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Emerging policy issues and other issues of concern: report on progress on emerging policy issues: chemicals in products

Making the business case for knowing chemicals in products and supply chains

Note by the secretariat

The secretariat has the honour to circulate, for the information of participants, a report received from the Inter-Organization Programme for the Sound Management of Chemicals on making the business case for knowing chemicals in products and supply chains (see annex). The report is reproduced as received by the secretariat, without formal editing.

* SAICM/OEWG.2/1.

Annex

The Business Case for Knowing Chemicals in Products and Supply Chains

A publication in support of
the SAICM emerging policy issue of

Chemicals in Products

IOMC

INTER-ORGANIZATION PROGRAMME FOR THE SOUND MANAGEMENT OF CHEMICALS

A cooperative agreement among **FAO, ILO, UNDP, UNEP, UNIDO, UNITAR, WHO, World Bank and OECD**

The Business Case for Knowing Chemicals in Products and Supply Chains

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Key Messages from:

The Business Case for Knowing Chemicals in Products and Supply Chains

- Regulatory requirements, customer demands, media attention, non-governmental organization advocacy, product recalls, and market opportunities are driving companies to know more about the chemicals in their products and supply chains. The demand for increased transparency grows every day.
- The use of CiP information systems demonstrates clearly the value of knowing about chemicals contained in products. They continue to enable and stimulate companies and entire product sectors to realize benefits, from achieving product safety to leading product innovation.
- Most product sectors do not have sufficient information systems in place to enable the reliable exchange of chemical content information that is needed to meet current and future regulatory and customer demands.
- Active strategies to know and act upon information on chemicals in products generate long-term value for companies, their shareholders, the public, and the planet.
- Brands and retailers that are passive—reacting when compelled by crises or regulations—hold hidden liabilities of chemicals of concern in their products. In the past costs from these liabilities has run to the tens or hundreds of millions of dollars, has tarnished brand reputation, and resulted in loss of market share and valuation.
- From governments and consumers to retailers and brands, access to information and awareness of chemicals in products is driving companies and customers to prefer and select inherently safer alternatives, selections that make possible achieving the goal of the Strategic Approach to International Chemicals Management (SAICM).

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Executive Summary

Regulatory requirements, customer demands, media attention, non-governmental organization (NGO) advocacy, product recalls, and market opportunities are driving companies to know more about the chemicals in their products and supply chains. From Apple to the Zero Discharge of Hazardous Chemicals initiative, companies want to know more about the chemicals used in manufacturing and contained in products. Without this knowledge companies are blind to the hidden liabilities of chemicals of concern* in their products. This blind spot can be a significant barrier to generating value as transparency becomes increasingly essential to informed decisions, supplier reliability, and clear communication to customers. This report develops the business case for knowing chemicals in products and across supply chains. It details the costs that companies pay for not knowing or not acting upon the knowledge of chemicals of concern in their products as well as the benefits to companies of knowing chemicals in products and using safer substitutes.

From Passive to Active—Strategic Options for Managing Chemicals in Products and Supply Chains

Business strategies for managing chemicals in products and supply chains vary widely, especially for those companies and purchasers that are downstream from chemical manufacturing and use chemicals by virtue of the products they purchase. The dominant chemical management strategy for downstream users is the "Passive Strategy," which is to be compliant with government regulations, i.e. certain chemicals may not be present in a product over defined thresholds. Companies employing the Passive Strategy do not employ robust oversight measures or preemptively look for chemical risks in their products and in the short term save costs by not investing in systems, staff, or third parties for chemicals management beyond meeting regulatory requirements.

The Passive Strategy, however, has serious flaws. It leaves companies vulnerable to the hidden liabilities of chemicals of concern in products and supply chains, and unprepared for swiftly changing market demands and regulations. Moreover the Passive Strategy leaves companies vulnerable to chemical crises that incur significant costs—monetary, to brand reputation, and to stock value—by failing to invest in due-diligence chemicals management.

An alternative approach for companies is the "Active Strategy"—the proactive management of chemicals in products and supply chains that seeks to stay ahead of regulatory and market demands. Companies employing the Active Strategy integrate chemicals management into product design, material selection, and supplier engagement. Chemicals become yet another element to be considered in products along with costs, performance, and other sustainability attributes. Companies in the Active Strategy make upfront investments ahead of regulatory and market demands and invest in systems for knowing chemicals in products and supply chains.

The Active Strategy creates long-term value for companies and shareholders by enhancing brand reputation, increasing sales, creating innovative products, increasing supply chain reliability, and avoiding the high costs of chemical crises. Seagate Technology PLC, Coastwide Laboratories (division of Staples), and Shaw Industries are all examples given in this document of companies employing an Active Strategy to chemicals management.

Passive Strategy—the Costs of Not Knowing Chemicals of Concern in Products

Chemicals of concern in products and supply chains are a hidden liability to companies, investors, and customers. If that liability becomes revealed to regulators or customers the costs can be quite high in terms of fines, lost market share and value, and tarnished brand reputation. Fines levied by regulators in the U.S. on retailers for failure to appropriately manage products that become hazardous waste when they break or are returned by customers are an indicator of the chemical risks to downstream users of chemicals of concern in products: over a three year period Walmart, Target, Walgreen Co., CVS

* In this report "Chemicals of concern" are "chemicals which, due to their inherent hazardous properties, present a known or reasonably suspected risk to human health and/or the environment" (Becker, 2009). Readers are also referred to chemicals targeted under Strategic Approach to International Chemicals Management (SAICM), for example, "persistent, bioaccumulative and toxic substances (PBTs); very persistent and very bioaccumulative substances; chemicals that are carcinogens or mutagens or that adversely affect, inter alia the reproductive, endocrine, immune or nervous systems; persistent organic pollutants (POPs), mercury and other chemicals of global concern" (SAICM, 2006, p.15 footnote).

Pharmacy, and Costco Warehouse paid $138 million in fines. These fines demonstrate the need for retailers to know the chemicals of concern in their products, know which chemicals trigger hazardous waste regulations, as well as to establish chemical management systems in their stores.

Similarly, product recalls exemplify the hidden liability of chemicals of concern coming to public light—where an unknown chemical of concern in products causes brands to incur significant costs for non-compliance, legal counsel, supply chain communication, product takeback, and/or product reformulation. All these costs can stretch into the hundreds of millions of dollars. Sony's recall of its PlayStation in 2001 cost the company $150 million in lost sales and product reformulation costs. Mattel's recall of more than 9 million toys in 2007 cost the company $110 million in recall expenses and pushed its stock price down 18%. And RC2 Corporation's recall of its toy trains in 2007 cost the company $48 million in recall expenses and legal fees, and its stock price dropped 50%.

Product recalls and other government non-compliance fines clearly demonstrate the costs of the Passive Strategy to brands and retailers. Yet the benefits of the Passive Strategy—delayed investments—are quite modest in comparison to the crisis costs of chemicals management. While the regulation of chemicals in products continues to grow globally, it is market forces that are moving faster and more aggressively to demand chemical ingredient transparency and safer substitutes. Two examples highlight the market costs of failing to address consumer demands for safer chemicals in products.

In 2009, Johnson & Johnson (international consumer and medical products corporation) lost significant sales in China when NGOs in the U.S. found chemicals of concern—formaldehyde and 1,4-dioxane—in some of its baby products (including shampoo). Consumers, when informed of the presence of the chemicals in the products, chose to avoid the Johnson & Johnson brand. The response in China was swift: tens of thousands of consumers stopped buying its products, thousands of stores dropped its products, and its market share for baby products declined almost 10%. In another similar event, retailers and consumers reacted swiftly when water bottle manufacturer, SIGG, failed to disclose a known chemical of concern in its products. SIGG USA (a subsidiary of SIGG Switzerland) filed for bankruptcy in 2011 with $13 million in liabilities due to failure to disclose Bisphenol A (BPA) in its water bottles (SNEWS, 2011).

The SIGG USA, Johnson & Johnson, product recalls, and regulatory non-compliance cases all illustrate the corporate risks of chemicals of concern in products. These risks are often hidden from the companies themselves, only coming to light through government enforcements or NGO campaigns. The Passive Strategy clearly creates vulnerabilities for companies, including tarnished brand reputation, lost shareholder value, and the high monetary costs of responding to revelations under crisis conditions.

Active Strategy—Creating Long-Term Value by Implementing Systems to Know Chemicals in Products and Supply Chains

Proactive businesses do not wait for government regulations, product recalls, and market demands to emerge before knowing the chemicals in their products and supply chains and reducing the use of hazardous chemicals. Instead they integrate knowledge of chemicals in products and supply chains into their management systems and create value for their organizations. Seagate Technology PLC (manufacturer of data storage devices), Coastwide Laboratories (manufacturer of cleaning products and division of Staples, Inc.), and Shaw Industries (manufacturer of flooring products, including carpets) provide three examples of companies implementing the Active Strategy to chemicals management.

Seagate realized many benefits from knowing chemicals in products, including:

- Reduced costs: eliminating the "saw tooth effect." Every time a new chemical of concern emerges due to regulations or market forces Seagate staff simply search it chemicals management database to see if the chemical is present; enabling the company to quickly respond to new substance restrictions with current resources. As more and more chemicals of concern emerge the data collection costs remain relatively stable for Seagate instead of varying widely up and down (saw tooth effect) as the company cycles through new data requests (costs rise) and no new data requests (costs decline).
- Increased supplier reliability: An unintended benefit of Seagate's chemical management data system is a much more thorough understanding of its suppliers and the quality of their products. By knowing in detail the chemistries of its suppliers' products, Seagate can quickly identify when changes are being made to the materials in its components.

Coastwide Laboratories realized significant benefits when it invested in a new product line based on safer chemicals. Recognizing the changing market demands, Coastwide's Sustainable Earth brand become the primary driver behind the company's rapid growth during the early 2000s: net operating

income averaged double to triple the industry norm, sales rose 8%, market share grew to about 16% of the regional market, and new customers rose 35%.

Shaw Industries investment in safer chemicals for carpet backings netted the company substantial benefits, including: replacing polyvinyl chloride (PVC) plastic and its phthalate plasticizer with safer alternatives, reducing the weight of carpet backing by 40 percent, and quickly capturing market attention—production capacity tripled by 2000 and, by the end of 2002, sales of its new EcoWorx products exceeded PVC-backed carpets.

The demand for increased chemical transparency up and down the supply chain grows every day as the cases above illustrate. From consumers to retailers to brands, awareness of hazardous chemicals in products and supply chains is driving companies to disclose information on the chemicals in products and to select inherently safer chemicals. These are the companies that are leaving behind crisis-driven change and creating long-term value for themselves, their shareholders, the public, and the planet.

1. Introduction: Knowing Chemicals in Products & Supply Chains—The Future is Now

Regulatory requirements, market demands, media attention, non-governmental organization (NGO) advocacy, product recalls, and market opportunities are driving companies to learn more about the chemicals in their products and supply chains. From Apple to the Zero Discharge of Hazardous Chemicals initiative, companies want to know more about the chemicals used in manufacturing and contained in products. Without this knowledge companies are blind to the hidden liabilities of chemicals of concern to human health and the environment in their products. This blind spot can be a significant barrier to generating value as transparency becomes increasingly essential to informed decisions, supplier reliability, and clear communication to customers.

The growing demand for more knowledge and disclosure of chemicals in products is part of a larger movement to transparency. As Meyers and Kirby write in their *Harvard Business Review* article, "Leadership in the Age of Transparency," "The first thing we can all agree on is that greater accountability for corporate impact is unavoidable" (Meyer & Kirby, 2010). They articulate the growing expansion of transparency as "ripples of responsibility" that emanate out from the core business (see Figure 1). While Meyer and Kirby do not explicitly note chemicals in products, the implications are clear: businesses, especially brands, are encountering growing demand for transparency up and down their supply chains. Applying Meyer and Kirby's "ripples of responsibility" to trends in chemical transparency we see downstream businesses taking ownership of chemicals in their products, taking action on chemicals in their supply chains and sector initiatives to enhance chemicals management, and taking interest in the sources of their feedstocks and chemical regulations.

Figure 1. Leadership in the Age of Transparency: Ripples of Responsibility (Source: figured published in Rossi, Peele, & Thorpe, 2012; developed from Meyer & Kirby, 2010)

Knowing chemicals in products and supply chains is foundational to advancing the development and use of safer chemicals. Without this knowledge businesses will not know nor will they be able to determine whether chemicals of concern to human health or the environment are present in their products and supply chains. "Chemicals of concern" are "chemicals which, due to their inherent hazardous properties, present a known or reasonably suspected risk to human health and/or the environment" (Becker, 2009). As highlighted in the BizNGO *Guide to Safer Chemicals*:

> Traditionally downstream users, especially brands and retailers, have not considered chemicals management as part of their responsibility. But ignorance is no longer tenable and in fact presents a very real business risk. Increasingly downstream users are the ones whose reputation is at risk when toxic chemicals are found in their products and in their stores. Downstream users are increasingly being held accountable for the chemical ingredients in their products and the environmental and human health impacts of chemicals in entire supply chains (Rossi, Peele, & Thorpe, 2012, p. 6).

Yet companies typically know very little about the chemicals in their products. Complex global supply chains and confidential business information claims hinder the collection of critical product content (Torrie, Buczek, Morose, & Tickner, 2009).

While the market barriers to knowing chemicals in products and supply chains are clear, companies that overcome these barriers capture clear benefits by reducing costs, protecting and more importantly enhancing brand reputation, managing supply chain quality, improving transparency and communication throughout the supply chain, expanding market share, and increasing trust among consumers, employees, and communities. Protecting brand image, in particular, is a significant driver for sustainability initiatives in general. As the 2009 European Sustainable Procurement Benchmark (a survey of procurement executives at 95 of Europe's

largest companies) found, avoiding risk to brand or image was the top driver for investing in sustainability (HEC Paris & EcoVadis, 2009).

This report develops the business case for knowing chemicals in products and across supply chains. The methodological approach is to build from secondary sources of data on the costs and benefits associated with not knowing and knowing chemicals in products; and to supplement the report with interview data from Seagate Technology PLC—a manufacturer of storage drives. The report specifies the costs that companies pay for not knowing or not acting upon the knowledge of hazardous chemicals in their products as well as the benefits to companies of knowing chemicals in products and using safer substitutes. And it frames the management of chemicals in products as a strategic choice that ranges from being passive to active.

2. From Passive to Active—Strategic Options for Managing Chemicals in Products and Supply Chains, and Using Safer Substitutes

Business strategies for managing chemicals in products and supply chains vary widely, especially for those companies and purchasers that are downstream from chemical manufacturing and use chemicals by virtue of the products they purchase. Brands, retailers, hospitals, and governments are all examples of downstream users of chemicals—their expertise is in design, purchasing, distribution, and/or service delivery, not chemicals. Table 1 summarizes the potential costs and benefits of two strategic approaches to managing chemicals in products and supply chains: Passive and Active strategies.

The dominant chemical management strategy for downstream users is the "Passive Strategy"—be compliant with government regulations. Compliance is the core driver to action in the Passive Strategy where government regulations define the practice of how to manage chemicals in products and supply chains. The core benefit of the Passive Strategy is it reduces costs, at least initially, as companies do not invest in systems, staff, and/or third parties for chemicals management beyond what is needed to meet regulatory requirements.

The low initial investment costs are the "benefits" of the Passive Strategy. In Table 1 this is the "Delay Quadrant." While companies will eventually need to know—or at least hire third parties that will know—the chemicals in their products and supply chains, they will not take action until compelled by government action. In the Delay Quadrant companies gain a temporary benefit by postponing action to the future.

The costs to the Passive Strategy, however, can be quite high to companies. Products containing chemicals of concern, whether unknown or known by a brand, create an embedded liability for that company. The mere presence of a chemical of concern in a product is a liability because it can trigger an NGO campaign, a lawsuit, regulatory action including product recalls and fines, and negative media—especially social media, which in turn can lead to a tarnished brand, lost sales, lower share price, new costs for crisis management and product reformulation. Referring to Table 1, these unplanned costs of the Passive Strategy are in the "Crisis Quadrant"—"Crisis" because now companies need to play catchup from their delayed action. The costs that they postponed over time have accumulated and now trigger immediate (re)actions and potentially very high costs. At its most extreme, playing in the Crisis Quadrant can cause bankruptcy, as happened in the case of SIGG USA—a distributor of SIGG water bottles in the U.S.

The Crisis Quadrant highlights the costs of managing chemicals one-by-one as new regulations emerge and markets shift. Companies move from one chemical of concern, for example decabromodiphenyl ether (decaBDE), to another chemical of concern, for example, Bisphenol A (BPA), rather than having a comprehensive value-based strategy for managing chemicals at the organizational and supply chain levels.

An alternative approach for companies is the "Active Strategy"—the proactive management of chemicals in products and supply chains that creates long-term value by staying ahead of regulatory and market demands. This involves making upfront investments in knowing chemicals in products and supply chains and creating an organizational culture that values anticipatory action—such as scanning the scientific horizon and interacting with government agencies and NGOs to identify emerging chemicals of concern to human health or the environment. Proactively identifying and avoiding chemicals of concern avoids the high cost of rapid formulation changes—costs that occur when regulatory requirements, customer demands, or NGO campaigns force companies to change products reactively.

Operating in the "Value Quadrant" of Table 1 creates opportunities for enhancing brand reputation, increasing sales and stock price, and developing innovative products that capture new market share. The benefits captured in the Value Quadrant are harder to quantify than the costs in the Crisis Quadrant because they result from companies integrating safer chemicals into overall organization strategy—especially product design and development—and do not stand alone as discrete results. Companies in the Value Quadrant stay ahead of regulatory and market uncertainty, know chemicals in their products and supply chains, increase transparency, use safer alternatives, innovate, and thereby generate long-term value.

Benefits and Costs	Strategy	
	Passive – Don't Know and/or Don't Use Safer Substitutes	**Active – Know Chemicals and Use Safer Substitutes**
Potential Benefits	**Delay Quadrant** Low initial costs, no investment in: -- chemical ingredient knowledge: no cost for data collection and management or hiring third party -- product reformulation -- product verification and testing -- supplier communication and training	**Value Quadrant** -- Brand reputation protected and enhanced -- Increased sales -- Higher stock valuation -- Costs greatly reduced or eliminated for crisis management -- Nimble in addressing rapidly shifting market and regulatory demands -- Increased supply chain reliability and quality (for example, require suppliers to test products at third party laboratories) -- Better, more innovative products -- Responsiveness to customers builds long term relationships -- Recycle and reuse easier -- Lower costs of disposal -- Lower contingency insurance costs possible
Potential Costs	**Crisis Quadrant** -- Brand reputation damaged -- Higher costs for compliance, legal, and crisis management -- Lost customer trust -- Lost sales -- Product recalls -- Lower stock valuation -- Bankruptcy -- Government fines -- Lawsuits -- Product reformulation under crisis conditions -- Vulnerable to advocacy campaigns -- Supply chain disruption	**Investment Quadrant** -- Invest in knowing the chemicals commonly used by suppliers in manufacturing -- Invest in system to collect chemical ingredient information from suppliers or collect and manage data through a third party -- Invest in product reformulation ahead of regulations and market demand -- Randomly test products to ensure they meet requirements for restricted substances -- Train suppliers in better chemical selection and management practices inventory

Table 1. From Passive to Active: Strategies for Creating Long-term Value by Knowing Chemicals in Products and Supply Chains

The Active Strategy involves upfront costs—the "Investment Quadrant" in Table 1—to create and implement systems for collecting and managing data on chemicals in products and supply chains. These investments are essential to enabling a company to operate in the Value Quadrant. This knowledge, in turn, enables companies to make changes in production and product design on their schedule, reducing costs and opportunities for error that occur when operating in the Crisis Quadrant. Additionally it is much cheaper to remove chemicals of concern during the design phase—designing for the environment—as compared to trying to remove chemicals of concern from products that are already being mass produced and sold globally. For example, the U.S.-based conglomerate, 3M, "saved more than $500 million in lower raw material, compliance, disposal, and liability costs" from 1975-1990 by investing in pollution prevention initiatives (Hart, 2005).

In an analysis of value drivers associated with sustainable procurement practices, the consultancy Price Waterhouse Cooper (2010) found that the financial impact on brand value from passive strategies like poor supplier practices, which included the costs of supply chain disruptions from noncompliance with environmental regulations, can result in a decrease in market capitalization of 12%. Conversely, sustainable procurement programs—active strategies--provided a payback of up to 85 times program costs.

The next two sections summarize the costs and benefits to the passive and active strategies to managing chemicals in products and supply chains. The potential business costs detailed in the Passive Strategy section are reversed in the Active Strategy section where they become potential benefits—illustrating how an active

approach to knowing chemicals can reduce costs associated with managing chemicals of concern in products and across supply chains and generate real corporate benefits.

3. Passive Strategy—The Costs of Not Knowing Chemicals in Products and Supply Chains, and Not Using Safer Substitutes

Ignorance is not good business practice when it comes to hazardous chemicals in products and supply chains. Governments, businesses, NGOs, and consumers increasingly do not want products that contain hazardous chemicals nor do they want workers using those chemicals in manufacturing. Not knowing chemicals of concern in products and supply chains, and not acting upon that knowledge, especially for brands and retailers, is a potentially huge liability. Chemicals of concern in products and supply chains are a hidden liability—omnipresent but if and when that liability becomes real is almost a seemingly random event. The following sections detail the sometimes spectacular costs of regulatory non-compliance and failure to meet market demands for safer chemicals.

a. The Costs of Non-Compliance

Under the European Union (EU) Registration, Evaluation, and Authorisation of Chemicals (REACH) regulation companies that sell products to the consumer are required to know whether their product contains a substance of very concern (SVHC). Under California's Safe Drinking Water and Toxic Enforcement Act (also known as "Proposition 65") businesses must label products that contain carcinogens or reproductive toxicants above safe harbor thresholds. The EU Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive, EU Cosmetics Directive, and the United States (U.S.) Consumer Product Safety Improvement Act (CPSIA) are all examples of laws that restrict chemicals in products. Globally, China, Japan, South Korea, and other countries are developing and implementing regulations similar to EU REACH and EU RoHS.

For businesses manufacturing articles or formulating products the costs of compliance—to merely know whether or not your product contains a chemical of concern or a restricted substance—are growing every year. For example, the Consumer Electronics Association found that average company costs of compliance with the EU RoHS directive are: initially $2.6 million with annual maintenance costs of $0.48 million per company (note initial costs can include product reformulation)(HKTDC, 2008). Similarly, the Toy Industry Association in the U.S. estimates the costs of compliance with Washington State's Children's Safe Products Act at up to "$27.6 million in the first year, followed by $2.8 million annually in subsequent years just for testing data needed to comply with the program" (Hackman, 2013). While industry associations may inflate the costs of compliance, the trend line is clear: the costs of ensuring products do not contain chemicals of concern are rising.

Companies can incur significant costs, both monetary and to brand reputation, when they do not know the chemicals in their products or are out of compliance with government regulations. Merely being compliant with regulations concerning chemicals of concern in products—the Passive Strategy—is proving, however, to be a challenge due to a combination of factors, including:

- Lack of awareness of chemical regulations, especially for small businesses and those far down the commercial supply chain, like retailers.
- Lack of chemical ingredient transparency in products and manufacturing processes.
- Complex supply chains.
- Consistently poor data quality (chemical ingredient information) due to a range of causes including:
    - lack of knowledge and capacity on the part of suppliers,
    - insufficient data management systems,
    - supply chain pricing that incentivizes cutting corners including using the lowest cost materials (whose chemical ingredients are not known), and
    - suppliers using counterfeit and contaminated products.

These factors are causing record fines and costs to businesses for compliance failures.

i. Non-hazardous Products as Hazardous Waste: A Challenge for Retailers

A surprise for retailers in the U.S. is that products they routinely sell on their shelves as regular consumer items (that is, as a non-hazardous product) become hazardous waste when they hit the disposal system (either through customers returning the product or the product breaking in the store), because they contain chemicals that upon becoming waste, are regulated as hazardous. The costs to businesses for not knowing the chemicals in their products and not being compliant with regulations can be spectacular. Even given the limited reporting of legal fees, crisis management costs, supply chain management costs, government fines, lawsuit settlements, product reformulation costs, declines in sales and shareholder value, and damaged reputation, the monetary costs of mismanaging chemicals of concern can be huge.

Over the past few years many retailers in the U.S. have been hit with fines for failure to comply with hazardous waste regulations—and note these are just the fines and do not include costs for crisis management, including legal fees, as well potential damage to reputation and lost sales:

- Walmart in 2013:
  - $81.6 million in fines for the mishandling of products sold in its stores that became damaged or were returned—thus becoming hazardous waste, including:
    - $60 million to resolve Clean Water Act violations in California, including the illegal dumping of corrosive and hazardous liquid wastes into drains.
    - $14 million to resolve violations to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) in Missouri, including failure to properly train its employees with respect to the required handling of pesticides that were returned to Wal-Mart.
    - $7.6 million civil penalty and agreement to implement a comprehensive, nationwide environmental compliance program to manage hazardous waste generated at its stores (Siros, 2013).
- Other retailers fined by the U.S. Environmental Protection Agency (EPA) and state regulators for similar mishandling practices as Walmart:
  - Target Corp. in 2011: $22.5 million;
  - Walgreen Co. in 2012: $16.6 million;
  - CVS Pharmacy in 2012: $13.75 million; and
  - Costco Warehouse in 2012: $3.6 million (Berlin & Sieg, 2013).

These fines exemplify why U.S. retailers like Walmart and Target are becoming more attentive to the chemical ingredients in the products on their shelves and developing and implementing chemical policies that challenge brands selling in their stores to be more transparent about chemical ingredients in their products as well as avoiding chemicals of concern to human health and the environment.

ii. Product Recalls: Complex Supply Chains are a Management Challenge for Brands

Brands, like retailers, are increasingly challenged by the need to manage chemicals of concern in their products. Increasingly brands that do not exercise sufficient oversight are being forced into costly recalls of their products due to failures to comply with chemical in product labeling and restriction requirements.

Outsourcing manufacturing and component or material production, in general, saves brands money. However, brands now must exercise diligent oversight over their increasingly complex supply chains to ensure product performance as well as sustainability performance. A consultancy, Kinaxis Corp. (2012), in a white paper "Supply Chain Risk Management", cites research that estimates "supply chain glitches" as causing firms on average to lose over 10% in shareholder value as well as 6.9% in sales. In a survey of the food and beverage industry on recalls caused by a variety of factors including chemical issues, 78% of respondents are managing the risks of recalls by procuring insurance and many are particularly concerned about the impact of recalls on brand reputation (GMA, 2011). The greater complexity of supply chains creates vulnerabilities for brands. As brands outsource manufacturing they lose direct oversight over manufacturing. Suppliers, driven by cost cutting, might select cheaper formulations and materials that might contain chemicals of concern. The suppliers may or may not know the chemicals in the products they purchase; however, chemistry is not their concern—it is meeting performance requirements at lowest cost.

Products containing chemicals of concern, whether unknown or known by a brand, create a hidden liability for that company. Product recalls exemplify a hidden liability coming to public light—where an unknown

chemical of concern in the product creates a situation of non-compliance and legal action, and costs in the tens to hundreds of millions of dollars:

- Sony—in 2001, during the height of Christmas sales, Dutch authorities halted the shipment of 1.3 million Sony PlayStation game machines due to illegally high cadmium levels in their cables. The cost: $150 million in lost sales and product reformulation for Sony (Lewis, Liroff, Byrne, Booth, & Baue, 2008).
- Mattel—more than 9 million toys, including Barbie dolls, recalled due to lead in their paint in 2007:
  - $110 million: in recall costs including communications campaign.
  - Stock price down 18%: between August and December 2007. The stock value decreased from US $20.69 on 1 August 2007 to US $17.25 on 28 December 2007 (PricewaterhouseCoopers, EcoVadis, & INSEAD, 2010).
- RC2 Corporation—lead paint discovered on its Thomas & Friends™ toy trains in 2007:
  - Recalled more than 1.5 million units after learning they violated US government standard for lead in paint (Becker, Edwards, & Massey, 2010).
  - $17.6 million: cost of product recall and legal fees related to class action lawsuits (RC2 Corporation, 2008).
  - $30.0 million: cost of class action lawsuit settled in January 2008 (The Associated Press, 2008).
  - Stock price down 50%: From 2007 to 2008 RC2's stock price declined 50%, from greater than $40 to less than $20 per share. RC2 earned two cents a share from continuing operations, compared with 44 cents a share a year earlier (Investor Environmental Health Network and BSR, 2008).
- Palm—product fails EU RoHS compliance. The cost: stock price down 14% in June 2006 due to its Treo 650 product failing to meet EU RoHS requirement, causing Palm to withdraw the product from the European market (Wearden, 2006).
- McDonald's—in June 2010:
  - 13.4 million glasses recalled: 12 million in the U.S. and 1.4 million in Canada—Shrek-themed Happy Meal glasses recalled because of cadmium in the paint. McDonald's offered a refund of $3 for each glass (CPSC, 2010).
  - Total costs likely in the tens of millions: the exact cost to McDonald's has not been disclosed. But the potential costs are clearly in the tens of millions of dollars due to lost sales, refunds, costs of reverse logistics—managing the return of the glasses, and internal crisis management.

The year 2007 was a historical year in the U.S. for toy product recalls, especially due to lead contamination. An analysis of the 2007 Christmas season showed sales of toys in categories that experienced recalls were down by about 30 percent, compared to other toys that these manufacturers sold. There was also a ripple effect among companies who sold products in similar categories but who did not experience recalls. These companies' toy sales were down about 25 percent compared to 2005 (Freedman, Schettini Kearney & Lederman, 2009).

An index created to track the stock market value of companies facing recalls showed publicly-traded toy companies' stock fell 25.6 percent by year-end 2007 from the earliest round of recalls in May. Toy firms not facing recalls fell 7.6 percent in the same period (Freedman, Schettini Kearney & Lederman, 2009).

Other notable recalls in the last few years include: Walmart recalling over 55,000 necklaces due to cadmium contamination in 2010 (Washington Toxics Coalition, 2013); and the U.S. retailer Bed Bath and Beyond recalling toilet paper holders contaminated with the radioactive chemical, Cobalt-60 (Kinaxis Corp., 2012).

In addition to the product recalls, governments are fining companies for their failure to comply with chemicals in product labeling and restriction requirements. For example:

- $22.6 million: the cost in 2012 alone for failure to comply with California's Proposition 65 labeling requirements on carcinogens and reproductive toxicants in products (State of California Department of Justice Office of the Attorney General, 2012).

- Unilever paid $1.3 million for selling a deodorant body spray that failed to meet California's Clean Air Standards for VOCs in aerosol deodorants (California Environmental Protection Agency Air Resources Board, 2010).
- Fines paid by toy and children product manufacturers for failure to comply with U.S. CPSIA:
  - Mattel, Inc./Fisher Price, Inc. paid $2.3 million in June 2009,
  - Mega Brands America Inc. paid $1.1 million in April 2009, and
  - RC2 Corporation/Learn Curve Brands Inc. paid $1.25 million in December 2009 (Law360, 2011).
  - Daiso paid $2.05 million for importing children's toys and jewelry and recalled coin purses, charm necklaces and earrings because of excessive lead contamination in March 2010 (Consumer Product Safety Commission, 2010).
- Reebok (the U.S. shoe manufacturer) paid a $1.0 million fine (the largest for a Federal Hazardous Substances Act) and recalled 300,000 bracelets due to unsafe levels of lead in the product in 2008 (Consumer Product Safety Commission, 2008).

Baseline compliance costs with regulations of chemicals of concern in products are clearly trending upwards—especially for businesses selling toys, children's products, and electronics, or giving away/selling cheap promotional items. Both the recalls suffered by Reebok and McDonald's were not for their core products, but for promotional items. The costs businesses incur in fines, legal fees, product recall management, brand reputation, and lost sales would easily pay for implementing systems to manage chemicals in products.

Product recalls can be both costly to companies as well as relatively ineffective in removing hazardous products from circulation. A report by Ken Ross to the International Consumer Product Safety Caucus noted that the "US Consumer Product Safety Commission (CPSC) has said that the average response rate for most recalls is between 4% and 18%" (Ross, 2009). A 2014 study by the advocacy group Kids in Danger reported that, based on recent CPSC data, only 10 percent of recalled children's products are ultimately fixed, replaced or destroyed, including less than 5 percent of the products in consumers' homes (Ryan, 2014). Such statistics further underline the need for diligence in preventing hazardous products to enter into circulation.

b. The Costs of Changing Market Demands—Businesses and Consumers want to Know about Chemicals in their Products

Customer demand is rising rapidly, at both the individual and organizational levels, for products that do not contain chemicals of concern to human health or the environment. The costs to businesses for not acting upon the knowledge that hazardous chemicals are in their products or not being transparent about the hazardous chemicals in their products can be quite significant in today's market. At its most extreme point the liabilities can become so huge that the company goes bankrupt.

Increasingly downstream businesses are requesting greater chemical ingredient disclosure from suppliers, either directly or through a third party. Google (2014), concerned with chemicals of concern in its office environment, requires suppliers of building products to provide it with chemical ingredient disclosure using the Health Production Declaration form. Walmart requires suppliers of chemical intensive products like cleaning and beauty care products to submit ingredient disclosure to a third party, The Wercs. The Wercs holds the chemical ingredient information private, but provides Walmart product scores (Becker, Coffin, & Tickner, 2011). Drivers for firms like Target and Walmart to take action include legal compliance fines, growing consumer concern with chemicals in products, and state policies targeting chemicals of concern in products.

The costs to businesses for not being transparent about the chemicals in their products and not addressing chemicals of concern in their products can be quite significant. For example, consumer demand for Bisphenol A (BPA)-free water bottles forced SIGG Switzerland's distributor in the U.S. to file for bankruptcy after failing to disclose to consumers and the presence of Bisphenol A (BPA) in its aluminum water bottles.

SIGG USA (a subsidiary of SIGG Switzerland) filed for bankruptcy in 2011 with $13 million in liabilities due to failure to disclose Bisphenol A (BPA) in its water bottles (SNEWS, 2011). SIGG Switzerland, a manufacturer of aluminum water bottles, was well positioned to fill the demand for BPA-free water bottles when health concerns arose in the U.S. and Canada with water bottles made from polycarbonate plastic. With sales booming as customers stopped buying polycarbonate water bottles because they contained BPA, SIGG failed to inform consumers that it used BPA in the lining of its aluminum bottles. In 2008, the presence of BPA in SIGG bottle linings became public and the company came under criticism for failing to disclose the chemical in its water bottles. Consumers stopped buying its products and retail stores like REI, Patagonia, and

Whole Foods Market pulled the bottles from their shelves (Examiner.com, 2009). As Time Magazine reported in October 2009:

> The consumer uproar has been eye-opening for SIGG [Switzerland] CEO Steve Wasik. He thought going green just meant being good to the earth; he didn't realize it meant fessing up too. 'Being a green company also means being held to the highest degree of corporate transparency,' he wrote in an e-mail. 'I fully expect that SIGG will not let consumers down in the future' (Rochman, 2009).

Two years later, SIGG Switzerland's U.S. distributor filed for bankruptcy. The reason, as reported first in the *Wall Street Journal*:

> In bankruptcy-court documents, the company said it is fighting off allegations that say it had misrepresented the content of its water bottles and that the plastic liners contained trace amounts of BPA. The company said it is disputing those claims even though a letter in 2008 from Chief Executive Steve Wasik admitted that earlier linings had trace amounts of the chemical. A round of class-action lawsuits soon followed, alleging misrepresentations, breach of warranty and violation of consumer-protection laws, according to court documents. Meanwhile, sales of its widely recognized water bottles fell. 'The [company] has lost millions of dollars in each of the past two years as a result of decreased sales and an unsustainable cost structure,' the company said in court documents filed Friday with the U.S. Bankruptcy Court in Bridgeport, Conn. [Connecticut, USA] (Stech, 2011).

Damaged brand and lost market sales are a significant potential liability for international brands that prefer the Passive Strategy and being in the "crisis quadrant" to managing chemicals in products. For example, Johnson & Johnson, the international consumer and medical products giant, lost significant sales in China in 2009 when NGOs in the U.S. found chemicals of concern to human health—formaldehyde and 1,4-dioxane—in some of its baby products (including shampoo). While Johnson & Johnson knew the chemicals were in their products, the company took the position that the chemicals were at levels low enough not to cause risks to people. But consumers, when informed of the presence of the chemicals in the products, chose to avoid the Johnson & Johnson brand. The response in China was swift:

- "The Shanghai-based NGS Supermarket Group Co. Ltd. took Johnson & Johnson's infant bath products off the shelves at its 3,500 supermarkets and convenience stores in east China on Monday morning in response to the report, according to China Daily and other Chinese news outlets" (Allison, 2009).
- "Thousands of Chinese parents are turning their backs on Johnson & Johnson and other foreign brand baby care products after recent dramatic health scares damaged consumer confidence, according to a recent online survey. In the first major test of public opinion since a U.S. consumer group alleged that some baby products by the American giant contained traces of elements linked to cancer, three-quarters of nearly 120,000 consumers questioned by ifeng.com, said they had stopped buying Johnson & Johnson products" (Moody, 2009).
- "Michelle Huang, research analyst at global market researcher Euromonitor International in Shanghai, said there had already been an impact on the supermarket shelves. 'There is evidence from trade sources that Johnson & Johnson's sales have been declining as a result of this,' she said" (Moody, 2009).

From 2008 to 2010, Johnson & Johnson's market share for baby products in China declined from 64.3% to 55.9% by 2010 (Duy, 2012). How much of that decline in market share is due to the health scare in 2008 versus other factors, including market competition has not been determined. But the 2008 health care scare clearly tarnished Johnson & Johnson's image in China.

Recalls, either driven by regulations or market demands, are not only costly for a business, they also negatively affect a brand's reputation as indicated by both the SIGG and Johnson & Johnson events. SIGG's recall was so significant that to avoid potential costly lawsuits the U.S. distributor declared bankruptcy and moved its operations to Canada.

4. Active Strategy—Creating Long-term Value by Implementing Systems to Know Chemicals in Products and Supply Chains

> [E]arly awareness of environmental issues was coupled with the troubling observation that addressing these issues can be costly. And like quality advocates, the early advocates of sustainability try simultaneously to seek environmental goals and opportunities to increase profits. They have discovered that the search for sustainability can lead to innovation that yields cost savings, new designs, and competitive advantage.
>
> [E]nvironmental management and sustainable business are aligned with innovation, anticipatory thinking, and entrepreneurial management. Businesses that have moved forward have replaced isolated activity with organization-wide frameworks, tools, and programs. Profit and the environment are now self-reinforcing and compatible (Larson, Olmsted Teisberg, & Johnson, 2000).

Proactive businesses do not wait for government regulations, product recalls, and market demands to emerge before knowing the chemicals in their products and supply chains and reducing the use of, and risk from, hazardous chemicals. Instead they integrate knowledge of chemicals in products and supply chains into their management systems and create value for their organizations. Given that comprehensive knowledge of chemicals in products and supply chains is a massive undertaking, it can only be achieved in steps. As detailed in the BizNGO *Guide to Safer Chemicals*, companies start moving beyond regulatory compliance by identifying a few chemicals of concern in their products and supply chains. After companies develop systems and expertise for identifying and reducing some chemicals of concern, they then expand to knowing most or all chemicals of concern and striving to know all chemicals in products and supply chains. Figure 2 illustrates these stages of progression (Rossi, Peele, & Thorpe, 2012).

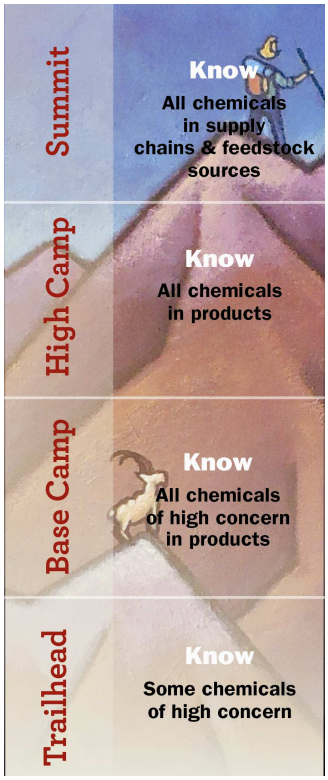

Figure 2. Stages in Knowing Chemicals in Products and Supply Chains (Source: Rossi, Peele, & Thorpe, 2012)

A challenge to the Active Strategy is that managing chemicals in products and supply chains costs more money upfront than the Passive Strategy. What follows are examples of how leadership in managing chemicals in products and using safer substitutes creates business value.

a. The Growing Transparency Movement to Knowing and Disclosing Chemicals in Products

Proactive companies are increasingly demanding that suppliers know and disclose the chemicals in their products. Initiatives in the retail, building products, and apparel and footwear sectors highlight growing demand for both knowing chemicals in products and supply chains, as well as disclosing chemicals in products.

Three U.S.-based retailers exemplify this transparency movement. Target, Walmart, and Whole Foods Market are all driving suppliers to provide more chemical ingredient information on packaging and websites of formulated products (cleaning, beauty, and personal care products in particular) (Rossi, 2013). Target's Product Sustainability Standard provides maximum points for disclosing chemical ingredients of formulated products on packaging and website. Walmart's Policy on Sustainable Product Chemistry requires online disclosure of chemical ingredients of formulated products. And Whole Foods Market's EcoScale Rating System for household cleaning products requires the disclosure of all intentionally added ingredients on all products using the International Nomenclature of Cosmetic Ingredient (INCI) names (Whole Foods Market, 2014; Rossi, Peele, & Thorpe, 2012).

Driving these escalating demands for chemical information is "retailers' need to compete for customers who want sustainable products and to support their sustainability claims, as well as standards adopted in Europe that affect large retailers in today's global economy" (Rizzuto, 2014). Due to their huge market share, retailer demands for disclosure are having a major impact on brands. When retailers like Walmart request chemical ingredient disclosure, brands are likely to follow since much of their sales are in the largest retailers. Clorox Co., for example, sells 26 percent of its products to Walmart stores and its affiliates (Rizzuto, 2014).

Due to regulatory requirements formulated product manufacturers provided partial disclosure of chemical ingredients on packaging. Regulations in Europe, the U.S., and elsewhere require brands to disclose most ingredients on certain formulated products, like beauty and personal care products. However, consumers are demanding greater disclosure beyond regulatory requirements. As a panel at the Beauty and Personal Care Products Sustainability Summit hosted by Target and Walmart in 2014 made clear, "consumers are demanding more sustainable products, they are more informed than ever before, and their expectations are higher. As one merchant [panelist] noted, 'The customer is ahead of us. And we are playing whack-a-mole. This is not a way to lead'" (O'Rourke, 2014).

Manufacturers of formulated products know most if not all of all the chemicals in their products because they specify those ingredients. Brands that sell solid (as opposed to liquid) products–what the EU REACH regulations refer to as "articles"—like chairs and computers, however, in general, often know very little about the chemicals in their products and supply chains. The building/furnishing product sector highlights the rapidly growing demands for knowing chemicals in articles.

In the building products sector, purchasers and standard-setting organizations are driving chemical ingredient disclosure. Google (2014), for example, requires manufacturers of building products and furnishings to provide "full transparency from our manufacturers and vendors, requiring them to provide us with comprehensive product ingredient information from every point in the supply chain." Specifically, Google and many architectural firms are asking manufacturers to provide Health Product Declaration (HPD, 2013) forms for their products. The Health Product Declaration (HPD) form is an ambitious effort to publicly disclose the chemical content of articles by Chemical Abstract Services number (CAS#). The purpose of the HPD is to facilitate transparency in the building material industry to support the selection of healthy building products. If successful in its uptake the HPD will create a consistent reporting format for product content and associated health information and increase the transparency of that data. The HPD includes chemical ingredients by CAS# and volume as well as a hazard summary of each chemical in the product. The hazard or fate endpoints for chemicals include cancer, reproductive toxicity, and persistence, bioaccumulation, and toxicity. Significantly for market uptake the HPD is now part of the U.S. Green Building Council's (USGBC) new building standard LEEDv4. The new "Building product disclosure and optimization – material ingredients" credit provides points for products that have a "published, complete Health Product Declaration with full disclosure of known hazards" (USGBC, 2014).

In the apparel and footwear sectors brands are starting to closely examine the chemicals used in the dyeing and finishing of their materials. For example, the Zero Discharge of Hazardous Chemicals (ZDHC) initiative seeks to eliminate the use of chemicals of concern in products and manufacturing processes (ZDHC, 2014). Major apparel and footwear brands and retailers—including Adidas, H&M, Inditex, Levi Strauss & Co., Li-Ning, Nike, and Puma—have made a shared commitment to lead the industry towards zero discharge of hazardous chemicals by 2020. "Zero discharge" is defined as the "Elimination of all releases, via all pathways of release, i.e. discharges, emissions and losses, from our supply chains and our products. In light of the increasing sophistication of analytical tools and methods, references to 'elimination' or 'zero' must be understood as 'not above background concentration' rather than 'not detectable'" (ZDHC, 2011).The ZDHC includes specific commitments and timelines to realize this shared goal. Requirements of the ZDHC that relate to knowing chemicals in products and processes include:

- "Develop a comprehensive, generic inventory of chemicals used in textile manufacturing."
- "Develop a joint generic audit approach for environmental performance (including chemicals management)."
- "Develop shared approach with third party for dye house and printer audit."
- "Within legal confines, develop a program to incentivize suppliers to fulfill the dye house and printer audit protocol."
- "Convene cross sector group to explore the best ways to encourage sector wide supplier chemical disclosure and deliver a study based on data collection from a select group of facilities."
- "Explore platform options for suppliers to disclose their chemical inventory under the assumption that disclosing their inventory will have a positive effect" (ZDHC, 2011).

As activities in the apparel and footwear, building product, and retail sectors clearly illustrate, the trend is toward transparency. Customers at all steps in the supply chain want to know more and more about the products they purchase, where they came from, who manufactured them, and their chemical contents.

b. Seagate Technology PLC—Saving Money by Knowing Chemicals in Products

The work of Seagate Technology PLC, a manufacturer of data storage devices, demonstrates the clear value propositions of knowing chemicals in products. Driven by the advantages of being ahead of regulations and customer demand, Seagate created and implemented a system that strives to collect full chemical ingredient information from suppliers. Seagate, which manufactures both hard drives for other companies as well as for its own branded products, aspires to full material disclosure from its suppliers.

Seagate requests "full material disclosure" (FMD) from its suppliers. FMD for Seagate is chemical ingredient disclosure by CAS#. Seagate strives for 100% disclosure, but to allow for confidential business information (CBI) claims it accepts 5% miscellaneous proprietary data at the homogenous material level. Seagate also has a list of chemicals of high concern and suppliers cannot claim CBI for those chemicals; meaning all chemicals of high concern identified by Seagate must be reported.

Substance	CAS Number	Cumulative Concentration
AL	7429-90-5	61.9451
FE	7439-89-6	80.5984
COPPER (METALLIC)	7440-50-8	86.12
SI	7440-21-3	90.705
CHROMIUM	7440-47-3	93.1778
NICKEL	7440-02-0	94.862
ZINC	7440-66-6	95.6614
FIBROUS-GLASS-WOOL	65997-17-3	96.141
NEODYMIUM	7440-00-8	96.5053
MAGNESIUM	7439-95-4	96.8692
MANGANESE	7439-96-5	97.1983
LCP polymer	147310-94-9	97.5019
POM, Polyoxymethylene copolymer	24969-26-4	97.7305
"DOPO" halogen free flame retardant	35948-25-5	97.9132
POLYESTER MATERIAL	79-14-1	98.086
ACRYLATE URETHANE OLIGOMER	73324-00-2	98.2507
PROPRIETARY	SYSTEM	98.3749
EPOXY RESIN	129915-35-1	98.4961
ACRYLIC POLYMER	37325-11-4	98.6128
FUSED SILICA	60676-86-0	98.7214
SN	7440-31-5	98.8116

Table 2. Seagate Technology: Material Disclosure for a Typical Desktop Disk Drive (Source: Martin, 2013)

Table 2, which lists the chemical composition of a typical Seagate desktop disk drive, is a result of Seagate's data collection system. This is a significant achievement in both data collection and public disclosure of chemicals in the product for an electronics company[2].

Brian Martin, Senior Director, Product Environmental Compliance, explains that by investing early in FMD Seagate greatly reduced the resource requirements for meeting regulatory requirements (chemical restrictions) and market demands for disclosing chemical ingredients and verifying compliance with regulations. Seagate has found that developing and implementing a system to collect all chemical ingredients in products is the lowest cost strategy for complying with regulations and market demands (Martin, 2009). The costs of data collection for Seagate have been almost flat over time. As illustrated in Figure 3, the number of chemicals (yellow bars of "regulated substances" in Figure 3) that companies and regulators require data collection on

[2] Note that the list of chemicals in Table 2 includes a "Proprietary" chemical (0.12% by weight) and that the list of ingredients adds up to 98.8% of the product's weight. Thus undisclosed chemicals account for 1.32% of the product by weight (Proprietary chemical plus undisclosed chemicals).

continues to rise while the costs for Seagate (see the green line in Figure 3) have remained relatively flat over time.

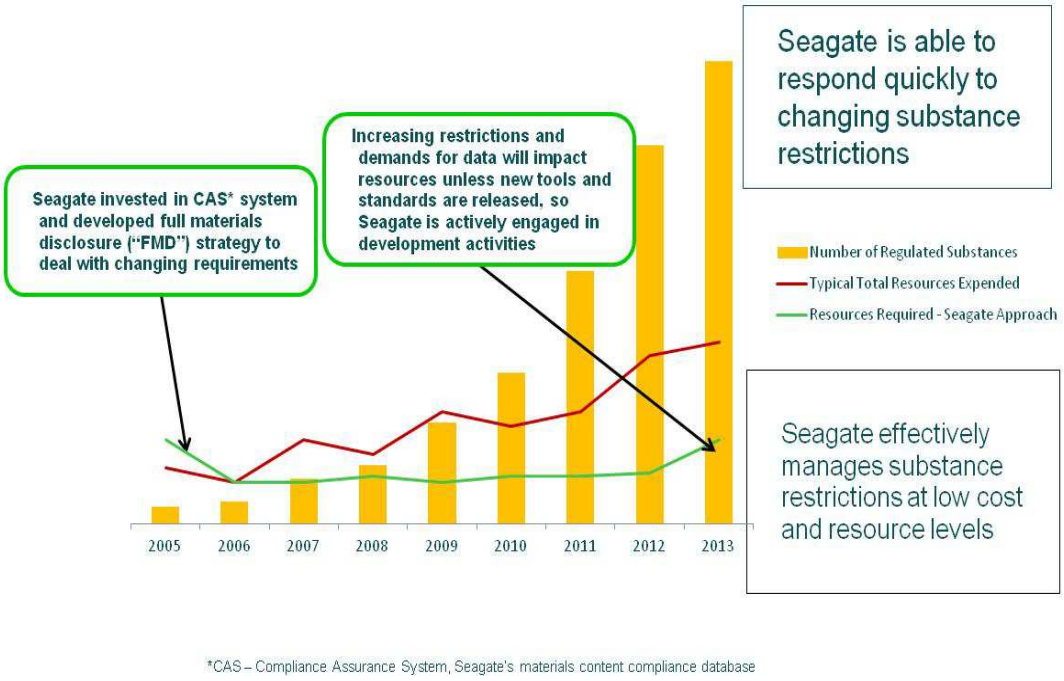

Figure 3. Seagate "Saw tooth" Graph: Costs of Managing Chemicals in Products Data (Source: Martin, 2013)

Every time a new chemical of concern emerges due to regulatory or market forces, Seagate no longer needs to return to its suppliers and ask if the chemical is in its component. Instead Seagate staff simply look into the database to see if the chemical is present, enabling the company to quickly know if it has newly identified chemicals of concern in its products. By keeping costs stable Seagate avoids the "saw tooth effect" of constantly fluctuating costs over time (the red line in Figure 3). For Seagate, as more and more chemicals of concern emerge the data collection costs remain relatively stable instead of varying widely up and down (saw tooth effect) due to fluctuating needs of collecting (costs rise) or not collecting (costs decline) data. Seagate avoided the saw tooth effect by investing in a chemical data collection system. Thus upfront costs for setting up the chemical management data system were higher than doing nothing, but it lowered the cost of having to respond as new restrictions and chemical information requirements emerge from governments and customers over time. The costs of data collection are rising slightly (green line in Figure 3) because of the significant new data requirements of collecting data on conflict minerals.

Ensuring high quality data is an essential element of Seagate's approach to chemical management. Rather than outsource data collection and ownership to a third party, Seagate created its own system that includes compliance software and a contractor that monitors data submissions as well as trains suppliers (in Chinese or English) in how to appropriately input data into the system, including testing reports that verify compliance with regulations like EU RoHS. Figure 4 depicts the Seagate FMD system.

An unintended benefit Seagate reaps by knowing its product chemistry is that it provides a constant view into the quality of products from its suppliers. Since suppliers must regularly report chemical ingredient data on their products, which is necessary to ensure compliance with regulations and customer requirements, Seagate receives a constant picture of chemicals in products and whether suppliers are changing chemical and material ingredients. Given that suppliers are always looking to cut costs, and one route to cutting costs is using cheaper materials, Seagate's Compliance Assurance System enables the company to know when changes in materials happen. This enables Seagate to track whether any changes in chemical and material composition of products affects performance. Figure 4 depicts in detail Seagate's Compliance Assurance System, which has a number of check points to assess and verify compliance with its disclosure requirements, including compliance software checking for completeness and quality, along with a third party auditing submissions and providing training to suppliers. Supplier training is essential to the success of the program as employees who fill in the forms are constantly changing. The Compliance Assurance System provides weekly reports to the suppliers and Seagate indicating compliance with the company's reporting requirements.

A cost that is rising for Seagate is the cost of reporting data to business customers. Often times its business customers have their own forms that Seagate must fill in and the completion and submission of these customized reports takes increasing time especially as the number of chemicals that must be reported grows. Seagate would prefer to provide full material disclosure to its suppliers rather than a subset of chemicals of concern because it is much easier to provide all the data then to create customized reports. The combination of customized reports and conflict mineral reporting is causing the costs of managing a unit of data to rise for Seagate. Yet, those costs would be growing much more rapidly if Seagate did not have a well-developed and -managed system for collecting and disseminating chemical ingredient information.

Seagate is not alone in the electronics sector in deploying a system to know chemicals in products. Sony Ericsson, for example, is implementing a system similar to Seagate's:

> There are two possible methods for Sony Ericsson to ensure that the items produced by its suppliers do not contain hazardous substances. Historically, the company relied solely on suppliers to verify that their products did not contain the substances included on Sony Ericsson's banned or restricted substances lists. In recent years, however, it became apparent to the company that using a materials declaration system would allow it to take a more proactive strategy as new hazards become known. Such a system would also inform the company as to exactly what is in its products and also enable it to monitor for known hazards. In May 2008, Sony Ericsson began implementing a materials declaration system, which had been in development for several years. The new system uses a standard industry format (IPC- 1752) to collect information from suppliers. This means that Sony Ericsson wants full disclosure concerning all substances in Sony Ericsson products from all suppliers (Nimpuno, McPherson, & Sadique, 2009).

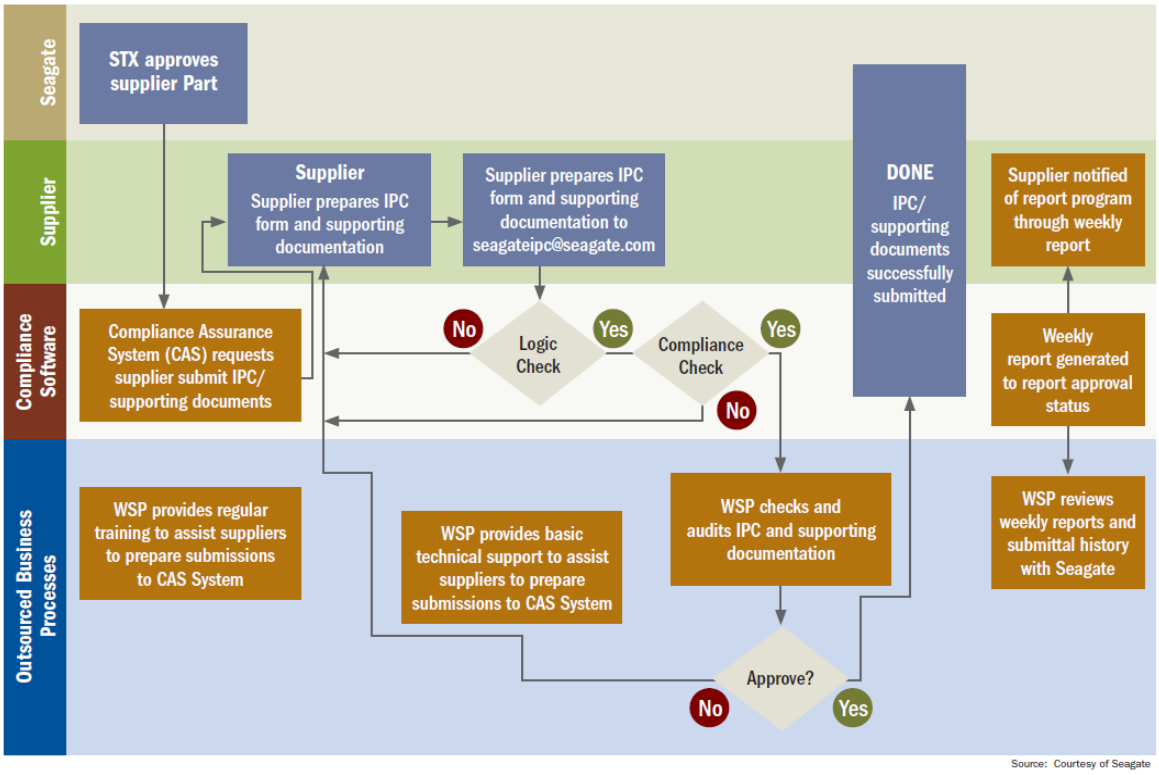

Figure 4. Seagate's Compliance Assurance System for Collecting and Managing Chemical in Product Data (Source: Rossi, Peele, & Thorpe, 2012; developed from Martin, 2009)

The verification of chemical ingredient information is critical, especially in terms of regulatory compliance. Given complex supply chains companies are under increasing pressure to verify claims made by suppliers. Apple's suppliers, for example, are "required to establish strict compliance management programs, which included using certified laboratory testing to demonstrate that they were complying with the new requirements" (Nimpuno, McPherson, & Sadique, 2009).

Similar initiatives for regulatory and/or market compliance are underway in the automotive, building product, and toy sectors. The automotive sector has a comprehensive system for tracking chemical and material ingredients in products through its International Material Data System (IMDS). And leading building sector

initiatives include the Swedish Basta Guidance to Sustainable Construction Materials (Basta, 2014) and Health Product Declaration collaboration (HPD, 2013). In the U.S. toy sector, industry-wide efforts to combat supply chain problems include the Toy Safety Certification Program to ensure toys conform to CPSIA requirements and ASTM F963, and the Eco-Toy Alliance, a partnership of four small toy companies (Becker, Edwards, & Massey, 2010).

c. Coastwide Laboratories and Shaw Industries: Creating Value by Using Safer Chemicals

Knowing chemicals in products is a first step to avoiding a regrettable substitution, when an organization replaces a known chemical of concern to human health or the environment with an alternative that itself turns out to be chemical of concern. A regrettable substitution can be costly because it means that companies invest in new technologies, materials, or systems, then have to replace it before they are able to recover sunk costs. Knowing chemicals in the alternative, before making a substitution, enables companies to evaluate the hazards of the alternatives before making the substitution.

One of the most compelling reasons to be more active in screening alternatives is to stay ahead of regulatory and market uncertainty. Not taking emerging regulations and market demands into consideration when designing and specifying a product can lead to costly product redesigns and multiple substitutions. In light of growing consumer concern and a shifting regulatory environment, businesses can end up making multiple substitutions. Screening replacement chemicals and materials for their hazards reduces the risk of having to do multiple substitutions for the same application, and also decreases the chances that future materials restrictions will apply to a company's products.

To know chemicals in products and supply chains requires a strong project management team that can evaluate and select the most appropriate product chemical management system for the organization (Torrie,Buczek, Morose, & Tickner, 2009). Knowing product chemistry improves transparency and communication throughout the supply chain, leading to increased confidence for downstream users and reduced risks from supply chain disruptions (Becker, Coffin, & Tickner, 2011).

Being active in identifying hazardous chemicals in products and using safer substitutes can increase sales. For example, Coastwide Laboratories (now a subsidiary of Staples, Inc.), a manufacturer of commercial cleaning maintenance products, saw an increase in sales due to a decision to integrate sustainability into corporate strategy. Coastwide's Sustainable Earth™ line of products began in 2002 as an experimental line apart from its main business, but was so successful that sustainability was integrated into corporate strategy.

In a case study of Coastwide, Larson and York (2007) found that:

> Net operating income averaged double to triple the industry norm. Sales in 2005 rose 8%, largely due to segments where most of the Sustainable Earth products were sold (education, property management, health care and cleaning contractors), while operating profits increased by an even larger percentage… The products performed as well or better than the category leaders (from equal to 63% more effective in soil removal using ASTM tests conducted by an independent testing laboratory). Coastwide's market share grew to about 16% of the regional market, making Coastwide the largest firm in the geographic area. New customers rose 35% in 2005 largely attributable to the Sustainable Earth product lines.

The Sustainable Earth line not only led to a profit increase, but also performed as well as category leaders, lowered customers' costs, protected users' health and reduced waste. It "enabled Coastwide to lower its customers' costs for maintenance by offering system solutions. Higher dilution rates for chemicals, dispensing units that eliminated overuse, improved safety for the end user, and less lost work time because of health problems associated with chemical exposure were reported" (Larson & York, 2007).

Another example of the benefits of deep knowledge of product chemistry and using inherently safer chemicals in products is Shaw Industries. As the world's largest carpet manufacturer, Shaw Industries in the 1990s launched an initiative to fully know the chemicals and materials in their product and phase-out the more hazardous chemicals. At the time architects and interior designers in the building product sector were becoming more aware of concerns with poor indoor air quality and the potential adverse human health and environmental effects from exposure to chemicals in interior furnishings. Recognizing the shifting trend in the market, Shaw made many sustainability changes to its carpets, including:

- "Replacement of PVC and phthalate plasticizer with an inert and non-hazardous mix of polymers, ensuring material safety throughout the system (PVC-contaminated nylon facing cannot be used for non-carpet applications of recycled materials).
- Elimination of antimony trioxide flame retardant, which has been associated with harm to aquatic organisms.

- Dramatic waste reduction during the processing phases by immediate recovery and use of the technical nutrients (the production waste goal is zero).
- A life-cycle inventory and mass flow analysis that capture systems impacts and material efficiencies compared with PVC backing" (Anderson, O'Brien, & Larson, 2009).

Shaw's innovations were driven by the development of a new material to replace the industry standard of carpeting backed with PVC. "EcoWorx offered an alternative to the industry-standard PVC backing at comparable cost, 40 percent less weight, and equal or improved effectiveness across all performance categories" (Anderson, O'Brien, & Larson, 2009). Their new innovation, which eliminated PVC and phthalate plasticizers from their carpets, quickly captured market attention. "Shaw tripled its production capacity in 2000 and, by the end of 2002, shipments of EcoWorx tiles exceeded PVC-backed styles" (Anderson, O'Brien, & Larson, 2009).

Shaw Industries, Coastwide Labs, and Seagate Technology exemplify the benefits of Active Strategies in managing chemicals in products. It is important to note that Active Strategies are not automatically self-sustaining. They require constant maintenance and support within the organization. A challenge for even large corporations is that Active Strategies are often driven by individual champions within the organization. In many cases, corporations are not implementing successor strategies to ensure that the work of the champions continues into the future.

5. Conclusion: The Benefits & Costs of Moving from Passive to Active Strategies

For brands and retailers, those companies that are closest to the consumer, the hidden liabilities of the Passive Strategy—do not know chemicals in products/supply chains and do not prefer safer substitutes—will continue to accrue. It is a risk that companies take as to whether those liabilities will evolve into actual costs. The trajectory of regulations and market demands, however, indicates that increasingly the liabilities of the Passive Strategy will evolve into actual monetary costs. And those costs can be quite significant as evidenced by Sony, Mattel, Walmart, SIGG, and Johnson & Johnson.

Transforming corporate cultures to the Active Strategy is itself a significant challenge. The demands from consumers as well as the continual increase in regulatory requirements help to foster that interest, but creating the organizational willpower to absorb upfront costs—Seagate's "saw tooth" graph—for uncertain future risks is often a difficult case to make. Businesses enter into the Active Strategy via a variety of pathways. Some organizations are fortunate/unfortunate enough (depending on one's perspective) to be the target of an NGO campaign that catalyzes/forces an openness to the Active Strategy. Others come to see the economic value. Most frequently, an organization is fortunate enough to have an internal champion who is passionate enough, savvy enough, and appropriately positioned to catalyze the development and implementation of an Active Strategy.

The pathways to knowing chemicals in products/supply chains and using safer substitutes are clearly established. Innovators and early adopters are already on this path. Many sectors—apparel, footwear, outdoor industry, automotive, electronics, cleaning, personal care, building, and retail—already have leaders in implementing the Active Strategy. Companies acting ahead of the regulatory and market curves are avoiding the chemical-by-chemical crisis management game and generating long-term value: increased sales, enhanced brand reputation, and well-managed supply chains. The question is how rapidly other businesses, the early majority which joins the leaders, begin to implement Active Strategies for managing chemicals in products.

The demand for increased chemical transparency up and down the supply chain grows every day. From consumers to retailers to brands, awareness of hazardous chemicals in products and supply chains is driving companies to disclose information on the chemicals in products and to select inherently safer chemicals. These are the companies that are leaving behind crisis-driven change and creating long-term value for themselves, their shareholders, the public, and the planet.

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