GC3 Green Chemistry & Commerce Council

MOVING BUSINESS TOWARD SAFER ALTERNATIVES

Considered Chemistry at Nike: Creating Safer Products through the Evaluation and Restriction of Hazardous Chemicals

Case Study for the Green Chemistry and Commerce Council (GC3)

When you hear the word Nike, immediately what comes to mind are sneakers, the "Swoosh" logo, or Michael Jordan gracefully depositing a basketball in a waiting rim. Typically one does not think about the vast array of materials that go into Nike products, the chemicals that make up those materials, and how both are chosen or, for that matter, rejected.

Nike's products must perform and materials are the building blocks of product performance. Up until the mid 1990's, the company chose materials to meet performance and cost targets. Then, inspired by Paul Hawken and driven to respond to outside critics, Nike began to shoot for a third goal: Sustainability. The company began to view its products in an entirely new light. Looking at the entire life cycle of its products—manufacturing, use, and end-of- life—Nike began to develop strategies for integrating sustainability objectives into the design and manufacturing of its products. Materials selection became a key focus of the company's sustainability efforts, with particular emphasis placed on evaluating the toxicity of the chemicals that go into Nike products and the materials that aid manufacturing.

Since that time, Nike's work in sustainability, like its products, has evolved. The company has been on a non-stop voyage to find better ways to evaluate materials and produce products that are safer for consumers and the environment.

SIZE AND SUPPLY CHAIN

Headquartered near Beaverton, Oregon, Nike reported record revenues of $18.6 billion for its fiscal year 2008. Nike does not own or operate any of the contract factories that make Nike products.[1] All manufacturing is done under contract by almost 640 factories in 52 countries, each supplied by between five to ten vendors.

CONSIDERED DESIGN: NIKE'S SUSTAINABLE DESIGN PROGRAM

Today, Nike's sustainable design activities are housed within the company's *Considered Design Program*. Launched in 2005, Nike assembled a team of chemists, biologists, material specialists and designers and charged them with the task of fundamentally integrating environmental sustainability with other Nike product design objectives. With the help of outside advisors from the Natural Step and other organizations, the company developed and adopted sustainable design guidelines, trained footwear designers and reviewed the application of those principles in quarterly meetings. Today, the goals of Considered Design are to reduce waste throughout the design and development process, use environmentally preferred materials, and eliminate toxics. Nike's long-term vision for their Considered Program is to create products that use the least possible material, are designed to be easily disassembled for recycling or safely returned to nature at the end of life.

In this case study, we describe two major elements of Nike's Considered Design Program.

- The Considered Index—a sustainable product design tool used to evaluate the expected environmental footprint of a product prior to commercialization.
- Considered Chemistry—a set of activities designed to achieve Nike's long-term corporate environmental goals to eliminate substances known or suspected to be harmful to human health or the environment.

1. Nike's Considered Index

Nike utilizes a sustainable product design tool called the Considered Index to predict the environmental footprint of a product prior to commercialization. The system examines solvent use, waste, materials and innovation for footwear. Apparel products are evaluated on waste, materials, garment

treatments and innovation. Products are assigned a Considered score using a set of metrics contained in the index framework. The metrics are based on over a decade of research about materials, solid waste, innovations, textile treatments and solvent use.

Specifically, the Nike Considered Index evaluates the following attributes:

- Solvents—the intensity of use of solvent based cleaners, primers and solvents in footwear assembly as well as in decorative applications
- Waste—in footwear, the waste footprint created in the manufacturing processes for material cutting, midsoles, sockliners, decorative applications, tooling use; in apparel, the waste footprint created in fabric cutting at the garment factory
- Material—a life cycle analysis approach to material evaluation which considers growing and extraction practices, chemistry, energy intensity, energy source, water intensity, waste, recycled content and end-of-life for both footwear and apparel
- Garment Treatments—the use of post assembly garment treatments in apparel
- Innovation—significant new solutions to product-related environmental impact issues that are not currently captured in the Index criteria for both footwear and apparel

Products bearing the label Considered are those whose score significantly exceeds the corporate average. There are different levels of Considered: Gold, silver and bronze. The company is aiming for all footwear, apparel and equipment to be bronze or better by 2011, 2015, and 2020, respectively. Achievement of these goals would mean waste in Nike's supply chain will be reduced by 17 percent and the use of environmentally-preferred materials will be increased by about 20 percent.

2. Considered Chemistry

One of Nike's long-term corporate environmental goals is to eliminate substances known or suspected to be harmful to human health or the environment. In 2004, the company stated that it would proactively target, remove, or replace chemicals that, while not illegal to use, fit the scientific definition of toxic.

Nike developed several programs to help realize this goal:

a. A Restricted Substances List Program (RSL Program);
b. An initiative to reduce the use of toxic chemicals in manufacturing operations;
c. An on-going initiative to evaluate material platforms to develop environmentally preferred materials; and
d. A chemical review process to evaluate individual chemicals.

Each of these programs is described in the sections that follow.

A. Nike's Restricted Substances List Program (RSL Program)

Nike has made a significant investment in the development of Restricted Substances List (RSL) and an extensive management system designed to ensure compliance on the part of suppliers. Restricted substances are chemicals or materials that must either be completely absent from a product, package or manufacturing process or present below a specified concentration. The list is a communication tool both for suppliers and internally for Nike.

Nike's RSL is derived from lists of chemicals or materials that are restricted by legislation or have been determined by Nike to be undesirable. Nike systematically reviews global legislation to identify chemical restrictions that are relevant for its products. Where more than one country or region restricts a chemical or material in the same application, Nike bases its corporate restriction on the strictest standard.

Nike engaged the services of a consultant to develop and update a regulatory tracking system to stay current on relevant chemical and material restrictions. Once developed, Nike recognized that this system had broad application to other companies in the apparel and footwear industry. Nike permitted the consultant to make the system public and it is now available on the internet at *http://www.regconnect.com/wsp/.*

Nike's RSL has nine sections:

1. Nike Finished Product Restricted Substances List (RSL)
2. Nike Corporate Odor Management Material Guidelines & Scented Material Guidelines
3. Nike Corporate Nanotechnology Material Guidelines
4. Nike Corporate Animal Skins Policy
5. Electrical and Electronic Components (this section applies to Regulated Substances in Electrical and Electronic Equipment (EEE)).
6. Packaging Restricted Substances List (PRSL)
7. Nike Footwear Manufacturing Restricted Substance List (MRSL)
8. Toys
9. Additional Chemicals of Concern

These nine sections are described in an appendix to this case study.

MANAGEMENT OF THE RSL PROCESS

Nike's specifications and agreements with factories and vendors reflect RSL requirements, which are in addition to Nike's Code of Conduct, quality standards and other health and safety standards.

TESTING. Nike notifies its suppliers and its vendors that it may request product testing at any stage of the manufacturing process, including development and production, or testing of the finished product. The testing may be part of a routine

testing schedule or a random selection of samples. Suppliers and vendors are expected to test items that Nike identifies in order to identify problems stemming from the production process or product content.

For apparel, equipment, and footwear products, Nike has developed standardized testing guidance, including specified test methods, test request forms and failure resolution forms. Some of the key provisions of these guidelines are summarized below. Testing guidance for toys, electronic and electrical equipment, and food contact materials are handled on a case-by-case basis.

Nike-initiated routine testing. Each season, Nike identifies a list of materials and/or styles that must be tested at a Nike approved laboratory. The supplier is responsible to pay for this testing. Once testing has been initiated, suppliers are prohibited from shipping materials or products until they have received a test report that meets the Nike RSL requirements. If an item fails, Nike expects the supplier to conduct an investigation into the source of the failure and report the results back to Nike using a *Failure Resolution Form*. The supplier must indicate the source of the failure (including chemical name), action taken to prevent the failure in the future, and acknowledgment that these changes will be implemented on future production.

Random testing. Nike randomly selects and tests products at all stages of production. Nike pays for this testing. Failures are discussed with suppliers in order to identify and correct the cause. Factories are also encouraged to randomly test materials prior to production.

Supplier initiated testing. Nike encourages suppliers to conduct their own testing, with the intention that the results will be kept confidential between the lab and the supplier.

Laboratories. Nike will only accept test reports from suppliers if the tests are conducted at laboratories that have been audited and approved by Nike. Currently, these approved labs are located in Asia and Germany.

TEST DATA MANAGEMENT AND ANALYSIS. Nike RSL approved testing labs are equipped to enter test data directly into the Nike RSL Database. The labs generate test reports that are sent to Nike and the supplier.

This database, accessible only to Nike Inc., allows the company to mine the data and generate supplier "scorecards" that enable evaluation and comparisons of alternative suppliers. In addition, Nike has used the data to analyze materials and specific colors of materials to determine which tend to contain restricted chemicals or Chemicals of Concern, and which do not. This information has also been used to drive future RSL testing and communication.

B. Reducing the use of toxic chemicals in manufacturing operations

Nike gathers chemical information from its environmental, safety and health (ESH), and engineering teams at contract manufacturing facilities to feed into decisions on the choice of process chemicals used to manufacture products. This work has led to the reduction of toxic chemicals such as solvents in manufacturing operations.

C. Evaluation of material platforms to develop environmentally preferred materials

Nike is engaged in an on-going effort to develop environmentally preferred material platforms. Chemical ingredients are evaluated for environmental, health and safety hazards and high hazard chemicals are prioritized either for elimination, if possible, or substitution with a safer chemical. This process requires full disclosure of chemical ingredients.

Using this approach, Nike evaluated the ingredients used to make a rubber outer sole for footwear. The effort resulted in the creation of a new, environmentally preferred material that uses more benign accelerators, vegetable oils, and modified processing chemicals and methods. Chemical substitutes were selected based on low toxicity, performance, processability and cost.

The company is currently evaluating alternatives to solvents used to produce synthetic leather for footwear products. The goal is to identify more benign, water-based chemical alternatives.

The process used for chemical evaluation is complex, costly and slow, particularly when hazard data is difficult to find. A significant portion of the cost comes from the use of toxicology consultants to evaluate the hazards of chemicals in the original material and potential substitutes. Nike is currently developing a streamlined process to reduce the cost and time required to conduct the chemical evaluation portion of the work. This system is described in the next section.

D. Chemical review system to evaluate individual chemicals—under development

Nike is developing a new system to evaluate the risk posed by individual chemicals. The system will be used to identify and prioritize hazardous chemicals either for elimination or control through Nike's RSL Program. Results from chemical evaluations will drive new additions to the RSL and help set priorities for substitution of toxic chemicals. The system will also be used to evaluate possible substitutes for hazardous chemicals to ensure that they are truly better alternatives.

An important objective for the development of this system is to increase the efficiency of the chemical evaluation process at Nike so that the company can evaluate the sizable

universe of chemicals that are currently used in Nike products, and chemicals that might be used in the future.

The system builds upon the environmentally preferable material development work described in the previous section. Once fully developed, the system will support those continuing efforts.

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 and hazard data.

Nike has developed a blueprint for this new chemical review system and some of its key components. The system, illustrated in Figure 1, proceeds according to a number of steps as described below.

STEP 1. FILTER

The process starts with the identification of a chemical, either during a systematic review of a material or product or through a request by a field-based environmental health and safety team to evaluate a chemical. The reviewer determines whether the chemical is already restricted by the existing RSL guidance or is a Nike Additional Chemical of Concern (Section 9 in the Appendix describes this designation). If not, the chemical goes on to Step 2.

STEP 2. PRELIMINARY ASSESSMENT

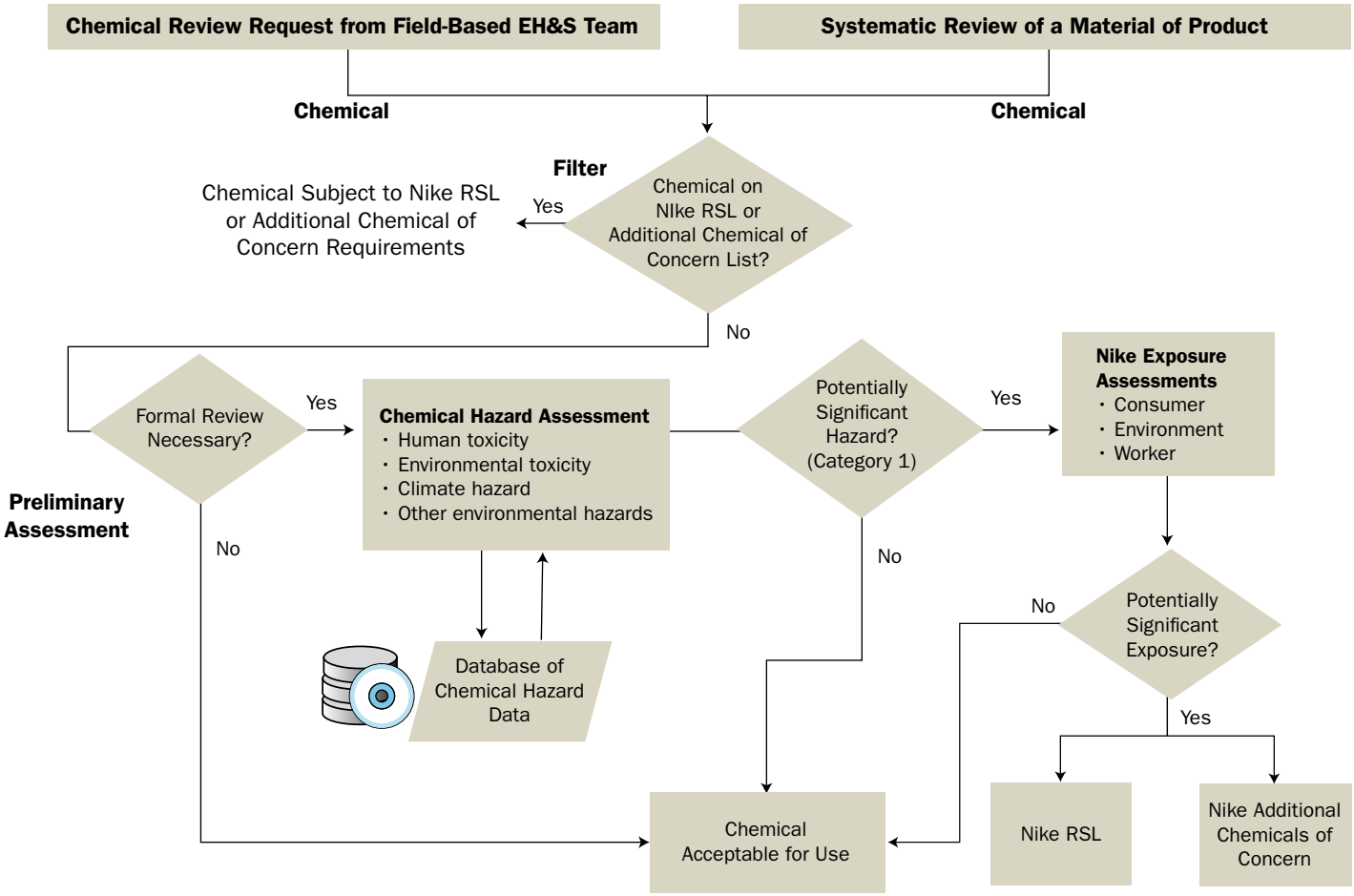
A preliminary assessment is conducted by a Nike toxicologist to determine whether a more detailed, formal review of the chemical is necessary. If the chemical is considered acceptable for use, i.e., it is a well known chemical that is generally accepted as safe, no further evaluation is done. If the chemical cannot be deemed acceptable in this stage, it proceeds to a formal review.

STEP 3. FORMAL CHEMICAL REVIEW PROCESS

STEP 3A. CHEMICAL HAZARD ASSESSMENT

Nike's approach to chemical hazard assessment follows the Organization for Economic and Cooperative Development (OECD) Harmonized Integrated Classification System for Human and Environmental Hazards of Chemical Substances and Mixtures. Nike chose the OECD system because it has gained wide acceptance among several countries,

Figure 1. Nike Chemical Review Process



toxicologists and environmental chemists and has become an internationally recognized standard for the analysis of mammalian and aquatic toxicity.

Nike's assessment scheme evaluates chemicals across 18 hazard characteristics, listed below.

Chemical Hazard Characteristics
- Acute toxicity
- Irritation of skin
- Eye irritation
- Skin or respiratory sensitization
- Genetic Toxicity/Mutagenicity
- Carcinogenicity
- Reproductive/Developmental Toxicity
- Specific target organ toxicity following repeated exposures
- Endocrine effects
- Chemical interactions/reactions
- Aquatic toxicity—Acute (Fish, crustacean, algae)

Chemical Hazard Characteristics *contintued*
- Bioaccumulation potential
- Degradability/Persistence
- PBT Classification (Persistent Bioaccumulative Toxicant)
- Halogenated Organic Compound (AOX)
- Heavy metal content
- Climatic hazard (greenhouse gas)
- Other environmental classification (toxicity to soil organisms, terrestrial plants)

Each characteristic is given a category designation from 1 to 4, or inadequate data, as follows in the box on the following page.

For each of the 18 characteristics, Nike has developed criteria for assigning the category designations. As an example, the criteria for the hazard characteristic "Irritation of Skin" are presented in Table 1.

Nike seeks out five data points from recognized data sources to evaluate each characteristic. Examples of these

Table 1. Criteria for the Evaluating Hazards Related to Irritation of Skin

Ranking Priority						
Category	**Category 4**	**Category 3**	**Category 2**	**Inadequate Data (To be judged)**	**Category 1**	**Reference (Data Source)**
Irritation of skin (2) [Also for long-term, or "cumulative" irritation (e.g. human patch tests) and phototoxicity] Regulatory Review	Non-irritating	Mild irritant	Irritant	No review available	Severe irritant or corrosive	[Merck Index, ACGIH, NIOSHTIC, HSDB, RTECS, IUCLID, TOXNET, MSDS sheets, TLV or MAK value documentation, USEPA HPV Database, ESIS]
Effect Definition	• as observed in animal tests or human experience • based on valid in vitro test • indicated by existing data in animals (from acute toxicity tests)	• reversible adverse effects in decimal tissue [Draize score in 2 of 3 animals for erthema/ edema between 1.5–2.3 • or as reported in human experience • based on valid *in vitro* test • indicated by existing data in animals (from acute toxicity tests)	• reversible adverse effects in animal tests, persistent inflammation [mean Draize score in 2 of 3 animals for erythema/ edema between 2.3–4.0] • reported from human experience • based on valid *in vitro* test • indicated by existing data in animals (from acute toxicity tests)	Review of technical literature may be used as an ancillary source for classification. Document in chemical summary sheet.	• visible tissue destruction/ necrosis observed in at least one animal, or reported from human experience • based on valid *in vitro* test • ph≤2, or ≥11.5	OECD Based primarily on animals tests conducted in accordance with OECD protocol; however, a host of other data based on human experience, acute (dermal) toxicity studies in animals, *in vitro* assays, and alkaline/acid nature of chemical (pH). Surrogate or SAR/ SPR data may also be considered and used to esimate the irritant potential of a chemical.

Chemical Hazard Assessment Categories

Category	Definition
Category 4	Safe
Category 3	Low level of hazard
Category 2	Low to moderate hazard
Category 1	Moderate to high level of Hazard
Inadequate Data	Unable to categorize hazard characteristic due to lack of data

recognized data sources are listed in the References column in Table 1. If the chemical falls into the range of a Category 1 for one or more characteristics the chemical proceeds to exposure assessment.

Finding five data points can be challenging given the limited availability of hazard data. John Frazier, Nike Director of Considered Chemistry, stated that he hopes the European Union's REACH[2] system and other regulatory programs will make data more available in a consolidated, easy-to-search format.

Nike would like to automate this process to more rapidly and cost-effectively assess chemicals. The automated system would be designed to enable Nike to simply enter a CAS[3] number or a chemical name and the system would electronically retrieve hazard data (ideally five data points) for each of 18 hazard characteristics from a set of designated sources of hazard data. Nike would like to develop this system in concert with other companies since there is a general need for this data across all sectors. As stated by John Frazier, "we all are paying to have the same chemicals reviewed over and over with little to no data sharing. If a tool like this was available, this money could be spent on other efforts."

STEP 3B. EXPOSURE ASSESSMENT

The Exposure Assessment examines potential consumer, environmental and worker exposure to high hazard chemicals using exposure models developed by Nike for apparel, footwear and equipment. The apparel exposure model is often used, even if the chemical is present only in footwear and equipment, because it produces a more conservative estimate of exposure (i.e., if a chemical passes the exposure assessment for apparel, it will pass for footwear and equipment as well).

High hazard chemicals with high potential exposure are added either to Nike's Chemical of Concern list or one of the sections of Nike's RSL.

Nike will use this chemical review process to evaluate chemical substitutes for materials or products to determine whether they pose less risk than the chemicals they would be replacing. The company does not produce a list of "acceptable" or "safe" chemicals for its suppliers. According to John Frazier, doing so would be fraught with problems since the safety of a chemical depends on the specific application.

Nike will also use this framework to determine whether to require a reduction in the allowable concentration of an RSL chemical, or to eliminate its use entirely. This process will begin with chemical testing of a product to determine actual concentrations of RSL chemicals. Using a safety factor, Nike will compare the actual concentrations to the acceptable concentrations, as indicated in the existing RSL guidance. If the actual concentration exceeds the RSL acceptable concentration, Nike will either lower the acceptable level in their RSL guidance or restrict the chemical entirely.

LESSONS LEARNED

Nike has learned a great deal about the significant challenges to, and opportunities for, improving the chemical safety of its products in a complex supply chain environment.

- **Getting complete and reliable chemical information from suppliers remains a challenge.** In some cases, contract factories or vendors do not have full chemical information from their suppliers on the chemicals, chemical mixtures, textiles or other materials that they procure. Even if information is provided, it may not be correct. In some cases, suppliers are simply unwilling to provide the information.

  John Frazier described an instance when Nike tried to get chemical information from a company that supplied dyes to a facility that dyed textiles for Nike products. The supplier, a formulator of dyes from chemical ingredients, was unwilling to provide the dye ingredients. Since sales to Nike made up approximately 5% of the suppliers total sales, Nike did not have sufficient leverage to get the information.

- **Finding hazard data on chemicals is challenging.** Nike aims for five data points from recognized sources to evaluate each hazard characteristic. Locating this data can be difficult and costly.

- **The importance of verification.** While certification of compliance has become a standard component of corporate RSL systems, Nike recognizes that it is not enough. Certification is not a guarantee of compliance with RSL policies. With hundreds of factories, each supplied by five to ten material vendors, it is impossible for Nike to audit all companies in its supply chain. The testing program is critically important to verifying compliance with RSLs.

- **Data collected from material and product testing under Nike's RSL program can inform future supplier and material selection.** Analyzing test data helps Nike identify

reliable suppliers and choose safer materials for future products.

- **The importance of building partnerships with suppliers.** Nike recognizes that they will not achieve their goals simply by dictating terms to their suppliers. When possible, Nike works in partnership with suppliers to find a solution to a problem. They recognize that over time, greater partnership will result in a more reliable supplier base. Clear communication with suppliers is a critical component of these efforts. Nike has learned that it must clearly communicate its goals to suppliers in order to achieve the desired outcome.

- **Restricting chemicals used in manufacturing can have unintended consequences.** When trying to restrict the use of certain chemicals in manufacturing, Nike has found that it must be careful to not simply "push" the use of the chemical to a different part of the supply chain. There is a risk that suppliers will simply "outsource" a process that uses the restricted chemical, thereby making it invisible to Nike.

- **The importance of sharing best practices with peers.** Nike has 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. Members include multiple apparel and footwear companies with RSL as well as regulatory, product safety and chemistry experts. AFIRM's aim is to reduce the use and impact of harmful substances in the apparel and footwear supply chain and to provide a forum to advance the global management of restricted substances in apparel and footwear.[4]

Nike has also benefitted from its participation in the Green Chemistry and Commerce Council (GC3), an organization of more than 120 representatives in various industries, seeking to integrate Green Chemistry and Design for Environment approaches into product development.

— Monica Becker, Monica Becker & Associates
Sustainability Consultants and Lowell Center Fellow

SOURCES

Information for this case study was gathered from the following sources:

1 Interviews with John Frazier, Nike Director of Considered Chemistry.
2 Nike Considered Design—Products That Redefine Performance and Sustainability, October, 2008, *http://www.nikebiz.com/media/pr/2008/10/28_Considered.html*
3 Nike's website on RSLs *http://nikeresponsibility.com/#environment-design/rsl and the RSL document http://www.nikeresponsibility.com/rsl_downloads/CorpRSL_Jan_2009.pdf*

Appendix

A Description of Nike's Restricted Substances List

Nike's RSL has nine sections, as described in the sections below.

1. NIKE FINISHED PRODUCT RESTRICTED SUBSTANCES LIST (RSL)

The Nike finished product RSL contains numerous chemicals organized by category (e.g., azo dyes, disperse dyes, and flame retardants). The list is available on the internet so that Nike suppliers and anyone interested can easily access the most current information. A table containing the list of restricted substances indicates the following:

- The reason for the restriction (legislated or Nike requirement)
- Nike's maximum allowable concentration limit (either prohibited, not detected, or an amount typically expressed as a concentration of the substance in mg per kg of component[5] material)
- Required laboratory reporting limit (i.e., laboratory equipment detection limit) for testing of components
- The specific test method that must be used for testing.

Table A-1 is an excerpt from the Nike Finished Product Restricted Substances List (RSL).

Table A-1. Excerpt from the Nike Finished Product Restricted Substances List

Restricted Substance or Group Name (CAS #):	Reason for Restriction	NIKE LIMIT: Maximum allowable concentration in component[5]	Required Laboratory Reporting Limit Per substance concentration in product	Test Method and Comments
Phthalates All esters of –phthalic acid including but not restricted to: di-isononyl phthalate (DINP) (28553-12-0) di(ethylhexyl) phthalate (DEHP) (117-81-7) di-n-octyl phthalate (DNOP) (117-84-0) di-iso-decyl phthalate (DIDP) (26761-40-0) butyl benzyl phthalate (BBP) (85-68-7) dibutyl phthalate (DBP) (84-74-2) Apparel and Equipment: For children < 36 months: all materials Footwear: Limits apply for the following shoe size Shoes < 160mm (Nike size 10C and smaller)	Legislated	Apparel and Equipment: For children < 36 months: all materials <500 mg/kg (total) Footwear: For shoes < 160 mm <500 mg/kg (total)	50 mg/kg for each phthalate	Nike – In-house Method Determination of defined Ortho-Phthalic Esters in Synthetic Fibers and Thermoplastics by LC-DAD-MS or GC-MS Confirmation of failure by fragmentation HPLC-MS
Polyvinylchloride (PVC) (9002-86-2)	Nike Requirement	Apparel, Equipment, Footwear: All products, all materials*: not detected *Apparel Only— Screen Prints: All screen prints for children < 7 years: not detected * Program to phase out all other PVC containing screen prints: ongoing.	PVC 10% (Due to complexity of analysis, Nike defines detection limit as 10%)	***Two tests for confirmation*** Beilstein's test*: Burning test for the presence of chlorine Infrared Analysis*: Spectroscopy (IR) with or without solvent extraction (Positive results for both tests indicate PVC): * PVC test methods are "qualitative"—the 10% limit is estimated sensitivity
Short Chain Chlorinated Paraffins (SCCP) with C10–C13 (85535-84-8)	Legislated	1000 mg/kg	100 mg/kg	Solvent extraction, followed by GC/ECD analysis and GC/MS confirmation

2. NIKE CORPORATE ODOR MANAGEMENT MATERIAL GUIDELINES & SCENTED MATERIAL GUIDELINES

Odor management materials are defined by Nike as antimicrobial agents (biocides, antibacterials and biostats), odor capture technologies and scented ingredients. Nike restricts the use of scented materials and odor control technologies in apparel, footwear and equipment. In order to be used, scented materials or odor control technologies must:

- Not leach or release chemicals in order to be effective[6]
- Meet global legislative standards
- For microbial technologies, be registered under the EU Biocide Directive
- Pass a corporate toxicity review
- Be proven effective
- Comply with the Nike Corporate RSL (Restricted Substances List)

3. NANOTECHNOLOGY MATERIAL (NANOMATERIAL) GUIDELINES

Nike reviews and controls the use of nanomaterials within apparel, footwear and equipment product lines. Nanomaterials are chemicals, compounds or components that derive their function from their extremely small size, between one to 100 nanometers (one nanometer is one-billionth of a meter). This restriction applies to any nanomaterial containing a substance or product component that is intentionally applied to a Nike product, either used to impart desirable physical properties to the final product or that remains in the product stemming from the manufacturing process.

Nike requires that products to which nanomaterials are applied must not leach or release chemicals or particles to be effective or as a result of wear, unless safety data are available and deemed acceptable. In addition, nanomaterials must meet global legislative standards, be either registered with a government body or the manufacturer/supplier must analyze consumer safety, pass a corporate toxicity review, be proven effective and comply with the Nike Corporate RSLs.

4. NIKE CORPORATE ANIMAL SKINS POLICY

Nike has set out specific requirements for animal skin materials and products used in products including requirements for sourcing some skins from U.S. sources, certification of compliance with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and prohibitions on the use of skins from certain animal species.

5. RESTRICTED SUBSTANCES IN ELECTRICAL AND ELECTRONIC COMPONENTS

Nike has established a set of chemical limits specifically for Electrical and Electronic Equipment or components, focused on heavy metals in batteries and in other components, as well as certain flame retardants.

6. PACKAGING RESTRICTED SUBSTANCES

For all packaging components[7],Nike directs its suppliers to comply with legal restrictions for heavy metals[8], forbids the intentional introduction of heavy metals and limits the combined incidental concentration of heavy metals to 100 ppm. Nike requires suppliers to test for heavy metals using specified tests and maintain formal certification of compliance with applicable laws. In addition Nike puts the onus on its suppliers to identify and minimize dangerous substances according to specific lists of dangerous chemicals. These substances must be identified on Material Safety Data Sheets (MSDS). The lists of dangerous substances provided to suppliers are the Nordic Council's N-CLASS Database on Environmental Hazard Classification[9] and the Finish Standards Association's SFS-EN 13428 standard addressing toxics in packaging.

Nike restricts the use of formaldehyde to 150 mg/kg and prohibits the use of polyvinyl chloride (PVC). Packaging must be tested for formaldehyde and all plastic and paper packaging with a plastic laminate must be tested for PVC.

Nike has additional design requirements for packaging including: minimum recycled material content requirements; restrictions on the number of packaging layers; recoverability by either recycling, energy recovery or composting; a prohibition on the use of expanded polystyrene packaging for small electronics and all toys; and preferences for sustainably harvested wood-based products.

7. MANUFACTURING RESTRICTED SUBSTANCES LIST (MRSL)

Nike prohibits suppliers from the intentional use of certain chemicals in manufacturing. A portion of the list is presented in Table A-2. While suppliers are working on eliminating the chemicals, Nike advises companies to minimize exposure to the worker, environment, and consumer. Suppliers are reminded that MSDS' for the chemicals that they are purchasing may not disclose the presence of these chemicals if their concentration is 1000 mg/kg or lower. Nevertheless, the suppliers are still responsible for ensuring that worker exposure does not exceed Nike's exposure limits for contract factories.

8. TOYS[10]

The toy section of Nike's RSL is based on the European Union's Toy Safety Directive 88/378/EC[11]. Nike provides suppliers with a list of chemicals and their maximum allowable concentrations for specific types of toys, toy components and toy materials. Toys must meet these limits as well as the Nike RSL for finished products, including a prohibition on PVC. Toys must also pass mechanical and safety testing.

Table A-2. Excerpt from the Nike Manufacturing Restricted Substances List (RSL)

Restricted Substance or Group Name (CAS #):	Synonym(s)	Common Potential Uses
Cresol (1319-77-3) m-Cresol (108-39-4) o-Cresol (95-48-7) p-Cresol (106-44-5)	Cresylic Acid	Nylon and plastic primers and resins
N,N-Dimethylacetamide (127-19-5)	DMAC	Solvent in Primers, Adhesives and Resins
Dimethylsulpoxide (67-68-5)	DMSO	Solvent Cleaner
Dimethyl formamide (68-12-2)	DMF	Solvent Cleaner
Ethylene glycol monobutyl ether (111-76-2)	EGBE/Butyl cellusolve	Solvent Cleaner
Formaldehyde (50-00-0)	Formic aldehyde	Solvent cleaner, anti-shrinkage resin, mold inhibitor
Methylene Chloride (75-09-2)	Dichloromethane, Methylene Dichloride	Solvent Cleaner
n-hexane (110-54-3)	Hexane	Solvent Cleaner
n-methyl pyrrolidone (872-50-4)	NMP, 1-methyl-2-pyrrolidinone	Solvent Cleaner
4,4'-methylenebis (2-chloraniline) (101-14-4)	MOCA	Press Pad
Phenol (108-95-2)	Carbolic acid, phenyl alcohol, phenyl hydroxide	Solvent in primers, adhesives and resins for nylon and plastics
Tetrachloroethylene (127-18-4)	Perchloroethylene, PERC	Solvent cleaners
1,1,1-trichloroethane (71-55-6)	1,1,1 – TCA, methyl chloroform	Solvent Cleaners
Toluene (108-88-3)	Methylbenzene	Solvent in primers, adhesives, paints and inks
2,4-toluene diisocyanate (584-84-9) Toluene-2,6-Diisocyanate (91-08-7)	TDI	Activator in some polyurethane foams
Trichloroethylene (79-01-6)	TCE, trichlorethene	Solvent cleaner
Xylene – all isomers (1330-20-7)	Ethylbenzene, o,m,p-xylene	Solvent in primers, adhesives, paints, inks
Trichloromethane (67-66-3)	Chloroform	Solvent Cleaner
1,1,2-Trichloroethane (79-00-5)	Vinyl trichloride	Solvent Cleaner
1,1-Dichloroethylene (75-35-4)	1,1-dichloroethene	Solvent Cleaner

ADDITIONAL CHEMICALS OF CONCERN

Nike has developed a list of chemicals that while not prohibited by the company, are identified as chemicals that are the focus of governmental, academic and/or NGO research and may in the future be legally regulated or put on the RSL. Nike requests that suppliers review the list internally and with their chemical suppliers, determine if these substances are likely to be found in their product, understand the function(s) they serve and if possible, avoid intentional use of these chemicals. Suppliers may be asked why and how the chemical is used and what can be done to eliminate its use. Currently, this list contains several categories of alkylphenol ethoxylates[12] and certain Organotin Compounds.[13]

ENDNOTES

1 In this case study, the term "factory" refers to Nike's contract manufacturers. These companies are independently owned manufacturing facilities that are under contract to Nike to cut, sew or assemble Nike products. These factories purchase the chemicals, materials, components, and dyeing services that they need from "vendors." Vendors enter into contracts with factories for the supply of these materials and services. The term "suppliers" refers collectively to factories and vendors.

2 REACH, or Registration, Evaluation, Authorization and Restriction of Chemicals, is a European Union law addressing the production and use of chemical substances and their potential impacts on both human health and the environment.

3 CAS, or Chemical Abstract Service registry numbers are unique numerical identifiers for chemical elements, compounds, polymers, biological sequences, mixtures and alloys.

4 See *http://www.afirm-group.com/*

5 "Component" is defined as any single part/layer of a product that is visibly distinguishable from other parts/layers and separable by simple physical means e.g. knife and tweezers.

6 Substances could include the heavy metals Copper, Silver, Tributyltin (TBT), Triclosan and Pentachlorophenol.

7 Nike defines packaging components as individual assembled parts of a package, including, but not limited to, interior/exterior blocking, bracing, cushioning, weatherproofing, exterior strapping, coatings, closures, dyes, pigments, adhesives, stabilizers, inks, labels and additives.

8 Cadmium, Mercury, Lead and Hexavalent Chromium.

9 The N-CLASS Database on Environmental Hazard Classification is compiled by the Steering Group for the Nordic Council of Ministers project on Hazard Classification and Labelling. The database contains substances, 7987 at present, that have or are being discussed by the European Commission Working Group (CWG) on classification and labeling for environmental effects. The database includes substances that have been assessed as dangerous to the environment and substances that have not been classified (either because they have been classified as not dangerous to the aquatic environment or because there is insufficient data). See *http://www.kemi.se/nclass*

10 A toy, as defined by Nike, is any product or material with play value by children of less than 14 years of age.

11 The European Union's Toy Safety Directive 88/378/EC draws on EU standards EN 71-3:1994 Specification for migration of certain elements, EN71-9:2005 Organic chemical compounds, EN71-10:2005 Organic chemical compounds - Sample preparations and extraction, and EN71-11:2005 Organic chemical compounds - Methods of analysis.

12 Alkylphenol ethoxylates (APEs) are used as surfactants in manufacturing of textiles and other products such as emulsifiers, detergents and pesticides. APEs do not biodegrade easily and are toxic to aquatic organisms. See for example, Environment Canada, Health Canada. "Nonylphenol and Its Ethoxylates: Priority Substances List Assessment Report." 2001.

13 Tributyltin, or TBT, is used as a biocidal preservative for wood, cotton, textiles, paper and paints and stains for residential homes. It has been used since the 1960s as an antifouling agent in marine paints. TBT is persistent and bioaccumulative in aquatic environments and highly toxic to aquatic organisms. See for example The Inter-Organization Programme for the Sound Management of Chemicals (IOMC), **"**Concise International Chemical Assessment Document 14, Tributyltin Oxide." 1999.