GC3 Green Chemistry & Commerce Council

MOVING BUSINESS TOWARD SAFER ALTERNATIVES

S.C. Johnson Is Transforming Its Supply Chain to Create Products that Are Better for the Environment

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

S.C. Johnson is a formulator of chemical-intensive products that are used in millions of households each day. The company does not produce the ingredients that go into their products. Rather, individual chemicals or chemical mixtures are selected by company chemists and procured from suppliers. The evaluation and selection of these supplied raw materials is of paramount importance to the company, determining whether products will perform, be cost-effective and better for consumers and the environment. In this case study we examine how S.C. Johnson, through its Greenlist™ process, is transforming its supply chain to create products that are better for the environment.

S.C. Johnson is a company with a long, proud history. Founded in 1886 as a parquet flooring company by Samuel Curtis Johnson, S.C. Johnson is now a diversified consumer product company selling home cleaning and storage, air care and pest control products. From its headquarters in Racine, Wisconsin, five generations of the Johnson family have grown the business into a sizeable, global company. The company generates more than $8 billion in sales, employs approximately 12,000 in more than 70 countries and sells products in more than 110 countries.[1] With brand names like Shout®, Windex®, Ziploc®, Glade®, Raid®, OFF!®, Pledge® and Scrubbing Bubbles®, few consumers are unfamiliar with S.C. Johnson's products.

S.C. JOHNSON'S PRODUCT DEVELOPMENT AND SUPPLY CHAIN

The majority of the product development work at S.C. Johnson is done in Racine, with a small development effort in China. All development for global products is done in Racine. The company aims to create standard formulations that are sold globally but in some cases, products need to be tailored for different markets. S.C. Johnson has one "global formulary" or chemical information system, which is the basis for all chemical selection. Chemical ingredients are chosen by product development chemists from the formulary database, which contains information on chemical structure, physical properties, composition, CAS[2] number and a Greenlist™ environmental, health and safety rating. Once selected, procurement staff purchase materials based on price, quality and delivery.

S.C. Johnson's primary suppliers are the larger chemical companies—Dow, DuPont and BASF—but the company also purchases from smaller, specialty chemical companies that supply surfactants, fragrances and other specialty components. Many of the company's suppliers are global, which contributes to the uniformity of the products that are manufactured worldwide.

GREENLIST™

In 2001, S.C. Johnson launched an innovative chemical classification process called Greenlist™ that rates 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 can choose materials in consideration of their environmental and health properties. Using the scores, materials can be easily compared. S.C. Johnson chemists around the globe have instant access to data on the score of ingredients for product formulation and reformulation.

The Greenlist™ program was developed with input from other organizations such as the U.S. EPA, Forum for the Future, chemical suppliers and university scientists. Greenlist™ has received a number of awards, including the Ron Brown Award for Corporate Leadership and the Presidential Green Chemistry Challenge Award. S.C. Johnson was awarded the U.S. EPA Safer Detergents Stewardship Initiative (SDSI) Award for the elimination of all nonylphenol ethoxylate surfactants from products. This was accomplished through the use of Greenlist™.

The Framework. Greenlist™ currently has unique rating criteria for 19 material categories (see box, right). The S.C. Johnson formulary has Greenlist™ scores for more than 98 percent of the raw materials currently used by the company.

Each of the 19 chemical categories is scored based on four to seven criteria. Criteria for each chemical category are unique and determined by use pattern and the environmental media impacted (i.e., air, water, soil). Criteria include ultimate biodegradability, acute human toxicity, aquatic toxicity and European Union environmental classification (also known as EU Risk or R Phrases).

THERE ARE FOUR GREENLIST™ SCORES.

3 Best
2 Better
1 Acceptable
0 Restricted Use Material (RUM)

First, the material is rated according to the appropriate criteria. As an example, the table below presents the Greenlist™ criteria for surfactants. Next, scores for the criteria are averaged. The average score is then adjusted for "Other Significant Concerns," which vary by material category (see box, right).

Greenlist™ Material Categories

- Surfactants
- Solvents
- Propellants
- Chelants
- Preservatives
- Waxes
- Insecticides
- Fragrances
- Inorganic acids
- Inorganic bases
- Resins
- Organic Acids
- Dyes
- Colorants
- Thickeners
- Packaging materials
- Non-woven fabrics
- Silicones
- Sawdust and plant materials

Greenlist™ Examples of Other Significant Concerns

- Possible endocrine disruption
- Carcinogenicity
- Reproductive toxicity
- EPA's PBT Profiler classification
- Other environmental concerns
- Ban by countries where SCJ does business

Table 1. Greenlist™ Surfactant Criteria

Categorical Criteria	Scoring Criteria Endpoints		
	Acceptable (Score = 1)	**Better (Score = 2)**	**Best (Score =3)**
Aquatic Toxicity	• LC50/EC50 ≤1 mg/L • 1–2 species	• LC50/EC50 > 1 mg/L • 1–2 species	• LC50/EC50 > 1 mg/L • 3 or more species
Acute Human Toxicity	Rat Oral LD50 < 500 mg/L	Rat Oral LD50 500–2000 mg/L	Rat Oral LD50 > 2000 mg/L
Ultimate Biodegradability	≤ 60% within 28 days	> 60% within 28 days	• Classification of "readily biodegradable" by OECD 301 test methods • > 60% within a 10 day window
EU Environmental Classificaiton	Any combination of EU environmental classifications (N; R50; R51; R52; R53)	• No adverse EU environmental classification • Classification as "Readily Biodegradable" by international test methods • Aquatic toxicity > 1 mg/L	• No adverse EU environmental classification • Classification as "Readily Biodegradable" by international test methods • Aquatic toxicity > 100 mg/L
Source/Supplier	**Source:** < 25% preferred source **Supplier:** no environmental management standard in place	**Source:** 25–75% preferred source **Supplier:** an internal company environmental management standard in place	**Source:** >75% preferred source **Supplier:** internationally recognized environmental management standard in place (ie. ISO 14001 or Responsible Care)
Other Significant Concerns	• EPA classification as a PBT/POP chemical[3] • Classification as an endocrine disruptor • Classification as a known, probable, or possible human carcinogen according to IARC, EPA or NTP • Classification as a reproductive toxin according to Proposition 65 • Considered a "Chemical of Concern" with official or unofficial bans in one or more countries or by relevant trade associations		

If S.C. Johnson determines that the material carries other significant concerns, the score is reduced by one class (for example from a 2 to 1). A material with a score of "0" is designated as a "Restricted Use Material" or RUM. S.C. Johnson works to replace these chemicals with alternatives that have better environmental and health profiles and are more biodegradable. The use of a RUM chemical requires approval of top management and is granted in limited cases when alternative chemicals are unavailable. This element of the system provides flexibility to "downgrade" a material's Greenlist™ score if additional concerns exist. The score can only be lowered, not raised. The criteria are adjusted as new information emerges.

The Data. The environmental, health and safety (E,H&S) data required to score materials are provided to S.C. Johnson by the supplier. Generally, suppliers provide what are called "toxicology summaries" with all the information needed to evaluate a chemical. S.C. Johnson toxicologists receive the data and develop the scores. If additional information is needed to, for example, verify certain data elements, the toxicologists request additional data. In a small number of cases, as we describe in the coming section on Managing Supplier Confidentiality, suppliers conduct the Greenlist™ scoring and submit the score to S.C. Johnson.

In some cases, suppliers have been unwilling to disclose sufficient ingredient or toxicological information for S.C. Johnson to devise a Greenlist™ score. In these cases, materials must be assigned a score of 1. Suppliers are told that they will be at a competitive disadvantage and sometimes this leads to greater disclosure.

Managing Supplier Confidentiality. Some suppliers are guarded when it comes to sharing the E,H&S data that S.C. Johnson needs to evaluate a material under Greenlist™. Over time, S.C. Johnson has developed protocols to deal with these confidentiality issues.

There are essentially three levels of confidentiality. Some chemicals purchased by S.C. Johnson are in common use in industry and are not considered proprietary by their suppliers. For these chemicals, suppliers provide S.C. Johnson with EH&S data freely.

Certain chemicals or formulations are considered proprietary by their suppliers, but these suppliers are willing to provide S.C. Johnson with EH&S data under a non-disclosure agreement. Under these agreements, only S.C. Johnson toxicologists get access to the data for the purpose of scoring the material in Greenlist™. Polymers and dyes typically fall under this category.

Finally, some suppliers regard their products as highly proprietary. This is typically the case with fragrances. In these cases, the supplier determines the Greenlist™ score and provides only the score to S.C. Johnson. The company audits these submittals.

S.C. Johnson has had difficulty at times getting complete information on suppliers' Material Safety Data Sheets (MSDS). As stated by Daniel Lawson, Sustainability Innovation Manager for S.C. Johnson, "the typical MSDS prepared for the U.S. market is two pages long. In contrast, a typical MSDS prepared for the European Market is 16 to 20 pages long, containing significantly more chemical and E,H&S information." David Long, consultant to S.C. Johnson, believes that the implementation of the European Union's REACH program will over time lead to greater disclosure of chemical information by suppliers, even in the U.S., and that companies like S.C. Johnson and consumers will benefit from greater data availability.

Addressing Unintended Contaminants. In some cases supplied materials may contain small amounts of preservatives, contaminants, unreacted chemicals or unintended by-products from chemical reactions. S.C. Johnson typically addresses these by adjusting the Greenlist™ score of the supplied material under the "Other Significant Concerns" element of the Greenlist™ process.

The purity of the material supplied can be addressed in the specifications written during the procurement process. Suppliers are required to provide chemical analysis and certification of the purity of the product supplied and S.C. Johnson can prohibit certain substances. For example, S.C. Johnson uses caustic soda (Sodium Hydroxide or lye) in some of its formulations. Some caustic soda is produced in chlor-alkali plants that use a mercury cell process. Caustic and other products derived from this process can be contaminated with mercury. To ensure that the caustic purchased by the company is free of mercury contamination, S.C. Johnson will not purchase caustic or sodium hypochlorite made by the mercury cell process and has put in specifications that caustic cannot contain mercury above the part per billion level (ppb or 0.0000001%).

OTHER GREENLIST™ PROGRAM FEATURES

Relationship to Regulatory Compliance. Greenlist™ goes above and beyond what is required by current regulation and is forward-looking, anticipating future chemical regulations and seeking to phase out hazardous chemicals in advance of regulatory action. Greenlist™ has not replaced S.C. Johnson's environmental, health, safety and risk management programs. Rather, it compliments these efforts by eliminating chemicals before they are banned or otherwise regulated.

Tracking Overall Corporate Progress. In addition to providing a scoring system for materials, Greenlist™ also provides metrics for tracking S.C. Johnson's corporate-wide

progress toward greening its portfolio of products. Each year, the company calculates a weighted average Greenlist™ score for all raw materials used. The overall score is calculated by multiplying the weight of each chemical purchased by its Greenlist™ score, summing these numbers and then dividing by the sum of all raw materials used by weight. A rising score indicates increasing use of environmentally preferable materials. This metric is tracked yearly and yearly goals are set to reach a five year goal.

The company also tracks the year-on-year percentage change in the use of materials in each group. S.C. Johnson's goal is to increase the percentage of raw materials that are rated "Better" or "Best." At the start of the program (reporting period 2000/2001), a total of 4 percent of materials were "Better" or "Best." In their 2008 Public Report, the company reported that in the 2006/2007 reporting period, they reached 18%, increasing their use of "Best" materials by 25 million kilograms over the previous year. Use of RUM materials dropped from 17% to 1% during the same period, despite sales growth.

Tying Performance Evaluations to Greenlist™ Scores. Greenlist™ scores are linked to employee performance. Each year Greenlist™ goals are established. The goals are aligned from senior managers to the chemists. If targets are not met, employee performance evaluations may be affected.

Using Greenlist™ to Communicate to Consumers. The company has begun to put the Greenlist™ logo on packages of certain products, such as Windex® glass cleaner, to communicate information about its Greenlist™ program to consumers. Only products that have been improved significantly through the Greenlist™ process and meet the strict requirements receive the Greenlist™ logo.

S.C. Johnson's innovative new ingredient communication program includes a dedicated website designed to provide helpful information to consumers. The website can be found at *www.whatsinsidescjohnson.com*.

THE EVOLUTION OF THE GREENLIST™ PROGRAM

When S.C. Johnson first began to use Greenlist™ in 2001, the company approached their suppliers and challenged them to create better rated chemicals. Some suppliers got on board immediately. Others pushed back saying that their environmental, health and safety (EH&S) data are proprietary. Greenlist™ proponents were undeterred.

S.C. Johnson began meeting with suppliers to train them on the Greenlist™ process. Initially the focus was on the company's larger suppliers: Dow, Dupont, and BASF. S.C. Johnson requested input from these suppliers on the process. The training covered the overall structure of Greenlist™ as well as the specific criteria used to score the materials that each company supplied. As Dave Long described,

> "We said here's what we buy from you. These products are mostly 1's and 2's. We want 2's and 3's. We challenged them to give us better ingredients."

Over time, most suppliers embraced the protocol.

Today, S.C. Johnson's Greenlist™ program has evolved to a point where suppliers are designing new chemicals based on Greenlist™ criteria and pitching their chemicals to S.C. Johnson on the basis of Greenlist™ scores. This development is in large measure a result of S.C. Johnson's open and clear communication with its suppliers about the specific health and safety performance that it is seeking, as embodied in the Greenlist™ criteria.

Greenlist™ Accelerates Green Material Innovation. Greenlist™ is helping to accelerate green material innovation in a number of ways. As described by David Long,

> "Sometimes a supplier will bring S.C. Johnson a chemical that they say has a Greenlist™ score of 3. S.C. Johnson toxicologists evaluate the product to see if they can confirm the score. If confirmed, company chemists try it to determine whether or not it works. If it's a 3, and it works, SCJ puts it into the global formulary. If it's new and different, the company puts the word out that there's a new raw material that they should try. If a supplier is successful approaching S.C. Johnson in this way, and gets the chemical into use at the company, they stand to gain new business. Alternatively, if they are already supplying a chemical to the company, and can get the company to switch over to a greener product, the supplier avoids the possibility of losing sales to a "greener" competitor."

Daniel Lawson described how S.C. Johnson has given suppliers a target Greenlist™ score as well as price and performance requirements. Some suppliers are using state-of-the-art methods such as combinatorial chemistry and high throughput screening (HTS) techniques to create molecules en masse and rapidly test them for desirable properties. Using these breakthrough technologies, suppliers create 150 to 200 formulations in a matter of hours. They provide mini formulas to S.C. Johnson chemists for performance evaluation.

Suppliers too are finding innovative ways to market their green materials to S.C. Johnson. As an example, several suppliers have participated in technical briefing sessions that describe their green products and manufacturing practices at the S.C. Johnson corporate office in Racine. These sessions raise the level of awareness about green products among staff in technical and non-technical business groups at S.C. Johnson such as marketing and procurement.

S.C. Johnson is satisfied with the Greenlist™ process. The company encounters little resistance from suppliers

and is getting better and better chemicals. Even in its most challenging ingredient category—fragrances—S.C. Johnson's efforts to work with fragrance houses is paying off as more and more fragrances offered by suppliers are in the 2–3 range.

The Greenlist™ program is paying off in another way: Competitive advantage. Suppliers know what S.C. Johnson is looking for and they often go to S.C. Johnson first when they have developed new, greener ingredients. For example, S.C. Johnson was one of the first companies Dow approached with their new line of ECOSURF™ ingredients. Dow's ECOSURF™ product line is a series of biodegradable nonionic surfactants based on seed oil materials.

With regard to its existing products, S.C. Johnson has already made significant efforts to improve its formulations to achieve improved performance, cost reductions and higher Greenlist™ scores. Daniel Lawson stated, "low-hanging fruit has long ago been picked for our established products. Any additional improvements made today are only incremental improvements on those reformulated products."

However, there is still substantial opportunity to improve Greenlist™ scores through new product development. S.C. Johnson operates in the fast-moving consumer goods marketplace and the company is constantly developing new products. The company is moving the needle on its corporate Greenlist™ goals by leveraging the product development process, choosing high scoring ingredients for new products.

In a recent example, in March of 2009 S.C. Johnson announced that it is working to eliminate all phthalates—a class of chemicals that are of concern to some consumers—from its home cleaning and air products. Phthalates are included in some fragrances that S.C. Johnson sources for its products. Working closely with its fragrance suppliers, the company is leveraging its product development process to develop new and reformulated products with fragrances that do not contain phthalates. In S.C. Johnson's view, however, not all phthalates are unsafe. The company stated that, "making sure consumers know that they can trust S.C. Johnson products was well worth the time and cost to change them."

Other examples of product reformulation at S.C. Johnson include:

- Reformulation of Raid® ant powder worldwide with a new active ingredient to eliminate the use of the 0-rated insecticide propoxur.
- Reformulation of the European product Mr. Muscle® Shower Shine® bathroom cleaner with a new cleaning ingredient that provides increased biodegradability — 98 percent in standard tests.
- Reformulation of the North American product Windex® glass cleaner to replace a 0-rated solvent, removing 1.8 million pounds of VOCs and increasing cleaning power by 30 percent.
- Reformulation of Pledge® Multi Surface cleaner globally to increase biodegradability and reduce VOCs, while at the same time increasing cleaning power by 30 percent.
- Elimination of all PVC packaging and all chlorine bleached paperboard from S.C. Johnson packaging globally.

LICENSING OF GREENLIST™ TO OTHER COMPANIES, FOR FREE

From its inception, S.C. Johnson has been committed to sharing the Greenlist™ system with other companies, including direct competitors in the consumer products market. In an effort to further encourage its use, in February of 2007 S.C. Johnson announced that Five Winds International was chosen as a third-party administrator to license Greenlist™, royalty free, to other companies. Under the agreement, Five Winds works with companies interested in licensing Greenlist™. The company's motivation for licensing the system is to provide environmental leadership by helping other companies to measure and reduce the environmental impact of their products.

To date, Five Winds has given more than 50 presentations regarding the licensing of Greenlist™. A handful of companies making chemically-intensive products are considering licensing the system, others are interested in piloting it. While the framework for Greenlist™ applies to any company making chemical intensive products, the system needs to be customized to fit other manufacturing environments. To get started with Greenlist™ a company must define functional groups of chemicals and develop scoring criteria. A company with a product mix similar to S.C. Johnson would be required to do less customization. Once set up, the system requires a commitment of time and resources to collect the necessary data from suppliers and to score each individual chemical or formulation.

LESSONS LEARNED

Getting ingredient lists from suppliers remains a challenge. But, since Greenlist™ does not require chemical lists, it can accommodate different levels of supplier disclosure. Greenlist™ runs on toxicological and other hazard data for the individual chemicals or more complex materials that are supplied to S.C. Johnson; companies are not required to divulge ingredient information if they want to maintain confidentiality. Information on preservatives, contaminants or the presence of unintended by-products is particularly difficult to obtain from suppliers. S.C. Johnson places importance on limiting these unintended ingredients.

Clear and constant communication with suppliers on desired green material attributes yields results. Greenlist™ clearly articulates S.C. Johnson's criteria for greener materials. The company is extremely proactive in communicating

its desire for these 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.

Working in partnership with suppliers helps to accelerate the development of greener materials. Suppliers routinely provide samples of new chemicals to S.C. Johnson chemists for performance evaluations and these chemists can quickly determine whether the new products are effective. The company is currently working closely with fragrance suppliers to develop phthalate-free fragrances for its home cleaning and air products.

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. S.C. Johnson designs products for performance, cost *and* for environmental, health and safety. 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 (though the tool does not replace comprehensive risk and safety assessments).

Transparent metrics are essential for measuring and communicating corporate-wide progress toward greening of products. The Greenlist™ framework serves double duty as a metric to measure and communicate progress on greening products. It is a transparent metric that company employees can understand and get behind. Furthermore, it forms the basis of S.C. Johnson's efforts to communicate to its customers the progress it is making as a company.

Employee goals help create internal commitment to product greening. Linking performance incentives to measurable improvements in the environmental, health and safety of products has accelerated efforts to green products.

Actively engaging in and supporting government efforts to promote safer products has its benefits. S.C. Johnson has had a long-standing cooperative and collaborative relationship with regulatory agencies, particularly the U.S. EPA. The company has been an active partner in the U.S. EPA's Design for Environment Program's Formulator Program. This initiative encourages individual companies and industry sectors to compare and improve the performance, human health and environmental profile of products, processes and practices. S.C. Johnson has been publicly recognized for its commitment to formulate its products with environmentally preferable ingredients. In addition, the company has had direct access to the expertise of EPA chemists, environmental scientists and risk reduction staff.

— 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 Daniel Lawson, Sustainable Innovation Manager—Global Environmental Safety Actions, S.C. Johnson & Son, Inc. and David Long of Environmental Sustainability Solutions, formerly Sustainable Innovation Manager—Global Environmental Safety Actions, S.C. Johnson & Son, Inc.

2 S.C. Johnson website at *http://www.scjohnson.com*

3 Brian Lavendel, *The Greenlist™, S.C. Johnson and Informed Choices for the Environment.* Unpublished manuscript, 2003.

4 Five Winds International, *Greening the Supply Chain at S. C. Johnson July,* 2004.

5 S.C. Johnson, *The Value of a System of Stewardship: A Product Stewardship Communication from S. C. Johnson.* 2005.

6 S.C. Johnson, *Doing What's Right, Doing Our Part.* 2007.

ENDNOTES

1 *http://www.scjohnson.com*

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

3 As defined by the U.S. EPA's PBT profiler, classifying a chemical as either persistent, bioaccumulative, or toxic