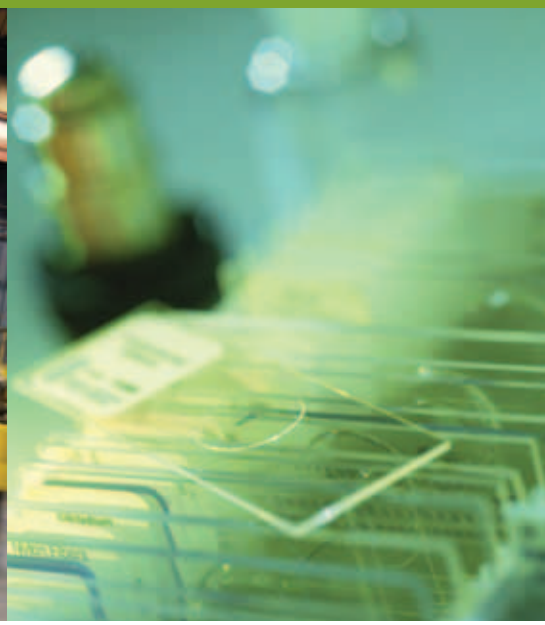
Gathering Chemical Information and Advancing Safer Chemistry in Complex Supply Chains

Case Studies of Nike, S.C. Johnson, and Hewlett-Packard

MOVING BUSINESS TOWARD SAFER ALTERNATIVES





GC3 Green Chemistry & Commerce Council

Lowell Center for Sustainable Production
UNIVERSITY OF MASSACHUSETTS LOWELL

September 2009

Acknowledgements

The Lowell Center for Sustainable Production would like to acknowledge Monica Becker of Monica Becker & Associates Sustainability Consultants as the primary author of this report and the case studies referenced within. A special thanks is due to the committed companies that were willing to provide their time and insights for the case studies. In particular, we would like to thank John Frazier from Nike; Daniel Lawson from S.C. Johnson and David Long from Environmental Sustainability Solutions; and Barbara Hanley of the Hewlett-Packard Corporation.

Gathering Chemical Information & Advancing Safer Chemistry in Complex Supply Chains

Case Studies of Nike, S.C. Johnson and Hewlett-Packard

Introduction

Consumer product companies need chemical information from their supply chains for many reasons, including the design of products that are safe for human health and the environment, regulatory compliance, participation in green certification programs, disclosure of chemical ingredients in products to retailers and customers, and preparation of Material Safety Data Sheets (MSDS). Companies with large, complex, global supply chains face many challenges in getting this information.

The Green Chemistry in Commerce Council (GC3), a project of the Lowell Center for Sustainable Production, at the University of Massachusetts Lowell, commissioned three case studies of leading firms with complex supply chains to explore and share experiences on how companies gather chemical information from their supply chains and how they use this information to develop safer products. The three companies are Nike, S.C. Johnson (SCJ) and Hewlett-Packard (HP) (See Table 1).

The case studies conducted for this project examined a number of questions:

1. Why is the company seeking chemical information from their supply chain?
2. What types of chemical information is the company seeking?
3. How is the company gathering chemical information from its supply chain? What system is it using?
4. What systems are companies using to manage chemicals in products?
5. What systems are companies using to create safer products using chemical information?
6. What challenges have existed and what has worked well to gather chemical information, manage chemicals and design safer products?

All three firms studied are sizable, consumer product companies with large and complex supply chains. They are diverse with regard to the types of products that they manufacture and the types of raw materials that they procure from their supply chain. The reader should keep this in mind when reading the cases and lessons reported in this document.

Information gathered for the cases came from interviews with personnel at each firm, internal documents provided by the firms, and publicly available information. The companies were given the opportunity to review and comment on case study drafts.

This summary report is designed to synthesize the lessons learned and best practices that were distilled from the case studies.

Table 1. Overview of Supply Chain Case Studies

Company Name	Products	Title of Case Study
Nike Corporation	Apparel, footwear, and athletic equipment	"Considered Chemistry at Nike: Creating Safer Products through the Evaluation and Restriction of Hazardous Chemicals"
S.C. Johnson	Home cleaning and storage, air care, and pest control products	"S.C. Johnson is Transforming its Supply Chain to Create Products that are Better for the Environment"
Hewlett-Packard	Information technology products	"Managing Chemicals of Concern and Designing Safer Products at Hewlett-Packard"

Background

Why are Consumer Product Companies Seeking Chemical Information from their Supply Chains?

A growing number of market and regulatory forces are driving manufacturers to eliminate or reduce the use of toxic chemicals in products and design products that are safer for human health and the environment. These forces include green consumerism, green certification programs, consumer demand for greater transparency of chemical ingredients in a product, and regulatory programs such as California's Proposition 65[1] and the European Union's REACH and RoHS[2] programs.[3]

In response to these drivers, many manufacturers are developing a variety of new corporate programs or systems to "green" their products and operations by reducing or eliminating the use of toxic chemicals or disclosing chemical ingredients to their customers. These programs include the evaluation and scoring of environmental, health and safety of chemicals prior to selection for use or to eliminate or substitute toxic components with safer alternatives; promoting the use of safer chemicals; and restricting the use of certain chemicals in products. While diverse in their approaches to promoting safer chemistry, these initiatives share at least one common element: They require chemical information.

We use the term *chemical information*, to cover a range of information, including the following:

- the identity of a single chemical or chemical ingredients in a mixture, material or component
- the amount or concentration of chemicals, including additives, in a mixture, material or component
- the presence of chemical reaction by-products or breakdown products
- the hazard and toxicological profiles of chemicals or mixtures
- the potential for human or environmental exposure to the chemical from handling, transport and use of chemicals, materials or components

Chemical information is also needed for other important functions including the preparation of MSDSs and regulatory compliance with programs such as the EU's REACH[4] and RoHS Directives.

Historically, the transfer of chemical information from suppliers of individual chemicals and mixtures to consumer product manufacturers has been limited to performance characteristics, safe handling and transport, and basic hazard and toxicological information delivered in product specification sheets and Material Safety Data Sheets (MSDSs). There is a growing consensus, however, that most MSDSs are inadequate for companies trying to evaluate materials and design safer products. MSDSs typically lack sufficient chemical ingredient information and toxicological data to support design for environment efforts. They were primarily designed to provide information on mostly acute occupational health hazards, not those throughout an entire product lifecycle.

Barriers and Challenges to the Flow of Information "Down the Supply Chain" from Supplier to Customer

A major challenge for many product companies is getting the chemical information that they need to fuel their green product design programs. Over the years, supply chains have become deeper, branched, and global. For example at Nike, all manufacturing is done under contract by almost 640 factories in 52 countries, each supplied by between five to ten vendors.

Maintaining visibility and control over the ingredients in the materials or components procured from the supply chain has become a major challenge for many larger companies and comes only at great expense. Original Equipment Manufacturers, or OEMs, typically have direct relationships with their Tier I suppliers, sometimes with Tier II, but rarely with suppliers deeper into a supply chain. Tier I suppliers may be willing to provide the information that they have but often have trouble getting information from their suppliers, and so on down the chain.

Barriers and challenges to the flow of chemical information "down" the supply chain, from supplier to customer have been described by Denison and the OECD and include the following:[5]

- **Suppliers may not have the information requested by customers because they source chemicals or materials from their suppliers who are unwilling or unable to provide information.** Suppliers may be brokers, distributors, or other intermediaries who lack information. Chemicals are often sold through intermediaries who often do not have the information that their customers are seeking or have little incentive to share the information that they do have.

- **Suppliers may not have the capability, infrastructure or resources to develop the information.** Small suppliers in particular may lack in-house expertise, technology and resources to collect and disseminate chemical information. They may also be unable to pass on the costs of information collection and transmittal to their customers, or may be overwhelmed by information requests from multiple customers.

- **Suppliers may not want to disclose chemical information because they fear losing sales or customers.** Some suppliers may be concerned that if they disclose compositional information on their products to their customers, their customers will use that information to find alternate suppliers.

- **Suppliers may not want to disclose proprietary information (confidential business information (CBI)).** Suppliers may be reluctant to divulge chemical information that they deem critical to their competitive advantage. This can be a particular problem with certain chemical categories such as additives to polymers, and fragrances.

- **Suppliers may not want to disclose information out of fear of potential liability.** Suppliers may be afraid of being assigned responsibility for problems that may arise from their products. Companies may also fear being out of compliance with existing laws and may not want to provide information that could reveal compliance problems.

- **Customers may not clearly articulate their need for information or provide incentives for its delivery.** Companies seeking information from their suppliers may not be providing a good explanation for why the information is needed, a clear description of the type of information needed, or the benefits created by having complete and reliable information from their suppliers. In addition, customers may need to provide incentives to suppliers to encourage them to be more forthcoming.

- **Suppliers may not feel compelled to provide chemical information to their customers if existing laws do not require disclosure of information on chemical uses, hazards or potential exposures.**

- **Differences in culture, language, values, and legal requirements in global supply chains may act as barriers to the transfer of chemical information between suppliers and customers.**

Flow of Chemical Information "Up the Supply Chain" From Customer to Supplier

The discussion so far has focused on the flow of chemical information "down the supply chain," from supplier to customer. It is worth noting that there are many important benefits to the flow of chemical information "upstream" from customer to supplier. At the annual Innovator's Roundtable of the Green Chemistry in Commerce Council, in May of 2009, Janet Mostowy, Vice President, Product Safety and Regulatory Affairs & Management Systems at Bayer Material Sciences noted the importance for chemical manufacturers to obtain information from their customers on how their chemicals are being used. This information can enable chemical producers to provide information to customers on the safe use of its products. She stressed the importance of the identification of chemical uses and applications along all links in the supply chain.[6]

Fostering this type of communication can be a challenge. As noted by Mostowy, Bayer has access only to its direct customers, who may be chemical distributors, but not always to the companies that incorporate their chemicals into products. Other barriers to information sharing from customer to supplier exist. A supplier may be concerned that they may lose customers if they ask for information on how their chemicals are used. A customer may have a use for the chemical that s/he does not want the supplier to know about, either because s/he wants to protect a novel application or conceal improper handling or use of the chemical.

Summary of Safer Chemistry and Product Design Programs and Chemical Information Needs Described in the Case Studies

To provide context for the discussion of lessons learned, this section presents a brief overview of the safer chemistry and product design programs described in the case studies and the types of chemical information that the companies are seeking to support these programs.

Nike Green Chemistry and Safer Product Design Programs

Nike's Considered Index sustainable product design tool is used to predict the environmental footprint of a product prior to commercialization. This system examines solvent use, waste, materials and innovation for footwear; waste, materials, garment treatments and innovation for apparel. Products are assigned a "Considered" score using a set of metrics. The metrics are based on over a decade of research about materials, solid waste, innovations, textile treatments and solvent use.

Nike's extensive RSL program consists of nine distinct lists of chemicals, including lists specifically for materials that are products of nanotechnology, packaging and toys, and a testing and data management system designed to ensure supplier compliancy. Nike's RSL includes chemicals or materials that are restricted by legislation and additional "Chemicals of Concern" that Nike has declared undesirable in products.

Nike's Considered Chemistry chemical evaluation system is used to evaluate chemicals in products for possible addition to Nike's restricted substances list and for conducting focused efforts to develop environmentally preferred materials (EPM) for product platforms (e.g., rubber outsoles, synthetic leather). The system employs a risk-based approach to evaluate the chemical ingredients of materials, considering chemical hazard and potential consumer, worker and environmental exposure to the chemical (risk = hazard x exposure). The system requires chemical formulation information from suppliers. Nike obtains hazard data either from a toxicologist or publicly available databases and conducts hazard and risk analysis.

Types of chemical information sought from the supply chain include:

- **Full chemical ingredient information on materials from suppliers for environmentally preferred materials (EPM) development.**
- **Chemical ingredients in materials that are used at contract facilities to manufacture products.** This includes materials such as adhesives and solvents used in manufacturing operations.
- **Testing for restricted substances and chemicals of concern in supplied materials, components, and products to verify compliance with Nike's RSL guidance.** The data from these tests are also used to generate Supplier Scorecards for evaluation and comparison of alternative suppliers and to analyze materials, and specific colors of materials, to determine which tend to contain restricted chemicals or chemicals of concern.

S.C. Johnson Green Chemistry and Safer Product Design Programs

The Greenlist™ process was developed by S.C. Johnson for rating raw materials based on their impact on the environment and human health. Greenlist™ scores are reported alongside performance and cost information in the company's chemical formulary so chemists choose materials in consideration of their environmental and health properties. Using the scores, materials can be easily compared. Greenlist™ also provides metrics for tracking S.C. Johnson's corporate-wide progress toward greening its portfolio of products. The company has created incentives to encourage the selection of safer materials and discourage less safe materials. Greenlist™ currently has unique rating criteria for 19 material categories.

Additionally, the website *www.whatsinsidescjohnson.com*, is S.C. Johnson's innovative new ingredient communication program that includes a dedicated website designed to provide chemical ingredient and other helpful information to consumers.

Types of chemical information sought from the supply chain, include:

- **Toxicological and other hazard data for individual chemicals or more complex materials to develop Greenlist™ scores.** Generally, suppliers provide what are called Toxicology Summaries with all the information needed to evaluate a chemical using the Greenlist™ system. Some suppliers, fragrance suppliers in particular, regard their products as highly proprietary. In these cases, the supplier determines the Greenlist™ score and provides only the score to S.C. Johnson. The company audits these submittals.
- **Full chemical ingredient information for *www.whatsinsidescjohnson.com* is sought from suppliers.**

Hewlett-Packard Green Chemistry and Safer Product Design Programs

Hewlett-Packard's General Specification for the Environment (GSE) includes a list of restricted materials, requirements for packaging, and requirements for products subject to the European Union's RoHS Directive. These specifications are for all HP brand products including subassemblies, part, materials, components, batteries and packaging that become part of HP brand products. The GSE is included in supplier contracts as part of the standard terms and conditions.

HP's Design for Environment (DfE) program seeks to reduce the environmental impact of its products. The three major elements of the DfE program are energy efficiency, materials innovation, and design for recycling. Materials innovation is focused on reducing materials use and using materials with less environmental impact and more value at end of life.

The company has also participated in the Electronic Product Environmental Assessment Tool (EPEAT) program, designed to help institutional purchasers compare computers, notebooks and monitors based on environmental attributes. EPEAT is a green certification program managed and governed by a not-for-profit organization that provides a clear set of performance criteria to encourage manufacturers to design environmentally sound products. Hewlett-Packard participated in the development of EPEAT and many of Hewlett-Packard's products have been scored using EPEAT.

Types of chemical information sought from the supply chain, include:

- **Information needed to confirm compliance with RoHS requirements.** Suppliers must sign a letter of RoHS compliance and submit it to HP. HP requires its suppliers to provide chemical data, material or component testing upon request.

- **Information on Substances of Very High Concern (SVHC), under Article 33 of the EU's REACH Directive.** HP must provide information to consumers on the presence of Substances of Very High Concern (SVHC) in specific products. HP's suppliers are required to provide information on the weight in grams of substances listed on the current Annex XIV candidate list of chemicals under REACH. Suppliers are given the option to indicate where the substances are used in the product. These data are consolidated by Hewlett-Packard and used to prepare reports required under Article 33 of REACH.[7]

- **Tracking of additional chemicals of concern in products.** In addition to the Annex XIV chemicals, HP requests information from its suppliers on approximately 240 additional chemicals. This voluntary reporting list was narrowed from the 67/548/EEC (as amended) Annex 1, as well as other chemical regulatory lists that contain substances meeting the SVHC criteria, such as the Stockholm Convention (POP list) and the Rotterdam Convention (PIC list) list. It includes carcinogens; mutagens; reproductive toxins (CMRs); persistent, bioaccumulative and toxic chemicals (PBTs); and endocrine disruptors that HP determined as possibly used in electronics products. These data provide HP with information on where and how these chemicals are used in their supply chain, should they become restricted in the future.

- **Information on chemicals of emerging concern is gathered from suppliers under a provision of HP's GSE.** This provision was written to allow Hewlett-Packard to collect information on a chemical's health or environmental hazards, requirements for safe use, and packaging or labeling issues.

As these highlights illustrate, each company has developed a unique mix of programs and techniques for designing safer products and gathering the chemical data required for these efforts. The types of programs and chemical information needed are further summarized and categorized in Table 2.

Table 2. Summary of Programs for Designing Safer Products and Chemical Information Required

Program Type	Company	Program	Type of Chemical Information Requested from Suppliers
I. Evaluation and scoring of environmental, health and safety of chemicals prior to selection for use	S.C. Johnson	Greenlist™	Toxicological & other hazard data for chemicals and materials to generate a Greenlist™ score
II. Evaluation and scoring of chemicals in existing products to eliminate or substitute toxic components	Nike	Considered Chemistry Program—for development of EPM	Full chemical ingredient information
III. Promoting the use of specific chemicals that are highly rated for environmental safety and health	S.C. Johnson	Greenlist™	Toxicological & other hazard data for chemicals and materials to generate a Greenlist™ score
IV. Restricting the use of certain chemicals in products (either banning the chemical or limiting its concentration)	HP	General Specification for the Environment (GSE)	Signed letter of RoHS compliance. Chemical data, material or component testing upon request
	Nike	Restricted Substances List (RSL)	Analytical test results for supplied materials, components and products to verify compliance
	S.C. Johnson	Restricted Use Materials (RUM) under Greenlist™	Toxicological & other hazard data to generate a Greenlist™ score
V. Reporting of SVHC chemicals under Article 33 of the EU's REACH Directive	HP	REACH compliance	Weight in grams and location in product (optional) of Annex XIV chemicals
VI. Tracking of chemicals of concern in products to prepare for future regulatory requirements	HP	Extension of REACH compliance activities	Weight in grams and location in product (optional) of 240 chemicals of concern
VII. Programs to voluntarily disclose chemical ingredients in products to customers	S.C. Johnson	*www.whatsinsidescjohnson.com*	Full chemical ingredient information

Lessons Learned: Gathering Chemical Information

In this section, we present a description of the challenges and enabling factors reported by the case study companies for obtaining chemical information from their supply chains.

Challenges

All three companies reported that getting chemical information from supply chains can be difficult or impossible in some cases, time consuming, and costly. A number of specific challenges were cited by case study firms.

- **Suppliers are sometimes unwilling to provide chemical ingredient information.** Although the companies studied are quite large, they may still represent a relatively small share of a supplier's sales and therefore may have little leverage. Nike, for example, described an instance when the company tried to get chemical information from a supplier that supplied dyes to a facility that dyed textiles for Nike products. The supplier, a formulator of dyes, was unwilling to provide information on dye ingredients. Nike sales accounted for approximately 5% of the supplier's total sales.

  Case study firms cited concerns over confidential business information as the reason for some supplier's unwillingness to provide chemical information.

- **Some suppliers lack sophistication and do not have adequate data collection and management systems to collect and provide chemical data to their customers.**

- **Tier I companies are not always able to get chemical ingredient information from their suppliers.** This is particularly true when the Tier I supplier represents a small fraction of sales for the Tier II or higher suppliers.

- **Different languages and cultures can make it difficult for customers to successfully convey details on the type of information needed and to get a commitment from suppliers to provide the information.**

- **Getting information on dyes, fragrances, preservatives, contaminants and unintended by-products presents a particular challenge.** SC Johnson reported that in the case of dyes and fragrances, their suppliers often view these chemicals as proprietary and some are unwilling to disclose them. In some cases, suppliers do not want to disclose the presence of preservatives, contaminants and by-products in the materials that they sell or they are unwilling to test for these chemicals. The chemicals may have been introduced by Tier II or other suppliers back further in the supply chain and Tier I suppliers are unaware of their presence.

- **Chemical ingredient information provided may be incorrect.**
  Validating information provided by suppliers is difficult and costly and may require chemical testing of materials or products.

- **In some cases, data requirements under regulatory programs or green certification programs are unclear or confusing making it difficult for customers to provide clear instructions to their suppliers for information gathering and reporting.**

Enabling Factors

All three companies also reported that certain programs and practices that they have implemented have facilitated their efforts in collecting chemical information. Specific enabling factors include the following:

- **Clear communication with suppliers.** This has taken several forms, as described in the points below.

  – ***Provision of detailed written guidance on information sought.*** In particular, HP and Nike have developed detailed guidance documents for their RSL programs. These documents can be accessed on-line.[8]

  – ***Training of suppliers on chemi-cal data reporting requirements.*** In addition to training its Tier I suppliers, HP has reached out directly to Tier II suppliers to clarify data requirements.

  SCJ provides training to suppliers on their Greenlist™ system for rating raw materials according to environmental and human health impact and on toxicological data needed by SCJ to evaluate suppliers' materials. In addition, both Nike and HP provide detailed guidance documents to suppliers on their RSL requirements.

- **Providing an easy-to-use system for suppliers to submit chemical data.** HP's web-based portal for chemical data entry has facilitated data collection. This system was developed internally by HP and uses the companies SAP/Environmental Health and Safety modules to process the data.

- **Finding innovative ways to overcome barriers associated with confidential business information (CBI).** SCJ's Greenlist™ system overcomes CBI barriers by requiring suppliers to provide toxicological information on chemicals, chemical mixtures or materials rather than actual chemical ingredient information. Under this system, the identity of the chemical ingredients remains confidential.

- **Developing verification systems to ensure accuracy of data and compliance with RSL and other requirements.** Nike considers its material, component and product testing program critical to ensuring that suppliers are complying with its RSL requirements. Hewlett-Packard uses what they call an "active verification" process to ensure that suppliers and HP products are in compliance with the requirements of their GSE. This program consists of a signed letter indicating compliance, corrective action plans, and analytical testing in certain cases.

All three firms expressed a hope or an expectation that the EU REACH Directive will over time lead to greater disclosure of chemical information and that consumer product companies worldwide will benefit.

Lessons Learned: Advancing Safer Chemistry and Designing Safer Products

Each case study provides a number of important lessons and best practices for safer product design, as described in the points below.

- **Case study firms are expanding their focus from exclusively working to ensure that specific hazardous chemicals are absent from their products to identifying the chemicals that are in their products and determining whether they are safe.**

  S.C. Johnson's Greenlist™ System is used to evaluate and score the human and environmental health and safety of all of the ingredients in its products. (Though as noted by the company, in some cases it is difficult to get information from sup-pliers on certain classes of chemicals such as preservatives, and unintended contaminants and by-products from ingredient reactions.)

  While Nike and HP rely heavily on RSLs to ensure compliance with regulatory chemical restrictions, and to restrict other chemicals that they have deemed undesirable, they have begun to look more broadly at other chemicals that are in their products.

  HP is collecting data from its suppliers on 240 chemicals of "emerging concern," not yet restricted, and building a database that points to where these chemicals occur in its supply chain. This will facilitate future efforts by HP to restrict those chemicals, either because of new regulations or a corporate decision, and to work with suppliers to find safer substitutes.

  Nike's work in evaluating material platforms and its new protocol for evaluating chemicals in products represent efforts to evaluate all chemicals in products. These initiatives aim to identify chemicals that pose risk to consumers (i.e., they are high hazard chemicals with high potential exposure) and replace them with safer substitutes.

- **Working in partnership with suppliers helps to advance green chemistry.** Partnering with suppliers on R&D has advanced green chemistry at S.C. Johnson. Suppliers routinely provide samples of new, greener chemicals to S.C. Johnson chemists for performance evaluations so that the chemists can quickly determine whether the greener alternatives are effective. The company is currently working closely with fragrance suppliers to develop phthalate-free fragrances for its home cleaning and air products.

  Nike recognizes that they will not achieve their goals simply by dictating terms to their suppliers. When possible, Nike works closely with its suppliers to find a solution to a problem. The company recognizes partnerships with suppliers result in a more reliable supplier base over time.

- **Providing specific criteria for safer chemicals is effective in stimulating green chemistry innovation.** S.C. Johnson's Greenlist™ chemical scoring system clearly articulates the company's criteria for greener materials, and in response, suppliers develop new chemicals to qualify for Greenlist™'s top score. Greenlist™ is helping to accelerate green chemistry innovation within S.C. Johnson's supply chain.

- **Clear and constant communication with suppliers on desired green material attributes yields results.** S.C. Johnson is extremely proactive in communicating its desire for green materials through, for example, supplier training, and has been rewarded for these efforts. S.C. Johnson's supply base is well aware that by proactively introducing green materials to the company they can either gain new business or, they can protect their existing business relationship by offering greener materials.

- **If product greening is a core product design objective, integrated into the product development process and easily gauged by product developers, it is more likely to happen.** Greenlist™ is a yardstick that product development chemists can use to easily gauge the relative "greenness" of their proposed formulations, just as they gauge performance and cost with well established metrics. The Greenlist™ score is embedded into the company's global formulary, the chemical information system used by product developers. Nike's environmentally preferable materials (EPM) program and HP's DfE program are other examples of programs that integrate environmental objectives into design.

- **Collaborating and exchanging best practices with government agencies, non-profits and peers is highly beneficial when developing and implementing safer chemistry and product design programs.** S.C. Johnson's Greenlist™ program was developed with input from organizations such as the U.S. EPA, Forum for the Future, chemical suppliers and university scientists. The company has had a long-standing cooperative and collaborative relationship with regulatory agencies and in particular

the U.S. EPA, participating actively in the U.S. EPA's Design for Environment Program's Formulator Program[9], an initiative that encourages individual companies and industry sectors to compare and improve the performance, human health profile and environmental responsibility of products, processes and practices. The company has had direct access to the expertise of EPA chemists, environmental scientists and risk reduction staff that has been beneficial in investigating materials to improve the health and environmental profiles of its products.

HP was actively engaged in the development of EPEAT and many of HP's products are listed in the EPEAT database. HP also participates in other green product certification programs.

Nike's RSL programs have benefitted from its participation in the Apparel Footwear International RSL Management Group, or the AFIRM Group. AFIRM is a working group that shares best practices on RSL management programs in this sector.

Nike, HP and SC Johnson have been active participants in the Green Chemistry and Commerce Council (GC3), an organization of more than 120 representatives in various industries, which serves as a forum for the exchange of best practices to encourage the adoption of Green Chemistry and Design for Environment.

Nike has identified an opportunity to collaborate with other companies to overcome a barrier to safer chemistry and product design. Specifically, Nike would like to work with other companies to develop an information system and database to enable rapid retrieval of publicly available hazard data for individual chemicals. In Nike's view, it is inefficient for individual companies to search for the same data, on their own.

As a final note, case study firms are seeking global harmonization of similar chemical regulations to reduce the costs associated with regulatory activities. The patchwork of global chemical regulatory systems is seen as highly inefficient. Managing the proliferating regulatory programs takes considerable effort, even when the same set of substances is restricted in a similar manner (e.g., the variations on RoHS that have sprung up worldwide). These firms hope that harmonization will free up resources for more proactive green chemistry and design for environment activities.

Conclusions

The case studies reveal im-portant lessons, barriers and enablers for gathering chemical information in complex supply chains and using the information to advance safer chemistry and products. By sharing this information, these three companies and the GC3 hope to provide useful insights that other companies can benefit from as they design their own information, green chemistry and design for environment systems.

A number of chemical information systems have been developed for specific industry sectors, retailers, consumers, and government agencies. The report, *Toxic Substances in Articles: The Need for Information*[10], conducted for the Nordic Council of Ministers, describes many of these systems. These systems provide additional models that may be useful to individual companies. The report also provides several short case studies describing why information on toxic substances is critically important to a variety of stakeholders, at various points in the life-cycle of a product.

Endnotes

1 California's Safe Drinking Water and Toxic Enforcement Act of 1986, commonly referred to as Proposition 65, contains a provision that aims to warn workers and consumers about products containing substances that are known to cause cancer, mutagenic effects or reproductive health hazards. Companies selling products in the State of California that contain a listed chemical above a threshold concentration must label their products with a warning. The list includes approximately 775 chemicals. See California Office of Environmental Health Hazard Assessment, *Proposition 65 in Plan Language*, at *http://oehha.ca.gov/Prop65/background/p65plain.html*

2 REACH, or Registration, Evaluation, Authorization and Restriction of Chemicals, is a new European Union law addressing the production and use of chemical substances and their potential impacts on both human health and the environment. REACH replaces numerous EU laws related to chemicals. RoHS, or the EU Restriction on Hazardous Substances Directive, went into effect in July of 2006. The directive restricts the use of six toxic substances in electrical and electronic products: lead, mercury cadmium, hexavalent chromium, polybrominated biphenyls and polybrominated diphenyl ethers (PBDEs). China passed a similar law (China RoHS), applying only to electronic devices and requiring a labeling provision.

3 For a description of chemical information needs of various stakeholders and existing information systems, see Massey, R., Hutchins, J., Becker, M., Tickner, J., *Toxic Substances in Articles: The Need for Information*, Nordic Council of Ministers, TemaNord 2008:596, 2008. Available on-lie at: *http://www.turi.org/home/home_page/new_at_turi/toxic_substances_in_articles_the_need_for_information*

4 REACH is designed to improve chemical information flow and enhance chemicals management in multiple dimensions. It mandates information sharing about both chemical hazards and chemical uses. The information requirements under REACH require firms to obtain and disclose to their supply chains (and to some degree the public) significantly more information about chemicals in products than is currently available. As a result, it is expected that REACH will lead to greater information flow up and down the supply chain.

5 See for example, Denison, R.A., *Improving Information Flows – in Supply Chains and Beyond*, Workshop Background Paper, "Framing a Future Chemicals Policy," Boston, April 28-29, 2005; and Organisation for Economic Co-operation and Development (OECD), Environment Directorate, Joint Meeting of the Chemicals Committee and the Working Party on Chemicals, Pesticides and Biotechnology, Series on Risk Management No. 18, Workshop on Exchanging Information Across a Chemical Product Chain, Stockholm, Sweden, 15-16, June 2004, ENV/JM/Mono(2004)29.

6 Mostowy, J., Bayer MaterialScience, *Product Stewardship*, Workshop Presentation, "Green Chemistry and Commerce Council Innovators Roundtable: Opportunities and Challenges in a New Era," Broomfield, Colorado, May 4-6, 2009 *http://greenchemistryandcommerce.org/downloads/Mostowy.pdf*

7 See for example *http://www.hp.com/hpinfo/globalcitizenship/environment/productdata/reachdesktop-pc.html?jumpid=reg_R1002_USEN*

8 HP's General Specification for the Environment can be found at *http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf*. Nike's RSL document can be found at *http://www.nikebiz.com/responsibility/considered_design/documents/CorpRSL_Jan_2009.pdf*.

9 *http://www.epa.gov/dfe/pubs/projects/formulat/index.htm*

10 See note 3.

GC3 Green Chemistry & Commerce Council

Chemicals, alone or in combination, are the platform upon which key elements of the global economy have been built, and have been incorporated into millions of products used every day. Many chemicals may have inherently harmful characteristics that can impact ecological and human systems as they are used throughout supply chains. A growing number of companies are discovering that the approaches of green chemistry and Design for Environment (DfE) allow for a transition to safer alternatives. The Green Chemistry and Commerce Council provides open conversation about the challenges to and opportunities for this successful transition. The GC3 is a project of the Lowell Center for Sustainable Production at the University of Massachusetts Lowell.

Green Chemistry and Commerce Council • 978-934-2997 • greenchemistryandcommerce.org