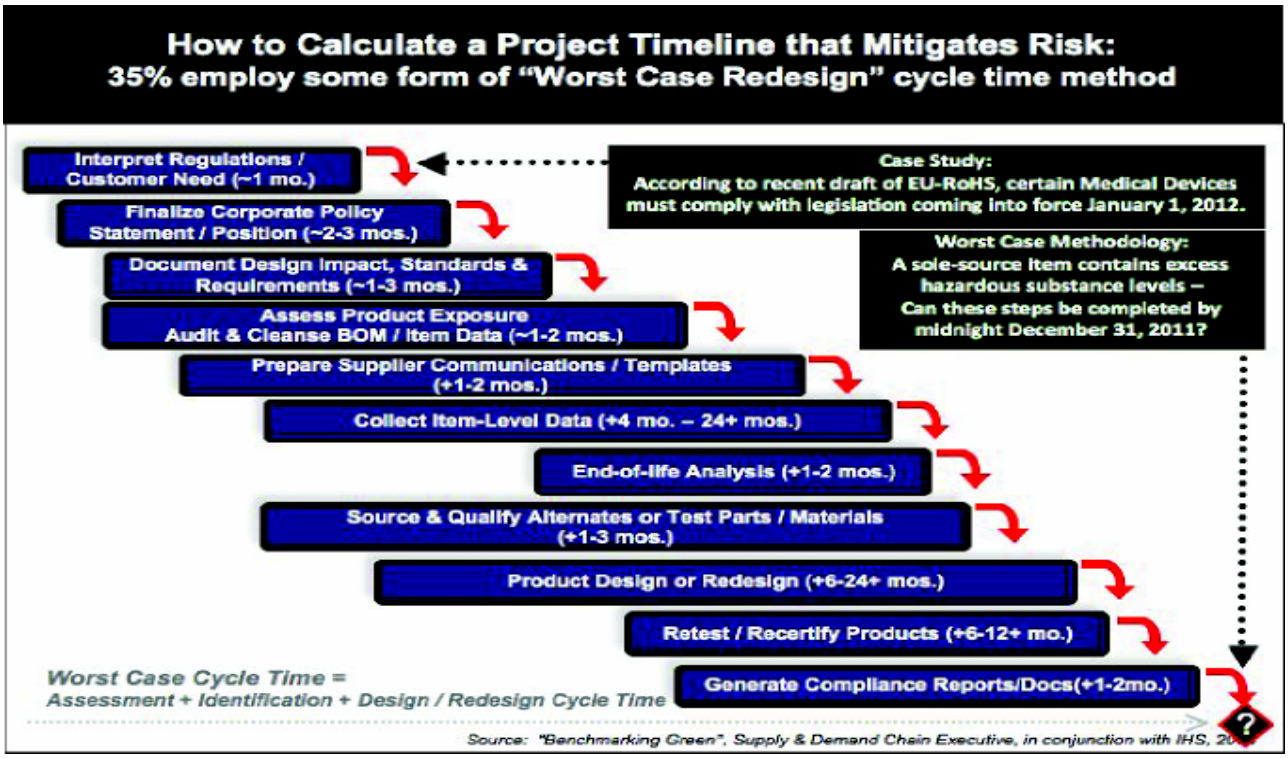


Figure 1

Supplier Management is Critical to Performance: 70% of those surveyed said that capabilities to meet environmental substance or compliance requirements were included in supplier performance and risk evaluations, while 64% say those who provide no visibility are viewed the same or worse as non-compliant suppliers. 15% would add a probationary-like period "e.g. 6-12 months" to schedules and 53% would add time to resolve initial cases of non-compliance.

Benefits: Short- and Long-term Performance Opportunities The Business Opportunity: Corporate executives see Green as driven, to some extent, by social responsibility and regulatory obligations. However, many also see top- and bottom-line opportunities in moving toward Green:

- **Customer Service and Market Share**: 64 percent of those participating in one of our studies said they believed that Green gave them a customer service or market share advantage.
- **Market Advantage**: 82 percent of participants in the Green Product Lifecycle study said that promoting a product's Green attributes offers advantages over a competitor's offering.
- **Price Advantage**: 56 percent indicated that Green products command a higher price than equivalent non-Green products. By moving more quickly than competitors, companies can take advantage of market perceptions of supply chain disruptions and the opportunity to maintain customers that are themselves challenged or to win customers away from competitors that are slower to respond. Margins can benefit from these advantages through short-term price power, which is likely to diminish over time. Companies also have the opportunity to leverage supply chain initiatives to effect cost reductions that can reduce cycle times and deliver savings directly to the bottom line. Fifty percent of participants agreed with the statement that "When introducing a replacement Green or compliant product, or redesigning an existing product, there are net total cost reduction opportunities." Some savings drawn from our findings include:
- **Reduction of complexity** in supply chains through supply base rationalization based on compliance/non-compliance of suppliers
- **Reduction of bill of materials (BOM)** complexity as part of product redesign initiatives, and the elimination of SKU as part of a supply chain transition strategy

Supply, price and demand economics resulting from changing demand patterns and their impact. For instance, 55 percent in our second study said that traditional supply such as parts not compliant with RoHS present greater price and availability volatility.

Business Justification: Not a Case for Green Business Advantage, but to Avoid Supply Chain Disadvantage
Yes, many global manufacturing players are required to meet regulatory mandates and social responsibility goals. But all players must mitigate the risks associated with how these issues in adjacent industries and segments change the playing field.

As Figure 2 depicts, "Regardless of compliance requirements or environmental ambitions, supply chains must prepare for Green adoption" due to critical mass across direct and indirect industry segments. The most obvious cases are compliance violations that are most routinely discussed, and the graphic shows how a top Japanese consumer electronics company faced a $160 million+ regulatory disruption resulting from excessive hazardous substance levels that violated a regulation. However, the other cases show how compliance is but one factor when arguably more consequential supply chain issues cause less-obvious product lifecycle disruption and social disruptions that must be mitigated.

Below is a summary of five select supply chain issues drawn from our studies. They are not exclusively regulatory compliance or eco-product strategies. They are supply chain vulnerabilities that can have serious consequences to performance metrics resulting from improper handling of Green transitions:

1. Supply risks begin to materialize as supplier consolidation, supply shortages or inconsistency or spikes in pricing and availability emerge as supply chains make Green transitions; 57 percent of our study participants agreed there is greater supplier volatility. Amazingly, about one-in-five of all participants said each of part changes, energy consumption, environmental substance presences, toxicity, supply chain disruptions, competitive part number cross-references for substitution and regulatory compliance transitions are present in their product change notification (PCN) and end-of-life (EOL) documentation.

2. Sustained design reliability as new materials, design principles and manufacturing processes are required. Our study validated to some extent the ongoing debate about reliability, as 37 percent believe that new parts/materials have greater risk of quality or reliability failure, while 47 percent do not. It cannot be argued that new materials are inherently different and must undergo scrutiny in how and where they are used. Certain issues like lead-free component reliability or the relative health and safety of various chemicals are well-known, and mishandling them can impact key performance metrics. Sixty-six percent of our respondents said that asking suppliers for reliability information can "drastically reduce the amount of rework and repair," while 57 percent are doing it today.

3. Obsolescence: Obsolescence must be closely monitored, as companies find that unsafe or non-compliant supply are "sunsetted"; 55 percent of our study respondents said obsolescence has increased due to Green market transitions, while a separate study from IHS validates that 76 percent of component EOL events in recent years were a direct result of RoHS compliance.

4. New product design or redesign required as a result of supplier disruption or customer and consumer requirements can pose a major hurdle to meeting top-line goals for all companies. According to our study results, 70 percent said that it would take more than six months to redesign a product as a result of supply interruption. Thirty-five percent say it would take more than one year, which can seriously impact product launches and business plans.

5. Counterfeit parts include, among other things, falsely branded components and lesser-quality or poor yield product that can cause design failures or even be used as a back door security threats to electronic equipments. Often counterfeit parts profiteers target traditional military or other markets requiring high- reliability components that are not lead-free. It is no surprise then that our study found 67 percent say they are concerned about counterfeits, 42 percent said they believe the shift to lead-free components has been a cause of counterfeit proliferation, and 56 percent say that one should transition to lead-free alternatives to reduce their risk of exposure to counterfeit parts. Proactively, 49 percent say that improvements at predicting obsolescence can mitigate most counterfeit component risk by avoiding the need to source aftermarket replacements altogether.

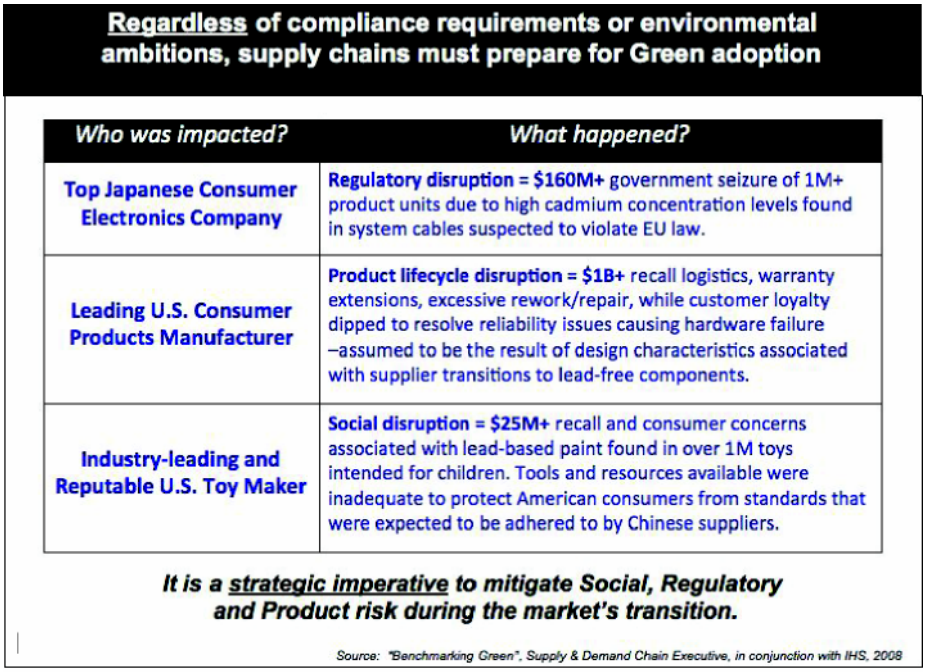


Figure 2

Laying out a Roadmap for Sustained Supply Chain Performance

Given restraints on resources, companies must set priorities for dealing with Green supply chain transitions. Below are key planning and execution considerations excerpted from our full published report, intended to summarize the framework that business leaders can review:

- **Scope and Priority**: Not surprisingly, our studies revealed that companies have largely focused their initial efforts on dealing with regulatory mandates in sequential order. The top priority thus far was RoHS, followed by REACH and then EuP. Digging in more deeply, these issues are converging and adding supply chain complexity.
- **Ownership:** 58 percent of participants in our studies said that ownership of Green supply chain initiatives at their companies resides at the vice president level.
- **Budget:** Initiatives will require investments in people, processes and technology, and companies increasingly are allocating dedicated budgets to these programs. Our studies show why approximately 20 percent pegged budgets at $1 million or higher and 41 percent would be increasing in the year ahead.

- **People:** It also is worth highlighting the "people" component and why executives overseeing these initiatives must ensure that they understand the level of commitment that will be involved in executing product lifecycle strategies.

  Many companies (about one-third in our study) have rolled all their compliance-side issues up under the umbrella of a single competency center responsible for environmental but also other product-related compliance issues.

- **Time:** Green is not a one-time event but rather a continuous process. Sixty-two percent of participants in our studies said that their company approached RoHS as an ongoing program once initial compliance had been achieved. Meanwhile, executive scoping the time necessary for a product lifecycle program must include such factors as redesign time and the time necessary to gather information.

- **Technology:** A substantial minority (22 percent) of companies studied currently employ technology to enable these issues within their four walls and across the supply chain. It is critical to understand that the Green product lifecycle encompasses an enormous amount of data on each item of each product, and managing the business impact will require more than spreadsheets.

Conclusion

Green supply chain management is becoming mainstream, but it nevertheless is still emerging as a discipline. The two studies conducted for this Executive Briefing, along with interviews with industry practitioners and a review of relevant studies from the analyst community, point to best practices that leading firms are adopting to ensure the long-term success of their initiatives to address these risks.

As the analyst firm AMR Research has pointed out, even companies that do not engage directly in Europe must ask whether or not they sell into a supply chain that imports into the EU, or if they purchase out of a supply chain that exports from the EU. Irrespective of EU regulations, other global regulations or social pressures, this demonstrates the longevity of the "supplier's supplier, and customer's customer" when considering supply chain performance.

In the Green Product Lifecycles survey, 91 percent of participants indicated that they were taking some action to either comply with environmental regulations or develop more environmentally friendly products. Thus, nine in 10 companies already are incorporating some strategy into their operations, reflecting the extent to which Green is not unique but rather should be viewed – and acted upon – as any other paradigm shift in business. This Executive Brief only delved into the leading issues, intended to highlight this strategic imperative organizations need to realize in order to maintain competitive performance, mitigate business risks, and ensure supply chain continuity.

The Source for Critical Information and Insight™

Compliance Conundrum: RoHS, REACH, and Reliability Oh my!

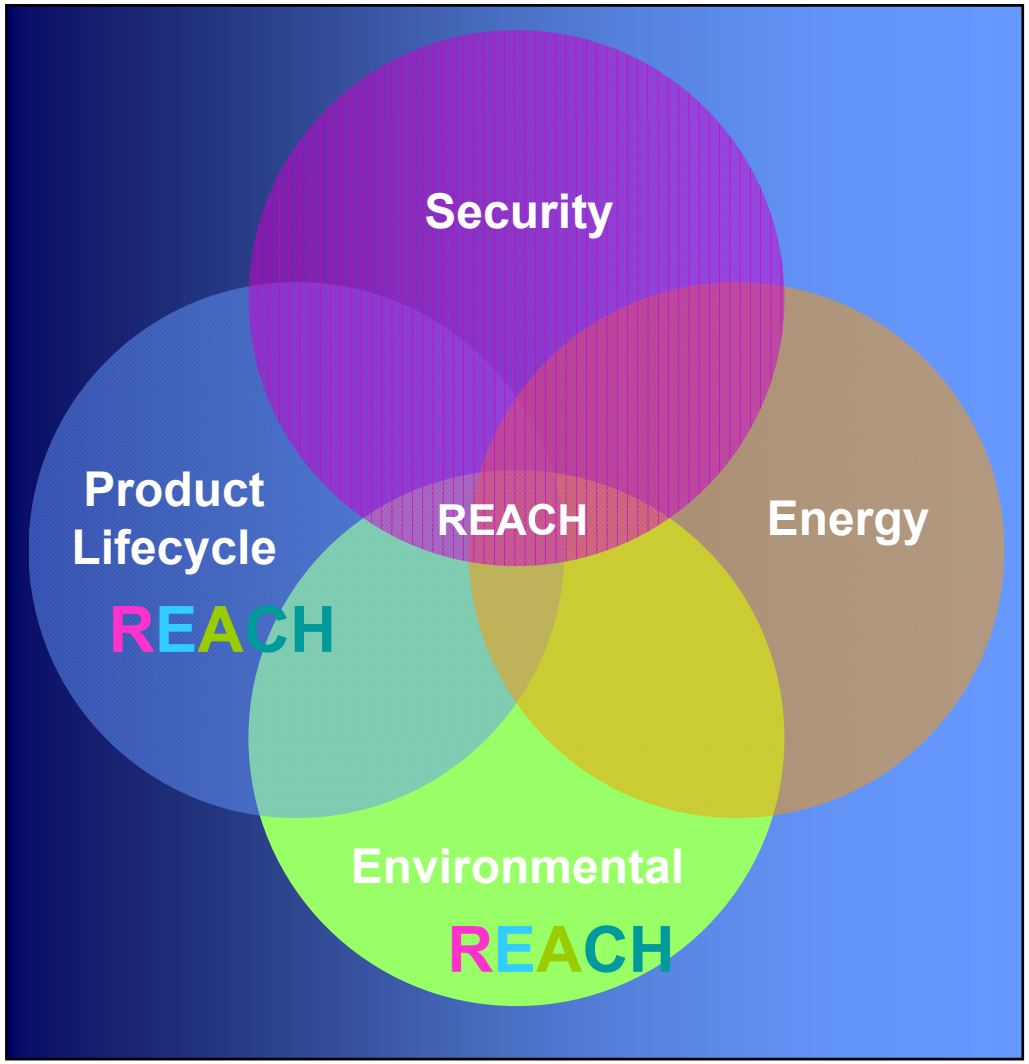
"Helping companies mitigate supply chain and design risk as they transition to regulatory-compliant and eco-inspired products."

Tom Keyserlingk
Director, North America
Compliance Services

January 2009

IHS Overview

Providing critical technical information and insight…



Founded in 1959: To provide product catalogues for aerospace engineers

Today: Leading provider of critical technical information and insight, decision support tools, and related services

- 55,000 customers in over 100 countries
- ISO9001 company with 3500 employees

Strong, Growing Products and Financials

- IPO Nov 2005
- Public, NYSE IHS
- Market Cap $3.2B
- FY08 revenue: $844M (+23% over ‘08)
- Net income: $175M
- 50% of revenue outside of US

Session Topics

1. State of the Industry

2. The RoHS era:
   What did we learn?

3. REACH, counterfeits, obsolescence – oh my!
   What are the current and future design pressures?

4. Sustainability, reliability, and volatility:
   How do you achieve product lifecycle performance?

Green movement now drives product design

Beyond regulatory and legislative compliance issues

Green pressures are mounting on a daily basis

What will be the expected, predictable and unintended?
Will history repeat itself with RoHS II or REACH?
CO2 – the new frontier?

Electronics

RoHS II - October 2008
Draft EU Legislation – Potential new Industries and Substances to RoHS

Chemicals

REACH - October 2008
Candidate List of Substances of Very High Concern (SVHC) Published

Source: http://echa.europa.eu/news

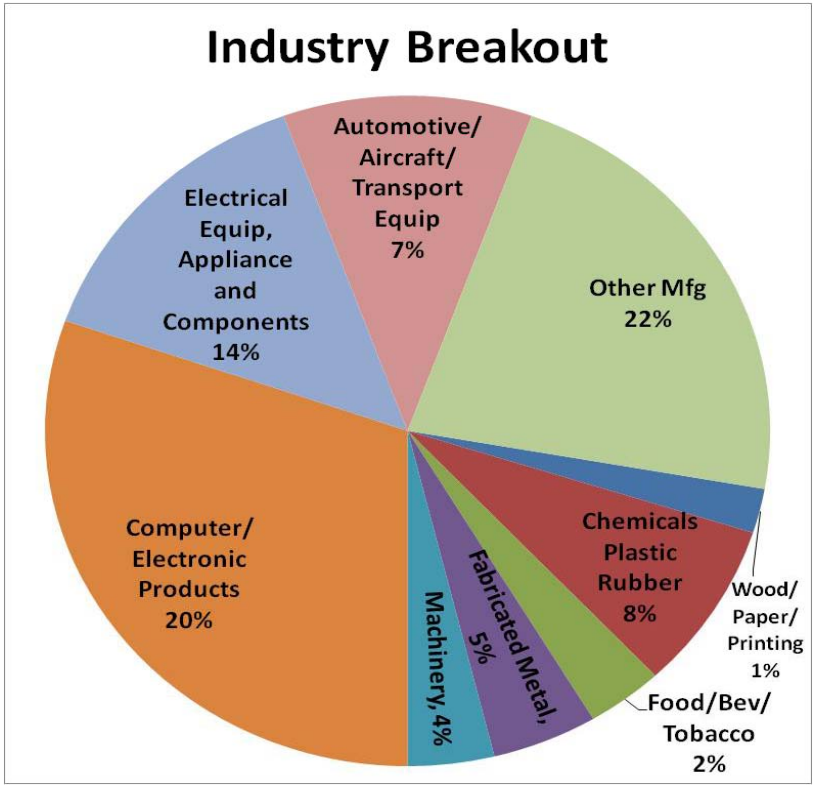
Carbon Emissions & Energy

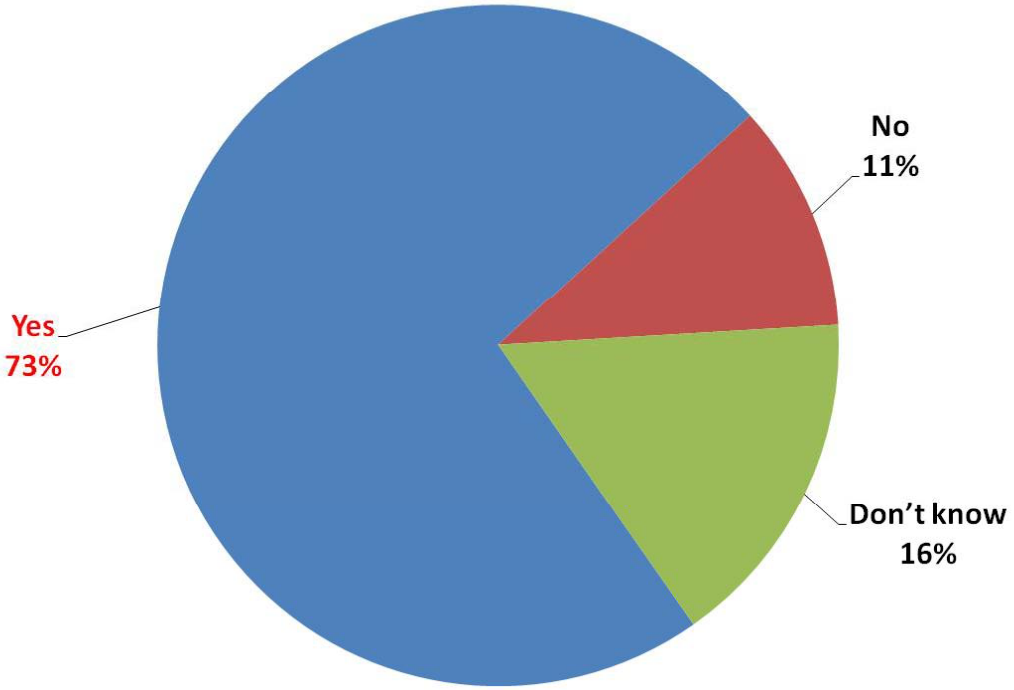
U.S. Election - November 2008
Outlook on North American and International Emissions Policies Change

Source: CTV Staff, Wed 5, 2008
www.ctv.ca

Green Products More Competitive?

Two Studies – Q4 2008
300+ Global Organizations Responded





Top concerns, objectives and priorities SDCE Q4 2008 Survey

Top green supply chain objective:

#1: Reduce carbon emissions
#2: Enable sales
#3: Eliminate hazardous substances

Leading concerns:

#1: RoHS is top concern
#2: (tie) RoHS II is top concern
#2: (tie) REACH
#3: Systems to manage/track green
- Regulations, supply chain, and product data

Program Execution:

- **Budgets / allocations are:**
  - Increasing according to 60%
  - Significant as 43% will exceed $100K, 20% say $1MM+, 11% say $10 million+
- **Executive visibility with supply chain-centric ownership:**
  - 58% say ownership resides at the VP level, 20% C-level+
  - Sourcing, procurement, and supply chain own programs
  - Enough resource and authority to orchestrate operational performance, behavior, and business process change

The Past: Lessons Learned from RoHS?

Impact of Green Supply Chain Behavior		
I. Explicit: ***The Expected***	**II. Implicit:** ***The Debated***	**III. Implicit:** ***The Controversial***
"As Advertised"	**Arguably Predictable**	**Inevitable "Unintended Consequences"?**
* Compliance enforcement * Need for traditional Pb-based exemptions to ensure reliability under high-stress * Emergence of two supply chains: Lead-free vs. Pb-based components/materials	* Demand shifts to lead-free and supplier transition/volatility * Manufacturer consolidation, line trimming, market exits * DMSMS, Obsolescence, Pricing and Availability issues e.g. Purchase Price Variance	* Product recalls, rework/repair, and field reliability failures due to new materials/processes * Proliferation of counterfeit parts threaten product quality, national security, and intellectual property

Entire supply chains were impacted and faced great volatility and risk

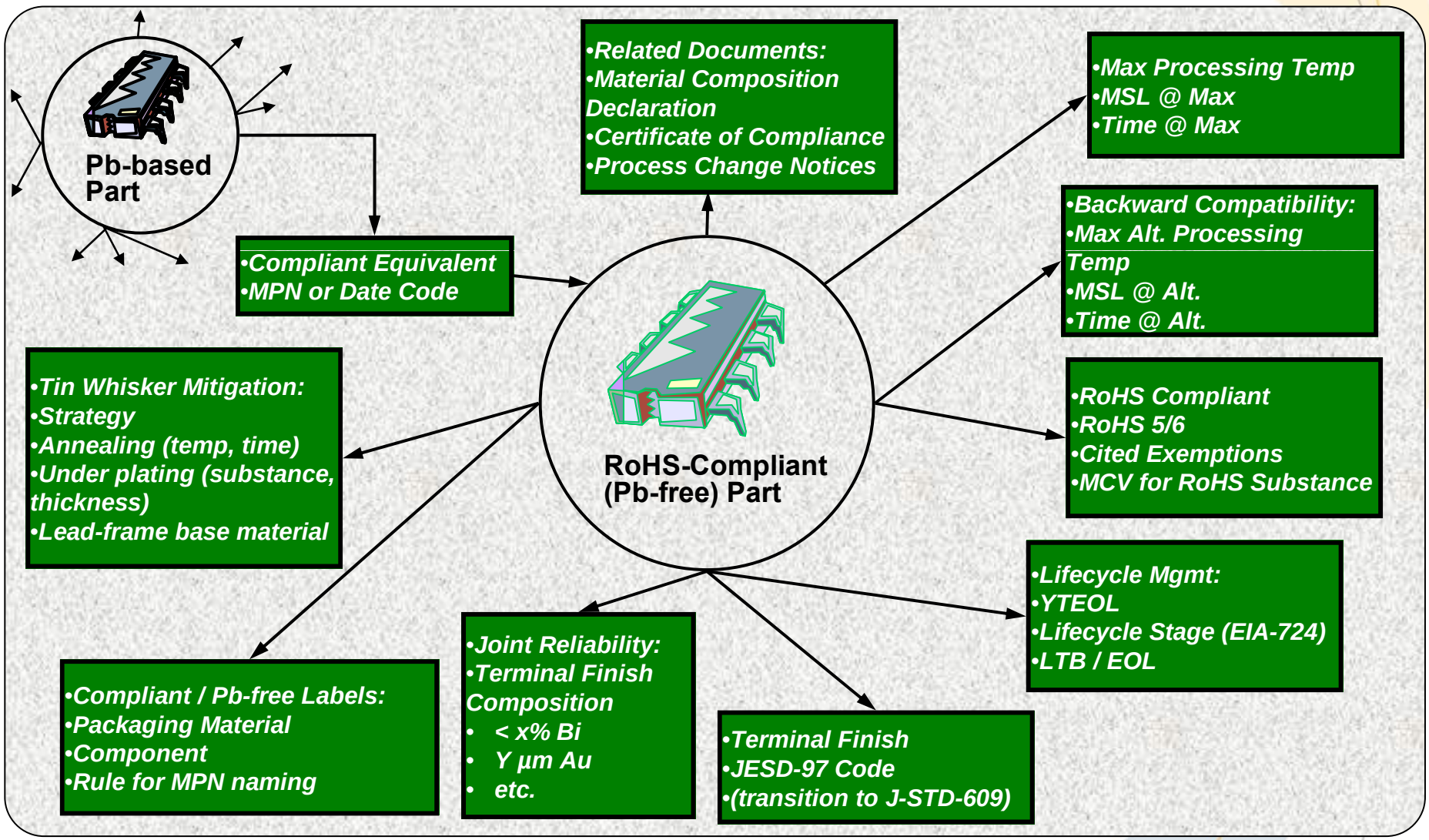
1. Those with motives to enable sales through compliance were rewarded
2. Supply chain scope, impact, and subsequent go well beyond compliance "requirements"
3. Well-intended or not, those that do not master supply chain volatility are at significant risk

Regardless of compliance requirements/ environmental ambitions, supply chains must prepare for Green adoption

Who was impacted?	*What happened?*
Top Japanese Consumer Electronics Company	**Regulatory disruption = $160M+** government seizure of 1M+ product units due to high cadmium concentration levels found in system cables suspected to violate EU law.
Leading US Consumer Products Manufacturer	**Product lifecycle disruption = $1B+** recall logistics, warranty extensions, excessive rework/repair, while customer loyalty dipped to resolve reliability issues causing hardware failure - assumed to be the result of design characteristics associated with supplier transitions to lead-free components.
Industry-Leading and Reputable US Toy Maker	**Social disruption = $25M+** recall and consumer concerns associated with lead-based paint found in over 1M toys intended for children. Tools and resources available were inadequate to protect American consumers from standards that were expected to be adhered to by Chinese suppliers.

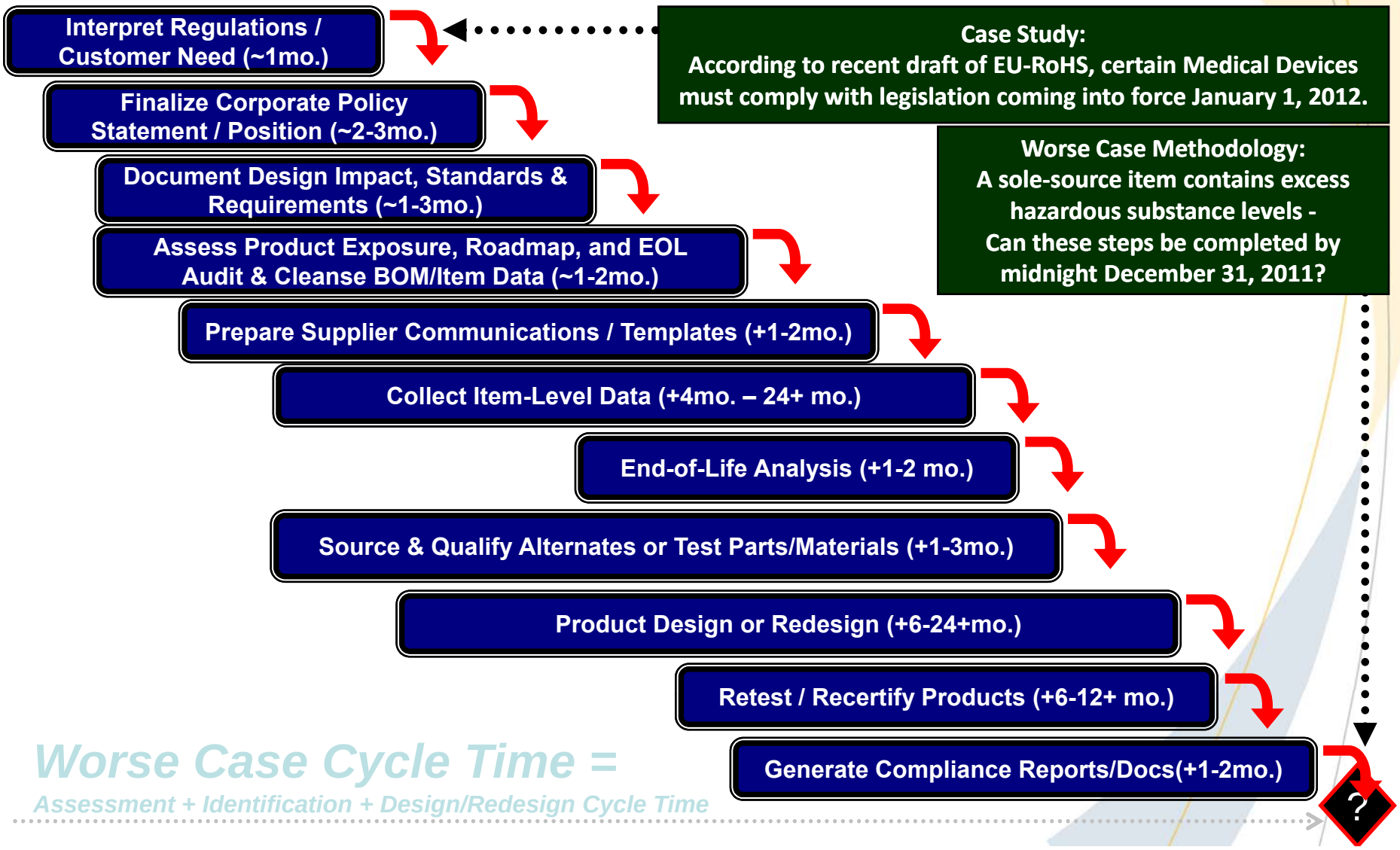
It is a strategic imperative to mitigate Social, Regulatory, and Product risk during the market's transition.

A single part needs information that goes well beyond explicit compliance requirements



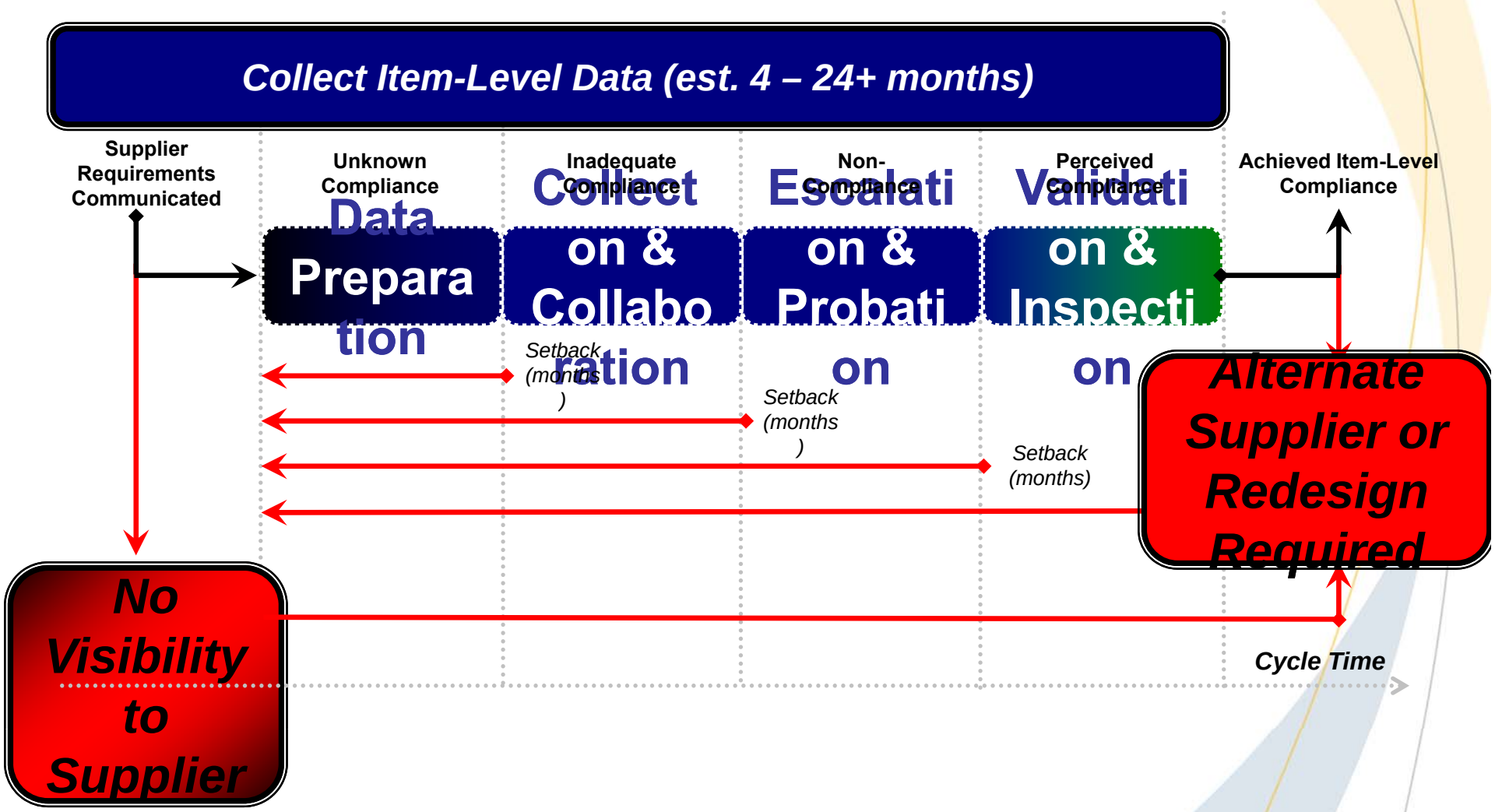
Calculate a Project Timeline that Mitigates Risk:

35% employ "Worse Case Redesign" cycle time method



#1 issue impacting redesign cycle time?

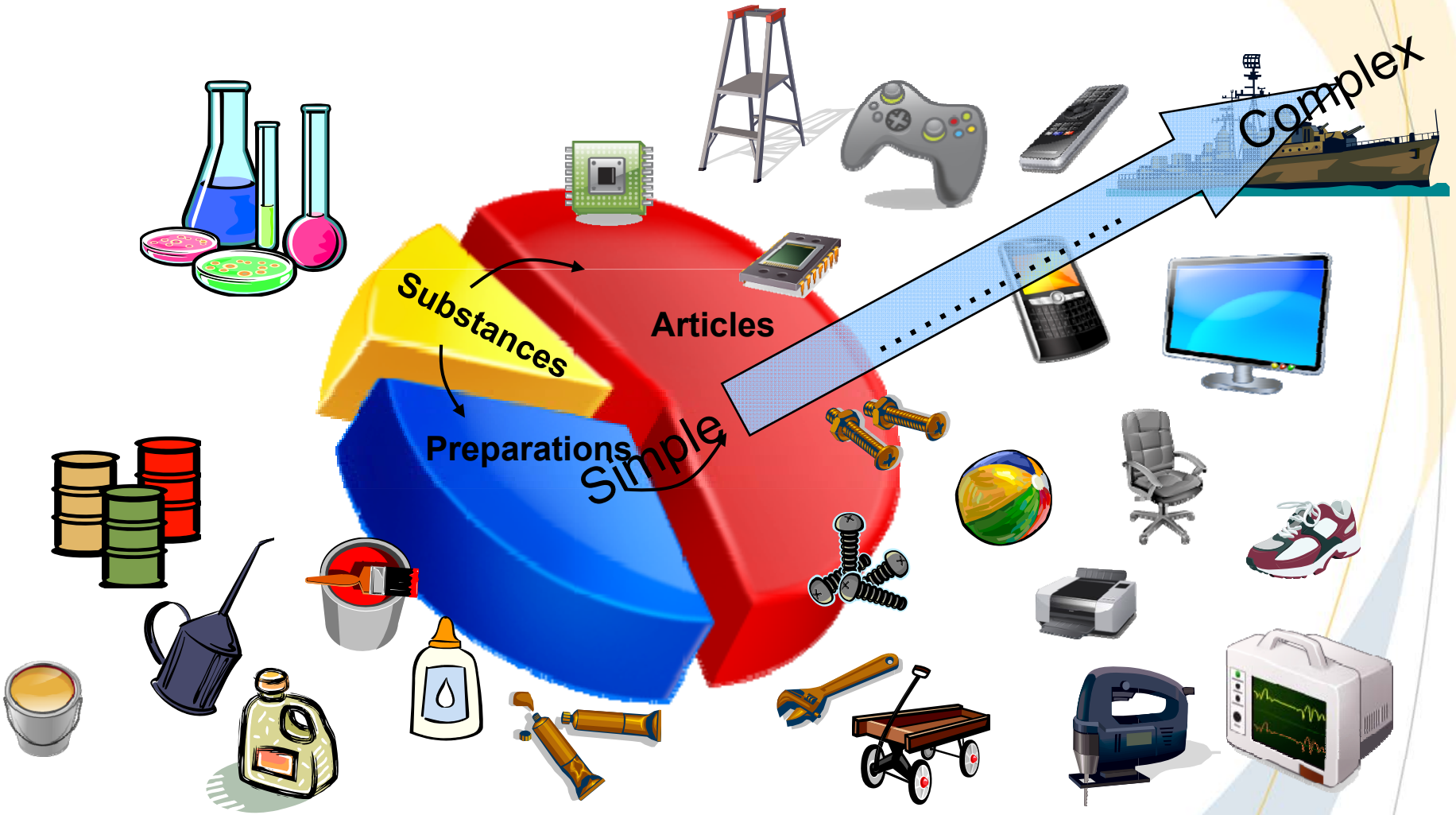
38% of respondents say time to collect component-level data least understood impacting redesign.



Meanwhile, 15% of those who knew would allow a probationary-like period "e.g. 6-12 months", while 53% would allow time to collaborate with non-compliant or uncooperative suppliers.

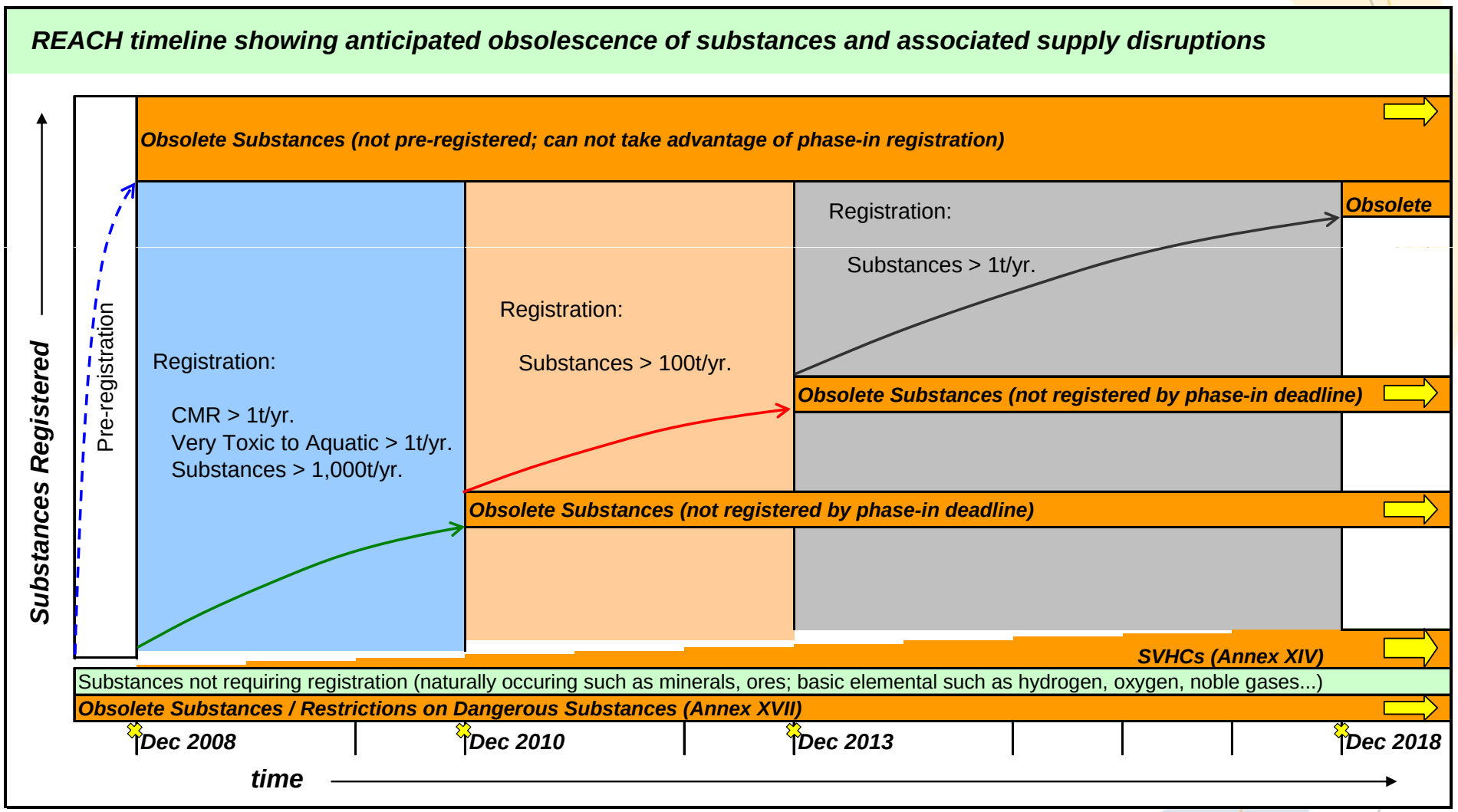
REACH

If you “touch” Europe—you’re affected!



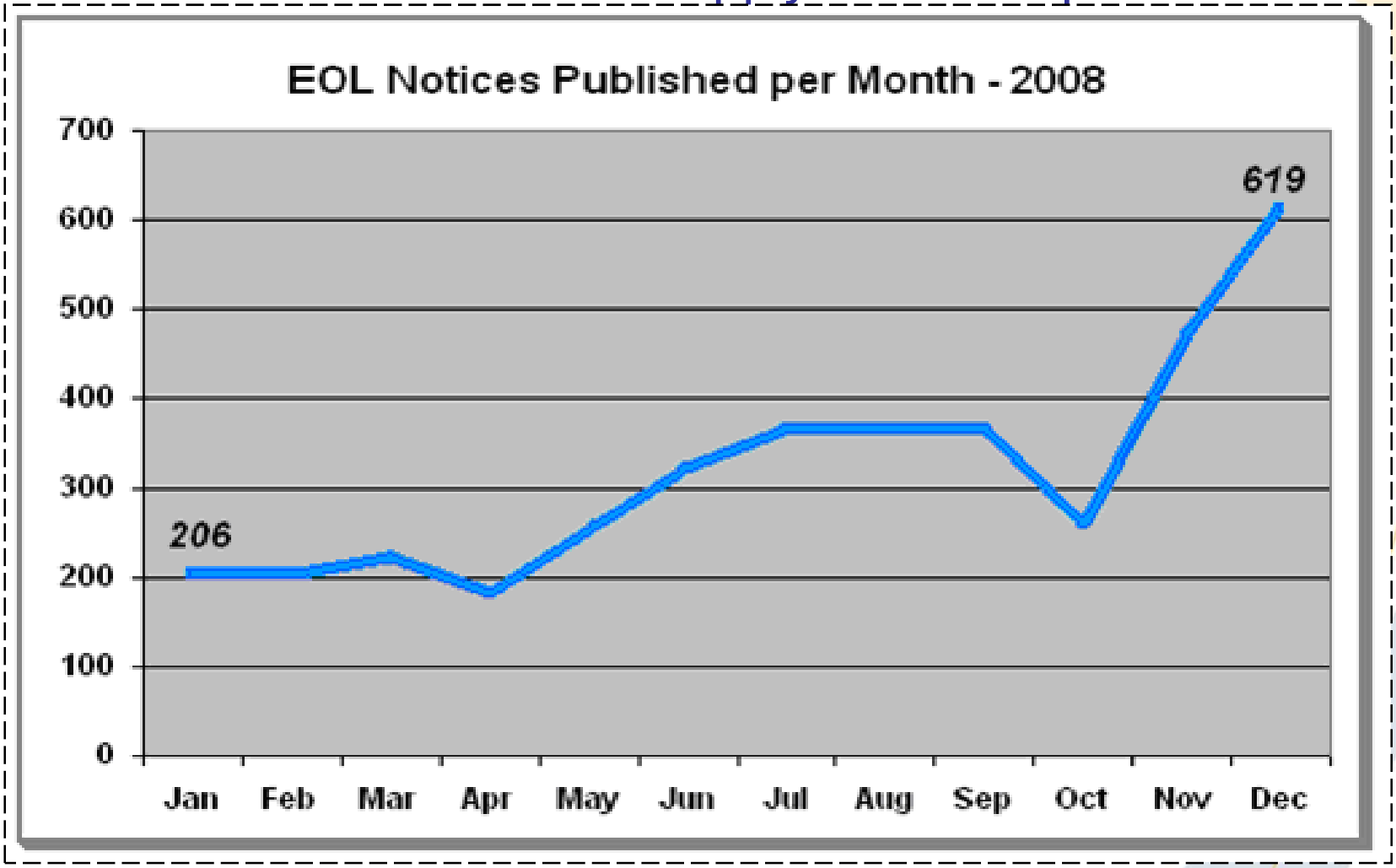
REACH

Timelines: anticipated Disruptions—Substance Obsolescence

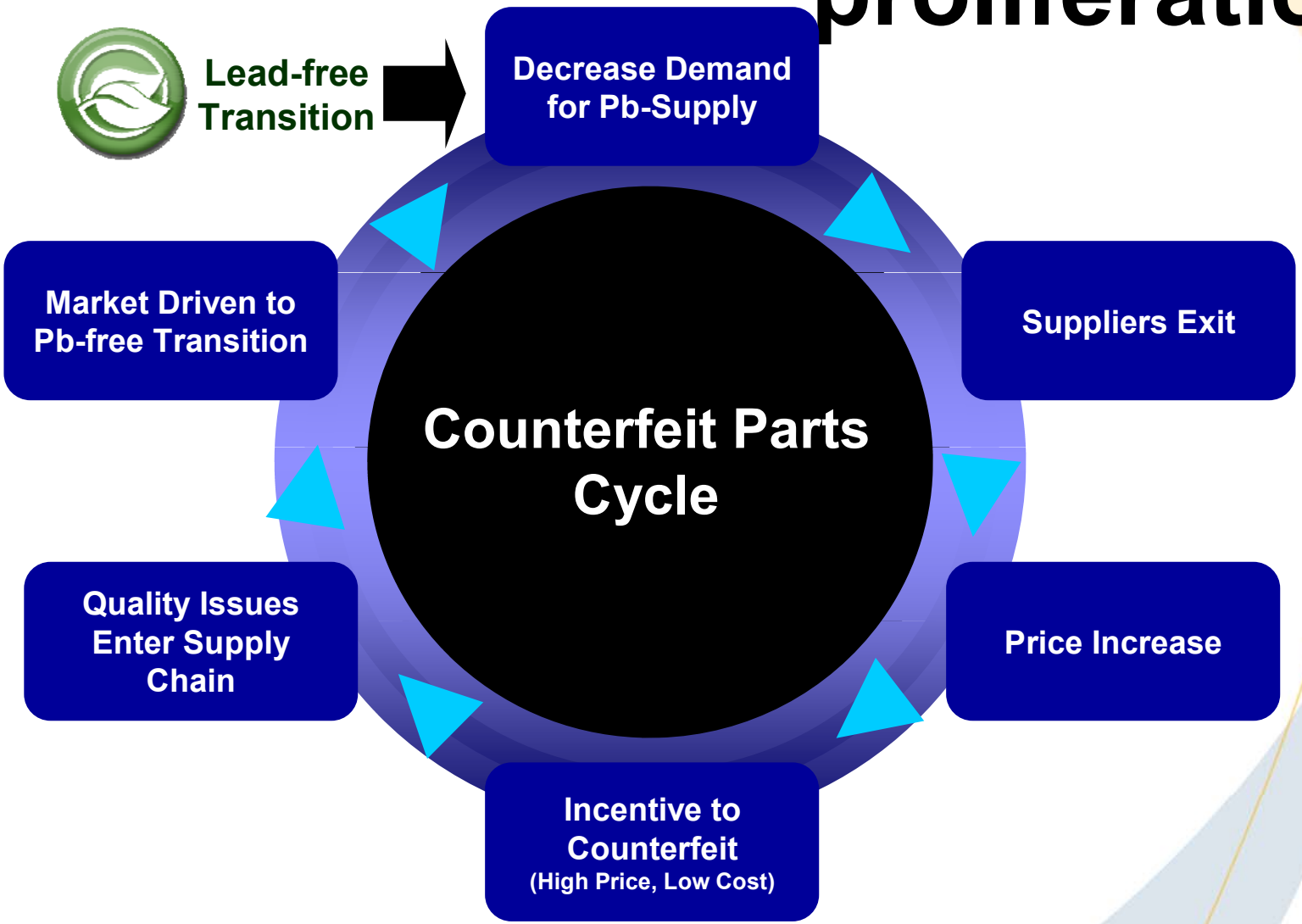


Compliance Impact on Supply Chain Key

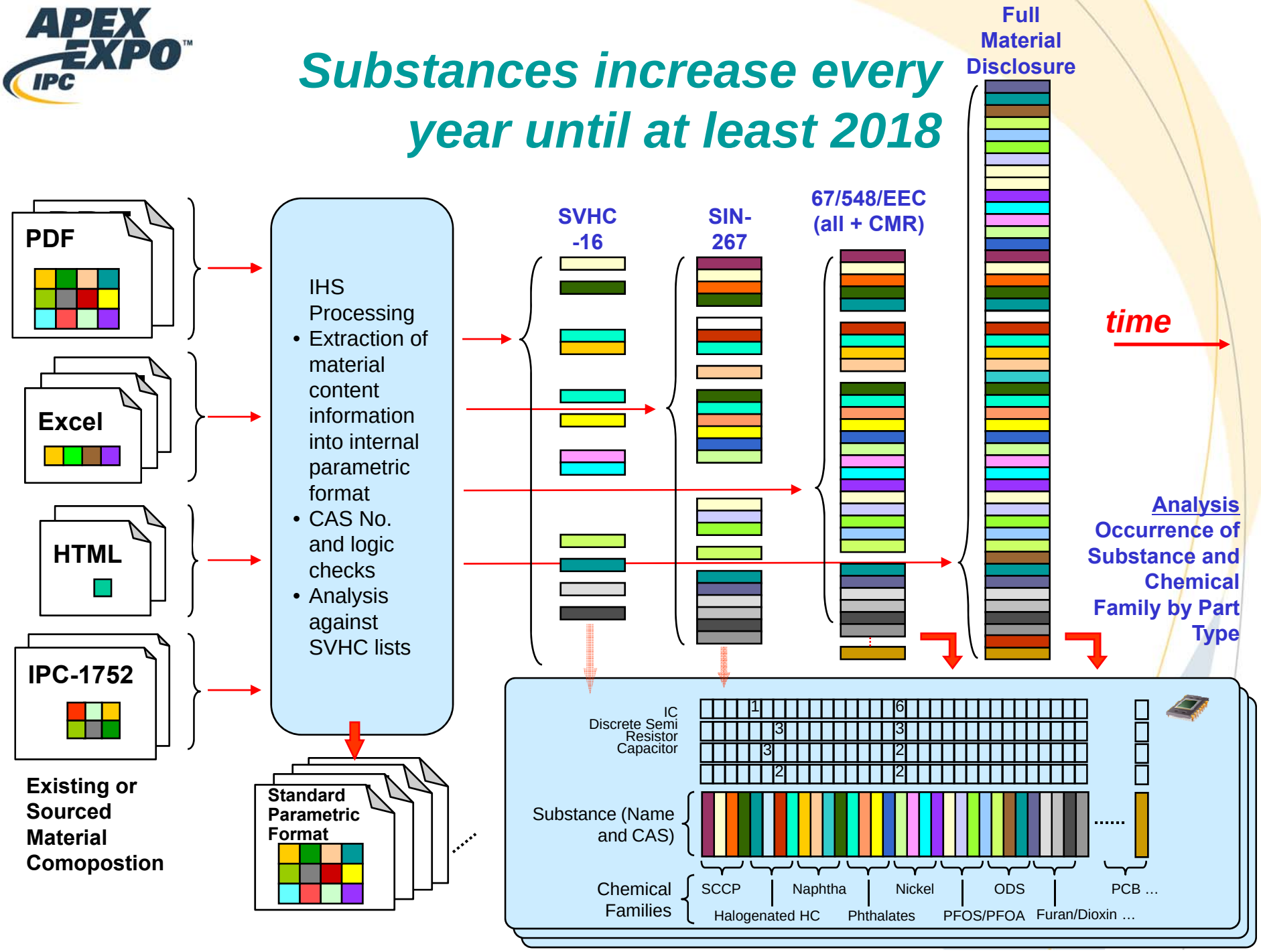
Supply chain will pull OEMs through



Coping with counterfeit part proliferation?



Substances increase every year until at least 2018

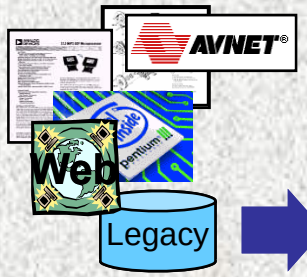


REACH

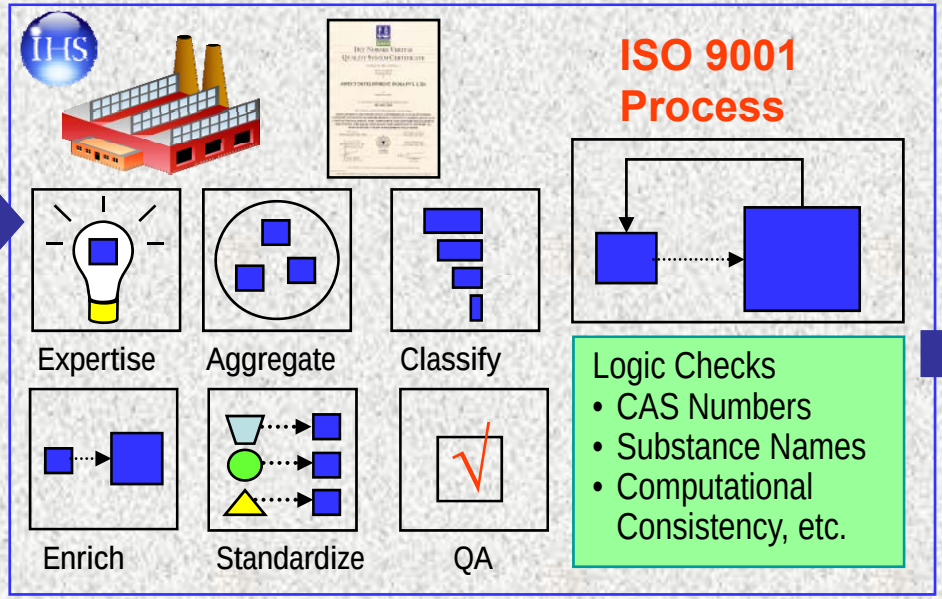
Content Services, Verification, Auditing

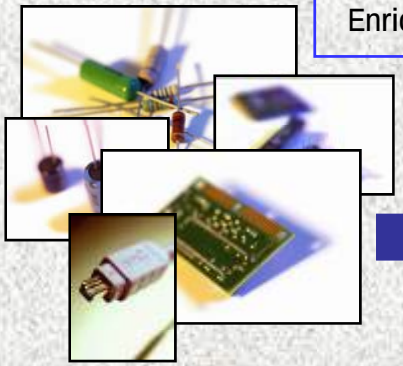
50M parts and 1B attributes

Initial and Sustaining Process

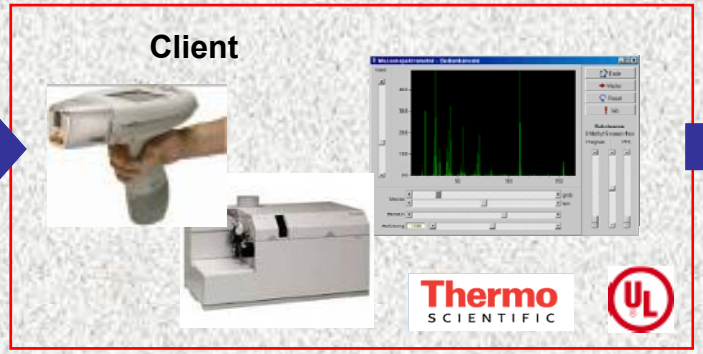


Part Content, Compliance and Related Sourcing

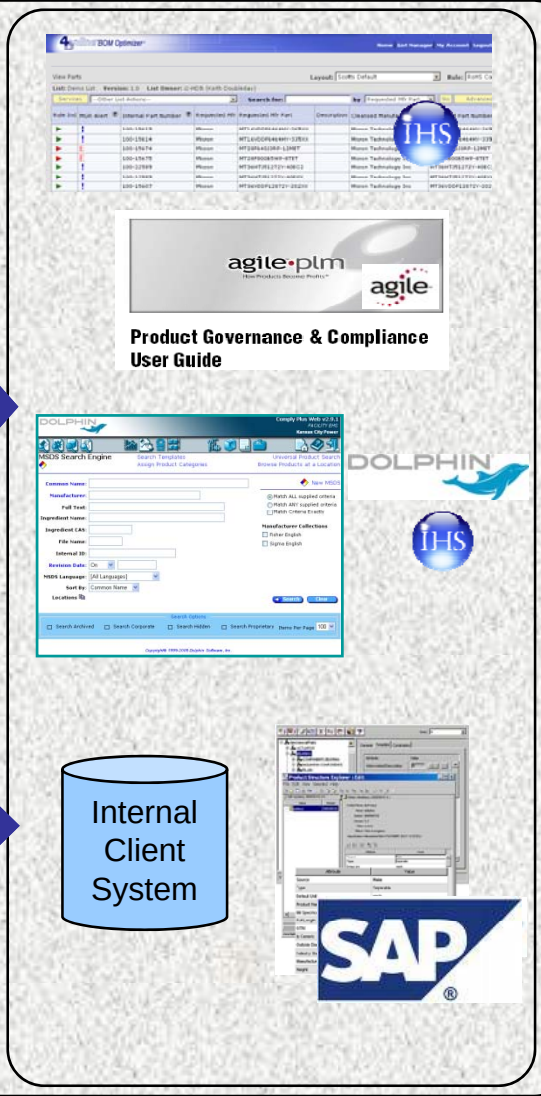




Part Sampling and Surveillance

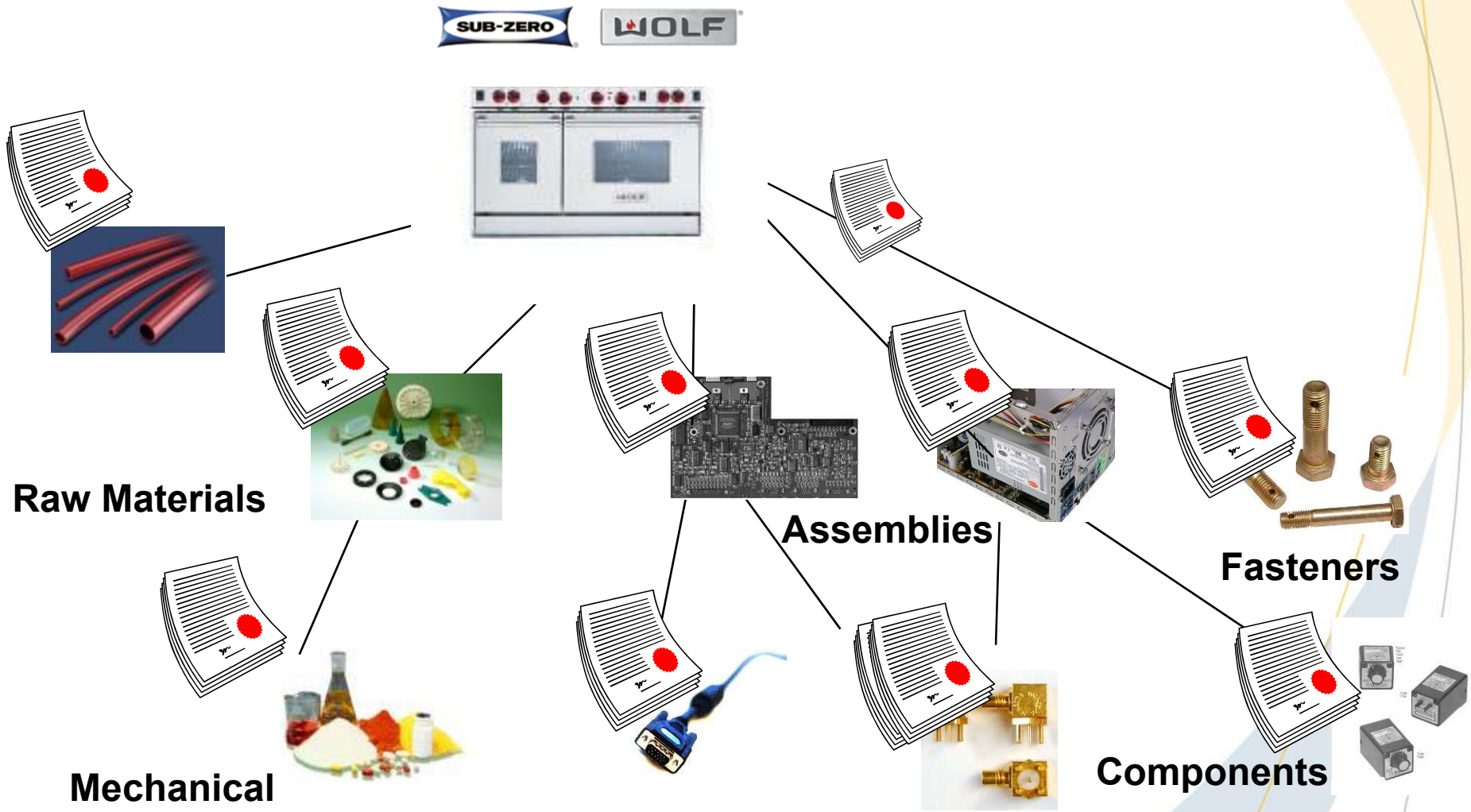


Client Incoming Inspection



REACH Compliance Data Collection

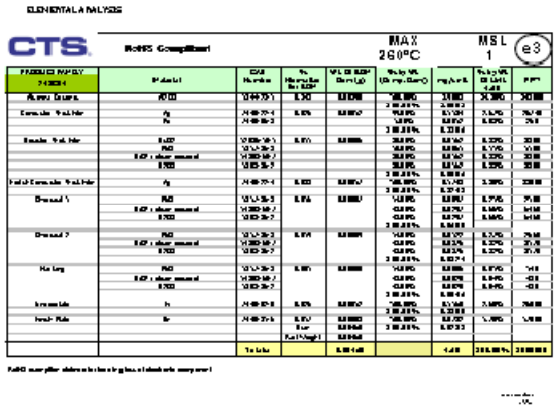
All Parts (AVL): Electronic, Mechanical, Sub-Assemblies…



REACH

FMD Samples: flat format (reported at the part level)

Source Datasheet (for example: non-standard pdf)


ELEMENTAL ANALYSIS

CTS RoHS Compliant MAX 260°C MSL 1 e3

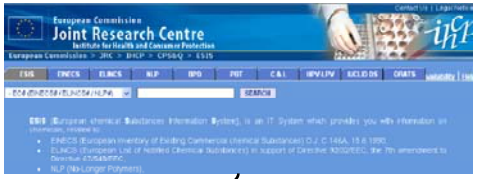
Extract substance information (maintaining hierarchy of composition)

Part Details	
Part Number	742C043111JP
Mfr Name	CTS CORP
Part Description	CHIP RESISTOR ARRAY
Part Status	ACTIVE

Product Content

Sub Part	Sub Part Weight (mg)	Sub Part Details	Sub Part Substance	CAS Number	Sub Part Substance Weight (mg)	Sub Part Substance Concentration (ppm)	Total Substance Weight (mg)	Total Substance concentration wrt total part weight (%)
ALUMINA CERAMIC	3.9008		ALUMINUM OXIDE	1344-28-1	3.9008	1000000	3.9008	84.80%
CONDUCTOR THICK FILM	0.1196		SILVER	7440-22-4	0.1184	989967	0.2932	6.37%
CONDUCTOR THICK FILM	0.1196		PALLADIUM	7440-05-3	0.0012	10033	0.0012	0.03%
FINISH PLATE	0.0782		TIN	7440-31-5	0.0782	1000000	0.0782	1.70%
MARKING	0.0046		LEAD MONOXIDE	1317-36-8	0.0006	130435	0.0276	0.60%
MARKING	0.0046		QUARTZ (SIO2)	14808-60-7	0.002	434783	0.0845	1.84%
MARKING	0.0046		BORON OXIDE	1303-86-2	0.002	434783	0.0845	1.84%
NOTCH CONDUCTOR THICK FILM	0.1748		SILVER	7440-22-4	0.1748	1000000		
OVERCOAT 1	0.069		LEAD MONOXIDE	1317-36-8	0.0097	140580		
OVERCOAT 1	0.069		QUARTZ (SIO2)	14808-60-7	0.0297	430435		
OVERCOAT 1	0.069		BORON OXIDE	1303-86-2	0.0297	430435		
OVERCOAT 2	0.0874		LEAD MONOXIDE	1317-36-8	0.0122	139588		
OVERCOAT 2	0.0874		QUARTZ (SIO2)	14808-60-7	0.0376	430206		
OVERCOAT 2	0.0874		BORON OXIDE	1303-86-2	0.0376	430206		
RESISTOR THICK FILM	0.0506		RUTHENIUM OXIDE	12036-10-1	0.0152	300395	0.0152	0.33%
RESISTOR THICK FILM	0.0506		LEAD MONOXIDE	1317-36-8	0.0051	100791		
RESISTOR THICK FILM	0.0506		QUARTZ (SIO2)	14808-60-7	0.0152	300395		
RESISTOR THICK FILM	0.0506		BORON OXIDE	1303-86-2	0.0152	300395		
UNDERPLATE	0.115		NICKEL	7440-02-0	0.115	1000000	0.115	2.50%
	4.6							100.00%

Flatten hierarchy and rollup substance information to part level



- Lookup by CAS in ESIS (European Substance Information System)
- Validate CAS and determine EC# and standardized name

Part Details	
Part Number	742C043111JP
Mfr Name	CTS CORP
Part Description	CHIP RESISTOR ARRAY
Part Status	ACTIVE
Hierarchy Form	Flat
Item Weight (mg)	4.6

Product Content

Substance (Mfr. Provided)	CAS Number (Mfr. Provided)	EC Number (look-up)	IUPAC Substance Name (look-up)	Total Substance Weight (mg)	Total Substance concentration wrt total part weight (%)
ALUMINUM OXIDE	1344-28-1	215-691-6	Aluminium oxide	3.9008	84.80%
SILVER	7440-22-4	231-131-3	Silver	0.2932	6.37%
PALLADIUM	7440-05-3	231-115-6	Palladium	0.0012	0.03%
TIN	7440-31-5	231-141-8	Tin	0.0782	1.70%
LEAD MONOXIDE	1317-36-8	215-267-0	Lead monoxide	0.0276	0.60%
QUARTZ (SiO2)	14808-60-7	238-878-4	Quartz (SiO2)	0.0845	1.84%
BORON OXIDE	1303-86-2	215-125-8	Diboron trioxide	0.0845	1.84%
RUTHENIUM OXIDE	12036-10-1	234-840-6	Ruthenium (IV) oxide	0.0152	0.33%
NICKEL	7440-02-0	231-111-4	Nickel	0.1150	2.50%

APEX EXPO IPC

REACH

Propeller (Blade and Hub) in hierarchical and flat view

Air Plane Propeller based on Industry Specs

Metallic Materials Data Handbook
Specification DTD150

Metallic Materials Data Handbook
Specification S97

Hierarchy View

Product Content							
Blade	**Material:**	**Aluminium Alloy per DTD150**		**Weight (kg):**	**182.34**		
Substance (Mfr. Provided)	**CAS Number (Mfr. Provided)**	**EC Number (look-up)**	**IUPAC Substance Name (look-up)**	**Minimum**	**Maximum**	**Total Substance Weight (kg)**	**Total Substance concentration wrt total part weight (%)**
COPPER	7440-50-8	231-159-6	Copper	3.500%	4.500%	8.2053	
MANGANESE	7439-96-5	231-105-1	Manganese	0.400%	0.700%	1.2764	
MAGNESIUM	7439-95-4	231-104-6	Magnesium	0.400%	0.900%	1.6411	
ALUMINIUM	7429-90-5	231-072-3	Aluminium	93.900%	95.700%	171.2173	
Hub	**Material:**	**Steel S97**		**Weight (kg):**	**91.17**		
Substance (Mfr. Provided)	**CAS Number (Mfr. Provided)**	**EC Number (look-up)**	**IUPAC Substance Name (look-up)**	**Minimum**	**Maximum**	**Total Substance Weight (kg)**	**Total Substance concentration wrt total part weight (%)**
CARBON	7440-44-0	231-153-3	Carbon	0.270%	0.350%	0.3191	
SILICON	7440-21-3	231-130-8	Silicon	0.150%	0.350%	0.3191	
MANGANESE	7439-96-5	231-105-1	Manganese	0.450%	0.700%	0.6382	
CHROMIUM	7440-47-3	231-157-5	Chromium	0.500%	0.800%	0.7294	
MOLYBDENUM	7439-98-7	231-107-2	Molybdenum	0.450%	0.650%	0.5926	
NICKEL	7440-02-0	231-111-4	Nickel	2.300%	2.800%	2.5528	
ALUMINIUM	7429-90-5	231-072-3	Aluminium	0.015%	0.050%	0.0456	
IRON	7439-89-6	231-096-4	Iron	94.300%	95.865%	85.9733	

Roll-up weights and calculate total substance % at the part level

** Use maximum of alloying element and minimum of main ingredient (discussion area)*

Product Content							
Propeller (Blade and Hub)							
Substance (Mfr. Provided)	**CAS Number (Mfr. Provided)**	**EC Number (look-up)**	**IUPAC Substance Name (look-up)**	**Minimum**	**Maximum**	**Total Substance Weight (mg)**	**Total Substance concentration wrt total part weight (%)**
COPPER	7440-50-8	231-159-6	Copper			8.2053	3.00%
MANGANESE	7439-96-5	231-105-1	Manganese			1.9146	0.70%
MAGNESIUM	7439-95-4	231-104-6	Magnesium			1.6411	0.60%
ALUMINIUM	7429-90-5	231-072-3	Aluminium			171.2628	62.62%
CARBON	7440-44-0	231-153-3	Carbon			0.3191	0.12%
SILICON	7440-21-3	231-130-8	Silicon			0.3191	0.12%
CHROMIUM	7440-47-3	231-157-5	Chromium			0.7294	0.27%
MOLYBDENUM	7439-98-7	231-107-2	Molybdenum			0.5926	0.22%
NICKEL	7440-02-0	231-111-4	Nickel			2.5528	0.93%
IRON	7439-89-6	231-096-4	Iron			85.9733	31.43%

Flat View

Baseline Data Standard

Realistic Minimum

- Holy Grail
  - Full Material Disclosure w/o Proprietary Data
  - IPC 1753 Class 6

- Realistic Baseline
  - Request Full Material Disclosure
  - Baseline - Joint Industry Guide A and B data with SVHC declarations
  - Proprietary for Full Material Disclosure – request SVHC CoC

- Fill Rates Expectation – Market Driven

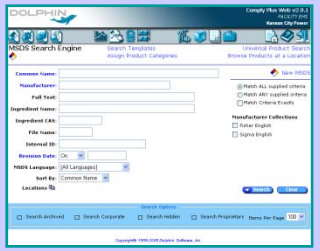
Leveraging Core Competencies

OEM focus on differentiation and value

Manufacture's Competency:

- Collecting publicly available data offers no value
- Decisions made based on data represents true value
- Focus on engineering and supply chain decisions – ECO …
- Leverage supplier relationship for escalation

Suppliers



- BOM load and analysis
- Parts Attributes
- Parts Reused

IHS Competency:

- Aggregating technical data core competency
- ISO 9001 certified data collection process
- Data validation with cooperative supplier escalation
- 50 million components and over 1 billion attributes processed
- Providing insight into data (SOR)

Information must become a core competency

Data Reduces and Identifies Risk

Transform your green goals / objectives into hard and fast requirements

- Design
- Compliance
- Green/substances

Communicate these to your internal and external partners

- Organizations: Compliance, Design, Supply Chain
- Partners, Customers, Suppliers

Plan, create, and monitor short and long term timelines

- Data collection to support reporting, audit, process needs
- Design/redesign for supply chain

Have a well-defined enforcement policy and process for non-compliance with these requirements

- Probationary periods
- Corrective action

Manage and monitor these ongoing

- Ongoing change to requirements assessed, monitored, documented
- Keeping information in sync