

BerkeleyHaas Case Series

Haas School of Business
University of California Berkeley

Date: July 15, 2016

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Levi Strauss & Co.: Driving Adoption of Green Chemistry

*Individual action by one brand will not create the
scale and scope of change we need.*

—ANNA WALKER, SENIOR DIRECTOR
GLOBAL POLICY AND ADVOCACY

Bart Sights, Vice President of Technical Innovation and the head of Eureka—Levi Strauss & Co.'s (LS&Co.) Innovation Lab—was feeling excited after a biannual meeting in late 2015 with ZDHC (Zero Discharge of Hazardous Chemicals), an apparel industry collaboration of various brands such as LS&Co., Nike, and H&M. At the meeting, LS&Co. had briefed the 26 ZDHC brands on its new Screened Chemistry Program, developed in 2013 to shift the company and the industry from a risk-based approach towards a hazard-based approach on chemicals. The program screened chemical formulations (a mixture of chemical ingredients) against human and environmental health hazard endpoints *before* chemicals entered the supply chain, managing chemistry upfront during the design phase instead of in the middle or at the end of the manufacturing process. This shift represented a radical departure—by screening chemicals for hazard before they entered the supply chain, LS&Co. was attempting to change the status quo of the relationship among brands, manufacturers, and chemical providers.

Traditionally, LS&Co. and other brands' efforts to reduce hazardous chemicals and environmental pollution in the supply chain focused on risk-based Restricted Substance Lists (RSLs) that identified chemicals the company did not permit in its products. These lists ensured compliance with international chemical regulations, but they did little to push toward the use of more sustainable chemistries in the textile supply chain. LS&Co. and others believed that there

Professor Martin Mulvihill (Senior Advisor at the Berkeley Center for Green Chemistry) and Professor Robert Strand (Executive Director for the Berkeley-Haas Center for Responsible Business and Assistant Professor, Copenhagen Business School) prepared this case with Case Writer Victoria Chang as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

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must be a better way to manage chemicals in the supply chain to protect people and the environment.

LS&Co.'s desire to shift from risk-based assessment to hazard-based assessment required new thinking, strategies, and processes. Collaboration meant working with industry-wide organizations such as ZDHC on chemicals management to achieve the previously stated goal of zero discharge of hazardous chemicals by 2020 and bring systemic change across the apparel and textile industry: "Ultimately, it takes more than one company to make a difference. By sharing our approach with others—and they with us—we can work together to move our industry forward while reducing our impact on the planet. Sure, we're a leader, but through collaboration and cooperation with governments, NGOs, suppliers and even competitors, we can ensure the progress we make is shared."¹ By the end of 2015, LS&Co. had screened chemical formulations for its products at three of its laundry vendors and was expanding to another 20 laundry vendors in 2016.

Despite LS&Co.'s progress, Sights knew that bringing change to the industry would not be easy or fast. Some challenges included resistance from chemical suppliers, multiple industry standards, different brand standards, scaling of third-party assessments and a generally slow-moving industry.

Background, Sustainability, and Governance

LS&Co. designed and marketed jeans, casual wear, and related accessories for men, women, and children under the Levi's®, Dockers®, Signature by Levi Strauss & Co.™, and Denizen™ brands. The company was deeply committed to minimizing the human health and environmental impact of its clothing manufacturing processes, supporting the goal of eliminating the industrial releases of hazardous chemicals into the environment—part of the company's overall long-term sustainability strategy. On LS&Co.'s website: "Sustainability is sewn into the fabric of everything we do—from how our clothing is made to the work we do to help protect our planet."²

Specifically, for jeans and garment finishing (wear patterns and colors), an average of 15 chemicals were used to process one pair of jeans—an amylase enzyme was used to de-size the garment, cellulase enzymes were used to abrade the garment, potassium permanganate or sodium hypochlorite (bleach or peroxide) was used to oxidize the garment, pigments or reactive tints were used to tint the garment and silicone-based softeners were used to soften the garment. For each of these steps, there were auxiliary chemicals too—acids for balancing pH, lubricants, and wetting agents to help some of those chemicals adhere better to the garment.

The company's Vice President of Sustainability Michael Kobori reported to the Chief Supply Chain Officer David Love. Kobori led a global team of professionals who were each responsible for a geographical region or functional area. Kobori and his team developed the company's sustainability strategies in partnership with business unit leaders, as well as defined global targets and measured progress. Business unit leaders had sustainability goals within their strategic plans. One of the company's board of directors' committees also had responsibility to assist the board and review corporate citizenship and sustainability efforts and issues.

¹ www.levistrauss.com/sustainability/introduction/

² www.levistrauss.com/sustainability/introduction/

Kobori summarized LS&Co.'s overall sustainability strategy: "At LS&Co., we believe that how we make our products is as important as what we make. Our sustainability efforts are focused on three main areas: manufacturing, people, and the planet. We also approach sustainability through the idea of 'profits through principles,' which has been our mission since Levi Strauss founded the company more than 160 years ago." He added: "Our commitment to sustainability goes beyond regulatory compliance or minimizing the environmental impact of our business practices. Our vision is to build sustainability into everything we do, so that our profitable growth helps restore the planet."

A few historical efforts included LS&Co. keeping workers on the payroll during the Great Depression; in the 1950s, integrating its factories in the South well before the Civil Rights Movement; in the 1980s, being one of the first to recognize HIV/AIDS and support educational efforts; and in the early 1990s, when offshore production became more commonplace, being the first multinational apparel company to establish a comprehensive code of conduct for all of its suppliers around the world that covered labor, health and safety, and environmental standards—one of the first companies to initiate the modern corporate social responsibility movement.

In addition, LS&Co. was the first company in its industry to establish global guidelines for water quality standards for its suppliers; it was one of the first companies in its industry to establish a Restricted Substances List in 2001; and it was the first to provide financial incentives for garment suppliers in developing countries to upgrade environmental, health and safety, and labor standards.³

In 2012, the company signed a Detox Solution Commitment with Greenpeace International that outlined the company's commitment and actions toward zero discharge of hazardous chemicals and joined the Joint Roadmap Toward Zero Discharge of Hazardous Chemicals (ZDHC), mentioned above. Started in 2011 with adidas Group, C&A, H&M, Li Ning, Nike, and Puma, the Joint Roadmap was a plan that set a new bar for environmental performance related to chemicals for the global apparel and footwear industry. It included specific commitments and timelines to realize this shared goal.

The Supply Chain

At a global company such as LS&Co., the supply chain for a pair of jeans, for example, began with the design team where a new collection might include more than 100 new products. A brand such as LS&Co. might work with a chemical company such as Italy-based Garmon Chemicals at this stage of the prototyping process. After prototypes were approved, they were sourced through the company's manufacturing process.

Alberto de Conti, Chief Marketing Officer at Garmon explained: "After the prototyping process, we traditionally have had problems with brands because they leave the choice of chemistry to their manufacturers and don't want to enforce the use of certain greener chemistries due to issues such as liability and cost, so sometimes we don't become the commercial partner to the brand. This has improved a little bit with the Screened Chemistry Program where we have had the chance to remain the partner beyond prototyping through manufacturing."

³ www.levistrauss.com/sustainability/introduction/

After the design process, there were other players such as mills and laundries, both of which used “a variety of chemical formulations and auxiliaries,” Sights said. Increasingly, however, the supply chain was becoming vertical with a mill, sewing plant, and laundry often within one facility. Linda Gallegos, R&D Project Manager at LS&Co., provided an overview of the process: “The manufacturer cuts our product, sews and assembles it, and then most of our products have a garment finish applied to them at the end. Typically, LS&Co.’s vendors were cut-and-sew vendors and laundries.” Other parts of LS&Co.’s supply chain included mills (where all the fabrics have their dyes and finishing chemicals applied) and sundries—everything besides the fabric such as zippers, buttons, and thread.

For example, for the denim fabric alone, a mill spun a cotton bale into yarns. Three-quarters of those yarns were dyed with indigo (chemicals used at this point related to sizing, wetting agents, lubricants, and indigo dyeing) and then woven with the natural yarns in a loom to make denim. Once that denim came off the loom, it went through a long rolling process that skewed, singed, shrunk, and prepared it to be cut and sewn. Other mill finishes were applied, such as resins and coatings for aesthetic effects or performance attributes such as water resistance.

The mill then shipped the fabric to a sewing plant and that fabric was rolled out on long tables until it was stacked anywhere from 20 to 100 plies high. Then a marker/pattern was laid on top of it and pieces were cut out to become one part of a pair of jeans. The sewing line would then sew the different pieces together to become a pair of jeans.

After that, garment finishing or laundries handled all of the garment-finishing applications such as softeners, garment dyes, de-sizing, and abrasion and wear patterns (of which some were manual, such as the application of abrasive paper). The laundries created stonewashed looks, used softening rinses, or created 3-D resin looks on denim. Most of these were chemical-based, but sometimes simple sanding or lasers were used to take off color from a garment. Sometimes the laundry was part of the cut-and-sew facility and there were also suppliers that printed on garments (e.g., T-shirts) as well as the chemical suppliers who supplied them.

LS&Co. had less than 150 direct vendors for tier 1 manufacturing (cut/sew/finish vendors, excluding mills and licensed businesses) throughout its supply chain. “Our supply chain is considered small compared to other apparel brands, and we have rationalized our supply chain from a fabric- and vendor-level significantly,” Gallegos said. “If you talked to other apparel companies, the number could be much higher. We have a much better handle on our suppliers than many other brands.”

Chemical Management System

Chemistry and a chemical management system were a part of LS&Co.’s overall sustainability strategy, according to Kobori: “Chemistry touches all of our sustainability efforts in terms of manufacturing, people, and planet. For over 100 years, chemistry has been used in the production of apparel. Over the years, responsible companies have established standards on safe chemical use that go beyond government regulations. We have always wanted to stay ahead of those regulations.”

Kobori elaborated on more recent developments related to chemistry: “There have been significant developments around chemicals by governments that signal to us that this is an issue

of growing importance.⁴ We've also seen organizations such as Greenpeace take up the banner of chemical safety with the apparel and footwear industry. We joined ZDHC, which aims not only to address protections for consumers and workers, but also to respond to the environmental concerns around hazardous chemicals. Zero discharge of hazardous chemicals is a very ambitious goal—as an industry, we need to get together and agree on the standards we're going to set and the approaches we're going to take. Many of the suppliers we use are shared by a number of brands and retailers so we can work together to achieve our goal.”

In fact, LS&Co.'s green chemistry efforts started to accelerate when ZDHC and Greenpeace began to “push the levers,” according to Gallegos. She said: “There was definitely more of a galvanizing force in the company to look at the chemicals we use more closely and to understand them better, as well as to identify a way that we could make better choices.” Gallegos added: “Prior to that, our designers were always interested in sustainability, but we still didn't really have a way to assess what was better—was using a natural dye really better than a synthetic dye, for example?” De Conti added on industry change: “Greenpeace put a lot of pressure on brands five years ago (and still does) and brands have put pressure on companies like ours, which has led to faster development and change in the industry. Consumers themselves also think and behave differently today in regards to what they are buying and are savvier.”

LS&Co.'s Chemical Management System was part of the company's efforts to achieve its goal of zero discharge of hazardous chemicals, shared by ZDHC. The four components of the Chemical Management System were: 1) Restricted Substance List, 2) Manufacturing Restricted Substance List, 3) Global Effluent⁵ Requirements, and 4) the Screened Chemistry Program. Sights called the company's Chemical Management System, the “whole big picture.”

Restricted Substance List (RSL)

Risk-based RSLs had been used in the textile industry since the 1990s by many brands and each brand had their own RSL, which contained a list of restricted chemicals due to their potential impact on consumers, workers, and the environment. Such chemicals were usually regulated and could be used in manufacturing and be present in consumer products as long as they weren't above a certain limit. RSLs had been a tool to help brands comply with regulatory requirements.

LS&Co. established its RSL in 2001, and this was the company's most “robust and mature” chemical management program.⁶ As an example, the formaldehyde maximum for an LS&Co. adult product was 65 ppm (parts per million); or, as another example, the RSL could ban a chemical or dye such as polyvinyl chloride (PVC) or phthalates so that a product could not contain these. If there were questions or concerns regarding a product from a particular vendor, LS&Co. would work with the vendor to implement RSL testing to test for the specific substances in question.

Gallegos added: “A RSL complies with regulatory requirements around the world for consumer safety. LS&Co. uses the most aggressive global requirements for a specific chemical. So if Japan has the most stringent law on a specific chemical, we'll adopt that and do another pass

⁴ Since 2002, the government has continued to increase disclosure requirements—for example, in 2006, the European Union established REACH, the broad umbrella regulatory framework for chemical registration in Europe, adopted to improve the protection of human health and the environment.

⁵ Liquid waste or sewage discharged into a municipal treatment system or body of water.

⁶ An example of a LS&Co. RSL is located here:
<http://levistrauss.com/wp-content/uploads/2015/11/RSL-2015.pdf>

based on that regulatory requirement and our knowledge to determine whether we want to increase it even further.”

On working with vendors/suppliers and the RSL, Gallegos said: “We’re not allowed to work with any supplier unless they’ve signed our Terms of Engagement and meet our minimum requirements to produce our products. Vendors have to have the RSL in place and make sure LS&Co.’s product doesn’t go out with any product safety concerns.” LS&Co. annually updated its RSL and provided that information to the company’s business partners.

Global Effluent Requirements (GER)

In 1992, LS&Co. released its Global Effluent Requirements (GER), the industry’s first discharge wastewater quality guidelines for its wet finishing laundries. A GER strategy was important to the company because water was used to finish jeans in industrial washing machines; jeans were sometimes washed many times, leading to the use of water and the prevalence of wastewater. Under LS&Co.’s GER, wastewater was treated to meet local water standards as well as the company’s GER standards.

Several years later, LS&Co. scaled the requirements, making them mandatory for the company’s suppliers globally. With these requirements, LS&Co. limited the contaminant levels allowed in suppliers’ wastewater from wet finishing and minimized the environmental impact to local water resources. In some countries the water quality requirements were more stringent than local regulations required.

Manufacturing Restricted Substance List (MRSL)

Building on the RSL, the industry began shifting toward managing input chemistry at the front of the manufacturing process rather than on the back end, so that chemicals of concern were eliminated prior to manufacturing. A Manufacturing Restricted Substance List (MRSL) was one example of this shift. It differed from an RSL because it restricted the chemicals used in the entire facility, not just those used to finish products.

Anna Walker, Senior Director of Global Policy and Advocacy, elaborated on the relationship between the RSL and the MRSL in the context of LS&Co.: “Our supply chain will lean heavily on the positive; if the MRSL is effective, you won’t need the RSL because the MRSL is the front of the gate. With the RSL, there are some chemicals you can use in your factory to produce the product, but as long as it doesn’t remain on the product, you’re free to use them; however, the MRSL will say you can’t use it at all. The RSL is focused on the product; the MRSL takes a much bigger view and is associated with an entire factory,” (**Exhibit 1**).

Gallegos added: “Prior to the implementation of an MRSL, most manufacturers focused solely on chemicals used on the product. The MRSL addresses chemicals used in the factory that workers could be exposed to.”

ZDHC developed and published an MRSL for the apparel industry in 2015 with input from brands including LS&Co. and key stakeholders including chemical companies. In 2016, LS&Co. was planning on adopting ZDHC’s MRSL and rolling it out, aligning the ZDHC MRSL with its own MRSL. Walker said: “The delivery of the ZDHC MRSL was a big moment. Now that we have the MRSL, we’re focused on how to bring it to the supply chain and how to conform around

communicating to our suppliers on its implementation. We're also focused on a secondary goal—it needs to be a tool that's updated and evolves with the science, it's not a static tool.”

Screened Chemistry⁷

LS&Co.'s new Screened Chemistry Program went even further upstream in the supply chain to the design process, producing a positive list of chemicals that were safer and better for the environment so that designers could be more proactive at the *beginning* of product development with regard to chemicals used to achieve their designs. In the past, LS&Co.'s Eureka Innovation Lab might have given a supplier laundry a recipe for a certain design look. It would then be “up to the laundry to replicate this look,” said Gallegos. “They could use any chemical from any chemical supplier, as long as they knew it would meet our RSL.”

However, the Screened Chemistry Program wanted to change that process from a risk-based one to a hazard-based one. Hazardous chemicals were ones that showed “intrinsically hazardous properties (persistent, bioaccumulative and toxic (PBT); very persistent and very bio-accumulative (vPVB); carcinogenic, mutagenic and toxic for reproduction (CMR); endocrine disruptors (ED); or equivalent concern), not just those that have been regulated or restricted in other regions.”⁸

Sights called other aspects of the company's Chemical Management System such as the RSL and even the MSRL “negative lists” in that they focused on eliminating harmful chemicals after the fact. RSL and MSRL were about managing risk. Most in the industry used phrases such as alternative assessment or hazard assessment, but LS&Co. coined “Screened Chemistry.” Sights said: “We're looking at the chemicals that we might use before we ever use them to make sure that they're safe and best-in-class, removing harmful chemicals, or finding better alternatives. The long-term vision is that Screened Chemistry can preempt all the other parts of the Chemical Management System such as the RSL.”

Gallegos provided an example: “Our Screened Chemistry Program calls out formaldehyde as something we want out of our chemical formulations. As long as there's an alternative formulation that doesn't have formaldehyde, the alternative will be used. Even though that chemical with formaldehyde probably has no consumer product safety issues, the Screened Chemistry Program says, ‘We want that out of our supply chain.’”

Kobori said that the conventional risk-based approach led to challenges in the industry, including the difficulty in getting chemical suppliers to phase out chemicals that could be of concern. “No one in the chemical industry has the incentive to phase out chemicals of concern because these chemicals are some of their biggest selling products. To get the industry to do something voluntarily is challenging and, because of this approach, it's very difficult to get the right incentives in place for chemical suppliers to do R&D on chemistries that might be better alternatives.”

Kobori said that consumers need to demand safer chemicals to make real change: “LS&Co. is closest to the consumer and we see growing awareness of chemistry, especially in the foods that people eat and in the growth of the organic movement as well as in the growth of cosmetics and personal care products. While clothing is not ingested, it's the next layer of product that comes in

⁷ This section quotes and refers heavily to the Screened Chemistry Framework presentation, 10-29-15.

⁸ Levi Strauss & Co., “Commitment to Zero Discharge of Hazardous Chemicals.”

contact with people. We believe that moving to safer chemistries is a good thing in the long run, and it's a good thing for us as a company to be positioned as a leader of that change. We are large enough to be able to influence the market. When we signal that we're interested in moving toward stronger protections and regulations around chemical use, such as the RSL, GER, MRSL, and Screened Chemistry, they tend to become industry standards and practice."

The Program

As LS&Co. developed and piloted the Screened Chemistry Program, it met with 15 brands to get input and learn what other companies were already doing in the area of hazard assessment. "They applauded us for the work that we were doing and acknowledged that we were on the leading edge," said Gallegos. LS&Co. discovered that a few other brands had done some of their own work on hazard assessment. "But the scoring and program we've developed is unique," said Gallegos. "I haven't heard of anyone developing anything to the extent that we have. Even other standards such as bluesign® [discussed below] are very risk-based."

LS&Co.'s Screened Chemistry Program, completed in 2015, was intended to "evaluate chemicals used to manufacture the company's products against specific human health and environmental endpoints to understand their impacts, identify better alternatives where possible, and identify areas needed for improvement and innovation."⁹ The program was intended to, over time, evaluate chemicals used throughout the supply chain including raw materials in: 1) garment finishing (laundries), 2) fabric dye and finishing (mills), and 3) sundries. The evaluations were conducted by ToxServices (a third-party assessor located in Washington, D.C.) because of their expertise, independence, and protection of the chemical supplier's intellectual property. Sights called Margaret Whittaker, the head of ToxServices, an "icon" in the world of safer chemistry.

LS&Co.'s program was based on two existing chemical hazard assessment methodologies that assessed human health and environmental hazards posed by individual ingredients within a chemical formulation: U.S. EPA Safer Choice Program and GreenScreen® for Safer Chemicals. The Safer Choice Standard identified the requirements products and their ingredients needed to meet to earn the Safer Choice label. The GreenScreen® hazard assessment classified a substance's chemical hazards on 18 human health and environmental endpoints ranging from carcinogenicity to skin sensitization to flammability. GreenScreen® was a chemical hazard screening method developed by the NGO Clean Production Action (CPA). Walker said that the EPA and GreenScreen® were both "third-party, transparent processes," which was important to the company.

LS&Co. worked with ToxServices to develop a scoring algorithm that could recognize formulations that exhibited degrees of toxicity. According to LS&Co.: "For chemicals that have ingredients of concern, the algorithm is intended to weigh these heavier with progressively larger negative scores based on the likelihood that those ingredients are associated with a human or ecological/environmental hazard."¹⁰

Once the scoring algorithm had been developed, LS&Co. worked with the company's vendors¹¹ (laundries, in this case) to identify the chemicals used on LS&Co.'s products, which would

⁹ LS&Co. Screened Chemistry Framework presentation, 10-29-15, p. 9.

¹⁰ LS&Co. Screened Chemistry Framework presentation, 10-29-15, p. 21.

¹¹ Vendors are companies that are supplying LS&Co. with product. Suppliers are supplying to LS&Co.'s vendors (chemical companies or mills).

require screening. The chemical supplier would then disclose product formulation ingredients (CAS numbers and ingredient percentages¹²) to ToxServices. After that, ToxServices would provide a hazard score for the chemical formulation (a weighted average of the ingredient scores) that ranged from 50 to -50 points. Green or preferred was 35 to 50, Yellow or Needs Improvement was 20 to 34, and Red or Phase Out was 19 to -50 (**Exhibit 2**).

Gallegos said: “LS&Co. then has the opportunity to look at the chemicals that we’re using and say that we have alternatives to this Red and that we don’t need to be using this chemical from this supplier anymore because there are better alternatives. It gives us the intelligence down to the ingredient level—what are the concerns of the chemistry and what percentage is it of the chemistry. We never had this visibility before.”

The Pilot Program

LS&Co. launched a pilot program in 2014 to implement the Screened Chemistry Program targeting garment-finishing vendors (laundries) for the first phase “due to our direct relationship and ability to control finish parameters,” said Gallegos.¹³ Moreover, typically laundries were developing finishes in the Eureka Innovation Lab, where LS&Co. was already using chemicals that had been screened.

The vendors needed to work with their chemical suppliers to provide ToxServices with an inventory of the chemical formulations used to make LS&Co. products. The chemical suppliers submitted their chemical formulations to ToxServices for third-party hazard screening by ToxServices. ToxServices would assign a final chemical formulation score based on the screening results (**Exhibit 3**). The pilot program included three laundries—initial vendors that agreed to the pilot program when LS&Co. contacted its vendors. The pilots provided LS&Co. with a list of chemical suppliers and the chemicals they used to finish LS&Co products.

Gallegos said that in 2015 LS&Co. focused on establishing a baseline related to its vendors and chemical management: “Right now, we’re trying to get a sense from our vendor base of where they are with their chemical management. We’re seeing whether our vendors have a technical representative on site (we require them to) and how much information they have about the chemicals they’re purchasing (do they have all the MSDS¹⁴ chemical sheets, do they know the raw materials and ingredients of these chemicals, etc.).”

The goal of establishing a baseline was to identify which vendors the company planned to begin working with on MRSL and Screened Chemistry. Gallegos said: “It will be a phased-in approach to see who’s ready to take on more chemical management within their facility. If a facility is ready, then we’ll make sure they go to the next step of chemical management in terms of adopting the MRSL and the Screened Chemistry Program.”

By the end of 2015, the pilot program had screened 132 chemical formulations and commodity chemicals (e.g., hydrogen peroxide, bleach) across the three pilot vendors. Of the 132 chemical formulations, 45 (34 percent) achieved a Green score, 70 (53 percent) achieved a Yellow score, and 17 (13 percent) achieved a Red score (**Exhibit 4**). For scoring, each ingredient within the

¹² A CAS Number is a short string of text that refers to a chemical substance. CAS Numbers are assigned by the Chemical Abstracts Service (CAS), a division of the American Chemical Society.

¹³ LS&Co. Screened Chemistry Framework presentation, 10-29-15, p. 21.

¹⁴ Material Safety Data Sheet.

chemical formulation received an individual rating, which was weighted based on its percentage within the formulation. The final overall chemical formulation score was the sum of all the ingredient scores.

“Surprisingly, our pilot vendors were using a lot of chemicals that scored Green or Yellow,” said Gallegos. “However, this also tells me that all of these chemicals would pass our MRS� and RSL, even though 17 are Red. The program helped us identify those 17 that we want to get out of there.” Gallegos also noted the example of categories of chemicals, such as softeners that might turn up Yellow but could easily be replaced with ones that ranked in the Green category.

Sights said that for the past few development seasons, the Eureka Innovation Lab had used the evolving and new Screened Chemistry Program’s preferred chemical list (a list of all chemicals screened to date and their scores) to develop all of its finishes: “We started this two seasons ago so there’s existing product out there that has already been made using screened chemicals.”

Screening Costs and Chemical Suppliers

LS&Co.’s plan was to have chemical suppliers pay for the chemical screens; however, initially the company paid for numerous chemical screens to get chemical companies on board. Such added costs were one of the challenges of the program and process, according to Kobori. However, the more companies that started to implement the program, the less it would ultimately cost. In terms of added costs, Gallegos said: “We can’t all of a sudden change to using only chemicals that have been through our screening process and have our consumers pay for that. We need to meet the existing cost criteria while using better chemicals.”

Early chemical supplier adopters were Garmon, as well as Switzerland-based Beyond Surface Technologies (BST), German company CHT and Singapore-based Dystar. By the end of the pilots conducted in 2015, approximately 12 chemical companies had participated in the program.

ToxServices charged its fees by the CAS number up to approximately \$1,500 per CAS number, so the total screening cost depended on how many CAS numbers a formulation contained (ranging from 5 to 10, according to LS&Co., but de Conti said it could go up to 20 or more). Sights said that in the end, the costs were “not that significant.” He said: “If a chemical company goes through the trouble of developing a formulation, then there’s a lot of expense in that itself—they have to envision that they’re going to sell enough of it to recoup that expense.”

In addition to paying for a few initial screens, LS&Co. told some chemical companies that if they invested to have their formulations screened and their profits over the following year did not cover the initial screening investment, LS&Co. would pay them the difference. Sights said: “We signed that agreement with a few chemical companies and no one has sent us a bill—early adopters are actually gaining business.” De Conti provided a chemical supplier perspective: “The screening money isn’t a huge problem if you’ve decided as a company to focus on green chemistry. However, development is costly in terms of certification, R&D resources, and opportunity costs.” He said that Garmon had invested \$1 million into the GreenScreen® process so far.

De Conti also challenged the notion that chemical companies should bear the added cost burden: “I would like to ask the brands such as LS&Co., if we all know that green chemistry and this journey has added costs, then how come the chemical companies are expected to bear the cost of innovation and still required to make their products remain cost neutral? In the case of the

Screened Chemistry Program of LS&Co., it's their program and what they are passionate about—why is it that the brand doesn't want to be responsible for a lot of the costs?"

Whittaker at ToxServices argued that chemical companies would receive a certificate and be able to use that to show other customers that they were "more green" than competitors and that would be an advantage.

To help address the issue of cost, ToxServices does not charge for screening CAS numbers that a chemical supplier has already paid to screen (except for a minimal processing fee), and chemical suppliers pay a reduced cost to screen a CAS number that has already been screened by another supplier. In addition, chemical suppliers could also pre-engineer their formulations before they even submitted a chemical for screening to save on cost.

With the three pilots, LS&Co. stayed cost neutral (at the price-per-unit level), while substituting better alternatives, according to Gallegos. Some drivers of cost included the type of chemical company laundries worked with—local chemical companies tended to be less expensive than the large global chemical companies, for example—but the local vendors might not have the right technical knowledge or chemical documentation. Gallegos said: "With the pilot program, there were two local suppliers who dropped out of the program and the laundry then bought chemicals from a global chemical supplier that was more expensive. But, due to the global chemical company's new added business, they lowered the price for the laundry, so it worked out in the end."

Some chemical companies readily worked with the laundries, said Gallegos and "did not bat an eye because they are looking toward the future." Others "struggled initially" while working with LS&Co., but in the end, the companies reformulated a number of their chemicals to meet the company's program. "The Screened Chemistry Program pushed them to make changes," she said.

In the case of Garmon, the company has licensed GreenScreen® and positioned themselves as the first specialty chemical supplier to introduce this certification in the apparel industry.¹⁵ De Conti said that Garmon liked GreenScreen® because it was very transparent in that chemical companies needed to disclose anything that was in a formulation such as percentages, CAS numbers, etc. "That's why some chemical companies are hesitating to use GreenScreen®," he said.

De Conti said that the new series of products that Garmon launched in 2015 were all GreenScreen®-certified (40 chemicals), and the adoption of green chemistry was growing. "More and more brands are interested. Now we have brands that have a full collection of denim that are fully GreenScreened. We also have brands in Europe and the U.S. that have converted their production completely 100 percent to GreenScreen® chemistry. The funny thing is that the brands are quiet about it so far because it's a touchy subject and they don't want people asking about the other products that aren't GreenScreened, so they're doing little by little, step-by-step." Garmon also gained incremental business because of their participation in LS&Co.'s program: "Apparel International, a manufacturer in Mexico, was not our customer before, but the Screened Chemistry Program allowed us to gain new customers such as this."

¹⁵ Garmon incorporated GreenScreen® chemical assessments into its raw materials assessment. The company also developed specialty chemicals called environmentally conscious chemistry to bleach indigo denim, replacing traditional chemicals with their Avol Oxy White product

In addition, Garmon launched a new innovative bleaching agent, Avol Oxy White, as part of their GreenScreen®-certified chemicals portfolio to replace potassium permanganate, but Garmon did not receive adoption as fast as they had expected. “Avol Oxy White is probably the best in terms of performance because operators don’t have to change anything and it uses the same process, but it does cost a little bit more,” said de Conti. “The issue is that even though respectable alternatives exist for many chemicals, they are not being adopted as fast as I would have expected from the industry. In this industry, people won’t do anything unless they are forced to do so.”

According to Gallegos, the company was working to adopt Avol Oxy White on some finishes in the near future, but there were other factors in addition to cost that the company faced: “There are also some issues around shade/cast—a booster needs to be used in some cases not to yellow the denim, so it’s not an easy transition to flip the switch.” Scott Echols, Technical Director at ZDHC and former Nike Director of Sustainable Chemicals said: “It often seems like things are a straight drop-in, but most of the time, there’s usually something that has to be changed. Because most of the brands rely on the factories to make the change and if it fails once (made a mistake or didn’t read the instructions), most people will just say that it didn’t work.”

Other chemical suppliers beyond Garmon were larger and “slower moving.” De Conti added: “We can be much faster and more flexible than other companies and that can be an advantage for a company such as LS&Co. because they can make faster progress by working with us.”

Despite the initial successes of working with chemical companies, there were some that were still more resistant to screening chemicals. Gallegos said: “We’re trying to uncover some of the chemical companies that have problems with the cost of screening and understand why. Sometimes where the laundry is buying the chemicals from is very removed from us.” Walker added: “The big challenge is that there are several big chemical suppliers in Europe that are supportive and that supply a lot of brands (due to the legacy of REACH¹⁶), but there are some smaller local chemical suppliers that are less knowledgeable and less willing to change. That’s going to be a lot harder on many fronts with them.” Walker said that some of the more resistant chemical suppliers might also do less work with LS&Co. and the apparel industry in general and might have less incentive to make changes.

Other Challenges

Another challenge identified during the pilot process included the length of time needed for screens due to a bottleneck with the third-party assessor. Whitaker from ToxServices did not plan on scaling her organization, an LLC, but hoped to develop a network of similar third-party assessors that she could recommend to brands such as Nike in the future. She said: “I’m trying to come up with a community-based system that still ensures that costs are reasonable and the best tools in the trade are used in terms of assessments. I’m happy to see it keep growing and scale, but it’s going to take another entity such as my company that’s willing to work collaboratively to share the same core data and assessment set.”

On the additional challenge of disclosing intellectual property, Sights said: “The first challenge was convincing the chemical companies that their intellectual property was safe and confidential. We’ve proven the confidentiality part because ToxServices works in other industries like electronics and cosmetics—industries that are further along than the textile and apparel

¹⁶ See prior footnote on REACH.

industry—so they have a pretty good track record. That’s progressing fine and there’s a good trust level now.”

Another challenge was the multiple standards across the industry, according to Gallegos. “There are more than 200 RSLs from all the different brands out there. These RSL requirements all vary. Then you layer in the MRSL, and add on top of that the industry certifications such as GOTS (Global Organic Textile Standard) and bluesign®, and then you have governmental requirements such as REACH. So the chemical companies tell us that they will screen for us, but ask us which standards we want them to use because all of the standards cost them money. The issue is having to meet multiple, different requirements for different brands.”

De Conti agreed: “LS&Co. is asking us to do use their Screened Chemistry Program. Other companies have their own approaches. Because of the lack of a cross-industry standard, we have to make choices. It’s all irritating and frustrating. At one extreme, you have LS&Co. with Screened Chemistry and it’s based on positive screening and you certify according to certain criteria such as GreenScreen®. That is the best way to manage risk, in my opinion. On the opposite side, there are other companies that focus on a list of bad chemicals that they don’t want to see in your formulations. They ask us to do full chemical assessments on each lot of chemicals that we supply to our manufacturers and the lot of chemicals we use on their garments. It’s just too unnecessarily complex. Only big chemical companies can afford that; we can’t.”

De Conti said that bluesign® asked brands, manufacturers, and chemical suppliers to each to pay \$20,000 to \$30,000 a year: “Different players in the industry wonder why they have to pay so much. Traditionally it works well in outdoor apparel, but it has never worked in apparel where our margins are lower.”

Scaling Screened Chemistry

The goal of the company’s Screened Chemistry Program from the start was to gain industry-wide adoption. Walker said: “Individual action by one brand will not create the scale and scope of change that we need—particularly in the apparel industry where you have a shared supply chain where any one vendor could be manufacturing and doing business with three to 12 brands. If we all communicate with the same set of expectations and tools, this can lead to faster uptake of the change we’d like to see.”

However scaling the Screened Chemistry Program was going to be a significant challenge: “Textile manufacturing is an old industry and attitudes are outdated,” said Gallegos. “It’s about changing a very big industry to think differently. And because we’re so engrained in this risk management operation, we need to look at how we can change the industry to be proactive, precautionary, and hazard-based to remove harmful chemicals from the get-go. That’s the heart of Screened Chemistry. We’re at the beginning and we have a path forward now.”

On the overlap in the industry, for example, a laundry in Mexico was doing work for LS&Co. and another brand in the same building: “If they’re running a softener on our jeans, they’re probably running the same softener on the other brand’s jeans too,” said Sights. “If because of LS&Co. the laundry has switched to something that is screened and green in our color code, as long as it’s cost neutral, they’re going to run that on the other brand’s product as well because it’s too complicated for them to buy two different softeners. In our palette so far, it’s been cost neutral—they’ve maintained their cost, their lead times, and quality.”

At the end of the day, Sights was optimistic: “Industry scaling seems daunting, but it’s not really as daunting as one might think. Many of our suppliers also work with a lot of our competitors. There’s also only so many CAS numbers that are used by different chemical suppliers. If you’re building a softener, there are a few CAS numbers you can use. If you’re building a resin, there are a few CAS numbers you can use. If you’re building a de-sizing agent, the same applies.”

Sights continued: “Our thought is that by using this third-party screener and building a database of positive CAS numbers and formulations, we’ll get through the existing CAS numbers pretty quickly. New chemical companies might come on board or existing chemical suppliers might come up with new products or formulations, but they’re still going back to the same CAS numbers. We’re proving that. Our list of approved formulations is growing as more chemical suppliers and facilities are coming on board, and the ratio to new CAS numbers is actually declining—chemical suppliers are coming up with different things to sell, but they’re using the existing list of screened CAS numbers because we’re screening them ahead of time for everyone. In a few years, we’ll march through our entire supply chain—first the laundries and then the mills.”

ZDHC and Other Brands

In November 2015, LS&Co. presented the Screened Chemistry Program to various apparel brands during a ZDHC meeting. “That was exciting for us because we could share our work with 26 brands in the room,” said Gallegos. At the meeting, LS&Co. did not include its name on the program and also told ZDHC that it could be a ZDHC program shared by all brands. ZDHC thought this was a good idea, according to Gallegos. Echols said: “I think LS&Co.’s Screened Chemistry Program makes sense. How they approached it is similar to what we did at Nike and similar to what was published by ZDHC in terms of an approach to looking at hazard classes you’d want to take into consideration. I think LS&Co. pretty much followed these, whether they knew that or not.” ZDHC wanted to work with LS&Co. to put together an accelerator group of five or six brands that would pilot the program.

LS&Co. was meeting with Nike in 2016 to see how they could collaborate on certain aspects of the program. Echols said: “It will be interesting to see how LS&Co. and Nike work together. Sometimes Nike likes to be the leader. We had a similar process there that followed the GreenScreen® and our RSL and screened chemicals five to 10 years ago. Our challenge there was that Nike is so big it was hard to determine how to implement something such as this. We did a lot of things that Nike didn’t like to talk about publicly such as having a program for chemical suppliers to bring us greener chemistries and they would be rewarded.”

Before LS&Co. presented to ZDHC, it presented to each of the ZDHC brands to get their feedback. Sights said: “Some brands were very positive, but felt like they don’t have the resources right now. There are also brands that will feel the advantages of the program because we share so many mills and laundries with them. Others were non-committal.” Walker said: “The people we’ve shared the program with are typically compliance people so their experience has been policing tools such as RSLs and MRSLs. Screened Chemistry is something that moves beyond those policing tools, but can work well alongside them. We’re not necessarily dealing with toxicologists and chemists so it may take them a little while to wrap their heads around what we’re proposing.”

Echols said that one of the biggest challenges was that “not every brand was in the same place so you can’t just adopt a program and implement it at the same time with everyone.” Also, he said

that not all brands handle chemicals in the same way in terms of who was responsible. In some cases, it might fall within the quality group, but that group might not have interaction with ZDHC, so there would have to be “a lot of internal selling going on.”

bluesign® and Standards

Walker’s biggest concern for scaling success was bluesign® and common standards because bluesign® had already been adopted by a number of sportswear brands. “It will be important for us to work with bluesign® to find solutions and collaborate,” she said.

“We looked at the Responsible Down Standard (RDS)¹⁷ that North Face put together that was gifted to the Textile Exchange, which allowed it to scale. Scalability has been our vision with Screened Chemistry and bringing it to ZDHC and bluesign®—they have the bigger infrastructure and experience to bring this to everyone than LS&Co. ever could on our own.” Walker cited the importance of ZDHC’s organizational infrastructure with a staff, Executive Director, and a Board of Directors.

Echols said on scaling, bluesign®, and collaboration: “I’d like to see all the brands get behind one of these standards and push it in one direction. The reality is that they’re all similar enough in terms of what they’re doing in terms of the hazard classes they’re looking at. The worst thing that could happen is to have people aligning on different tools so that people can’t agree on what chemicals need to be substituted.” Echols said that brands oftentimes have difficulties working together for competitive reasons and a “not invented in my backyard” way of thinking, so it might be easier for a sportswear company to work with a fashion brand than for two sportswear brands such as adidas and Nike to work together.

Echols also said that he would prefer starting with what’s already available such as bluesign®, even though it might not be perfect, instead of creating new systems. “It would be a miss if LS&Co. doesn’t work with bluesign® on this because bluesign® already has an established system. This would enable bluesign® to look at a different area like denim.” He said that ZDHC was in discussions with bluesign®: “I’ve known the CEO Peter Waeber for 10 years since we worked with them at Nike and I have a lot of confidence in his system. I don’t think today you can do everything on hazard because there are a lot of chemicals that there may not be any replacements for. bluesign® is closed about what they do. I spend a lot of my time interpreting for people and telling different organizations how their programs might fit together. I would like people to see how they could both evolve and show bluesign® and LS&Co. the benefits of working together on this. In my own mind, I do have ideas on how they could fit together. I think bluesign® is pretty open to things.”

Echols said on making real change in the industry: “I think if people just followed the RSLs and stuck to that or used bluesign®, we’d solve 70 percent of our problems. It depends on the will of the brands to make their laundries and mills follow it. The first thing is to have the brands be willing to drop their laundries and mills if they’re not complying. It’s easy to focus on the new bright and shiny things like a new tool for chemical screening, but if brands just know where their factories are or make sure their waste water treatment plants are turned on, and picked off the low

¹⁷ The RDS allowed companies to ensure that the down in their products came from ethically treated geese. The North Face developed the standard in partnership with Control Union, a global certification organization, and Textile Exchange for research, writing, and stakeholder review.

hanging fruit, we'd make big leaps. People ask when we will have chemicals to replace the banned ones, and we already have 80 percent of them, but no one is using them."

Next Steps

As Kobori reflected on LS&Co.'s accomplishments in the area of Chemical Management and Screened Chemistry, he felt proud of his team for their work and progress on a hazard-based assessment program. However, he also recognized that much needed to be done and many barriers existed.

The company's goal was to have 100 percent of its laundry vendors implementing the Screened Chemistry Program by 2020. Kobori and his team also planned to continue to push the Screened Chemistry Program through the ZDHC mechanisms and pilot with the brands who were willing to partner. The team also planned to map out the supply chain to see where LS&Co. shared vendors with other brands.

In 2016, LS&Co. also planned to focus on mills because the company did not currently have a methodology to screen dyes that existed primarily within the mills. Gallegos said: "Dyes are pretty hard to assess. We plan on working with industry experts and potentially another brand to work on dye assessment as a mid-term goal." Sights added: "One of the weaknesses of our Screened Chemistry Program is color—dyes are not well-documented. Using GreenScreen® and EPA Safer Choice—there's not that much information out there on dyes.

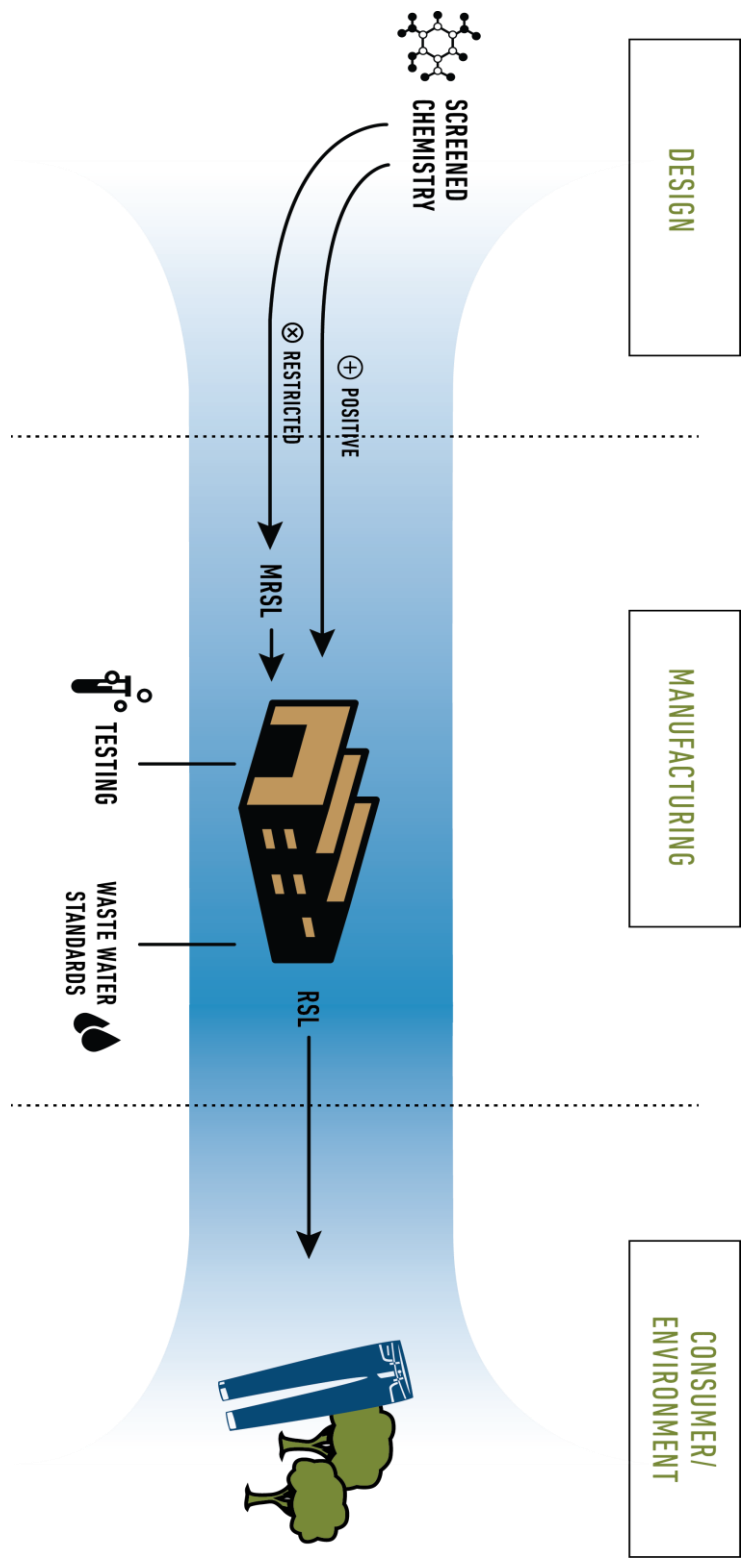
Echols at ZDHC provided his perspective on challenges and next steps: "The challenge for LS&Co. is to figure out how to prioritize what to go after—where to spend a limited amount of resources to tackle the issues. I think LS&Co. has gone about it the right way, but now how do you assess which opportunity you want to go after?"

Case Discussion Questions

1. What internal and external factors is LS&Co. responding to with the Screened Chemistry Program? How is this program different from other chemical management strategies within the textile industry?
2. How can LS&Co. advance its screened chemistry approach? Who are the key partners? What are the largest barriers to the adoption of LS&Co.'s Screened Chemistry approach? Is there a role for businesses, NGOs, and governments outside of the apparel industry?
3. Who should bear the responsibility and cost for screening chemistries? Who stands to gain from having chemicals screened for safety? Are there ways to share this cost?
4. What leverage does ZDHC have on the apparel industry? Is ZDHC the best avenue for LS&Co. to advance its Screened Chemistry Program?
5. Traditional approaches to corporate strategy emphasize the competitive nature of business with the objective to achieve a "competitive advantage." Porter's 5 Forces model¹⁸ depicts companies within an industry in a series of competitive battles with their industry peers and their suppliers. How might these traditionally competitive-based views of business hinder widespread adoption of LS&Co.'s Screened Chemistry approach across the apparel industry? What might be done to overcome this?

¹⁸ The Five Competitive Forces that Shape Strategy by Michael Porter available at <https://hbr.org/2008/01/the-five-competitive-forces-that-shape-strategy>

Exhibit 1 Chemical Management Continuum



Source: LS&Co.

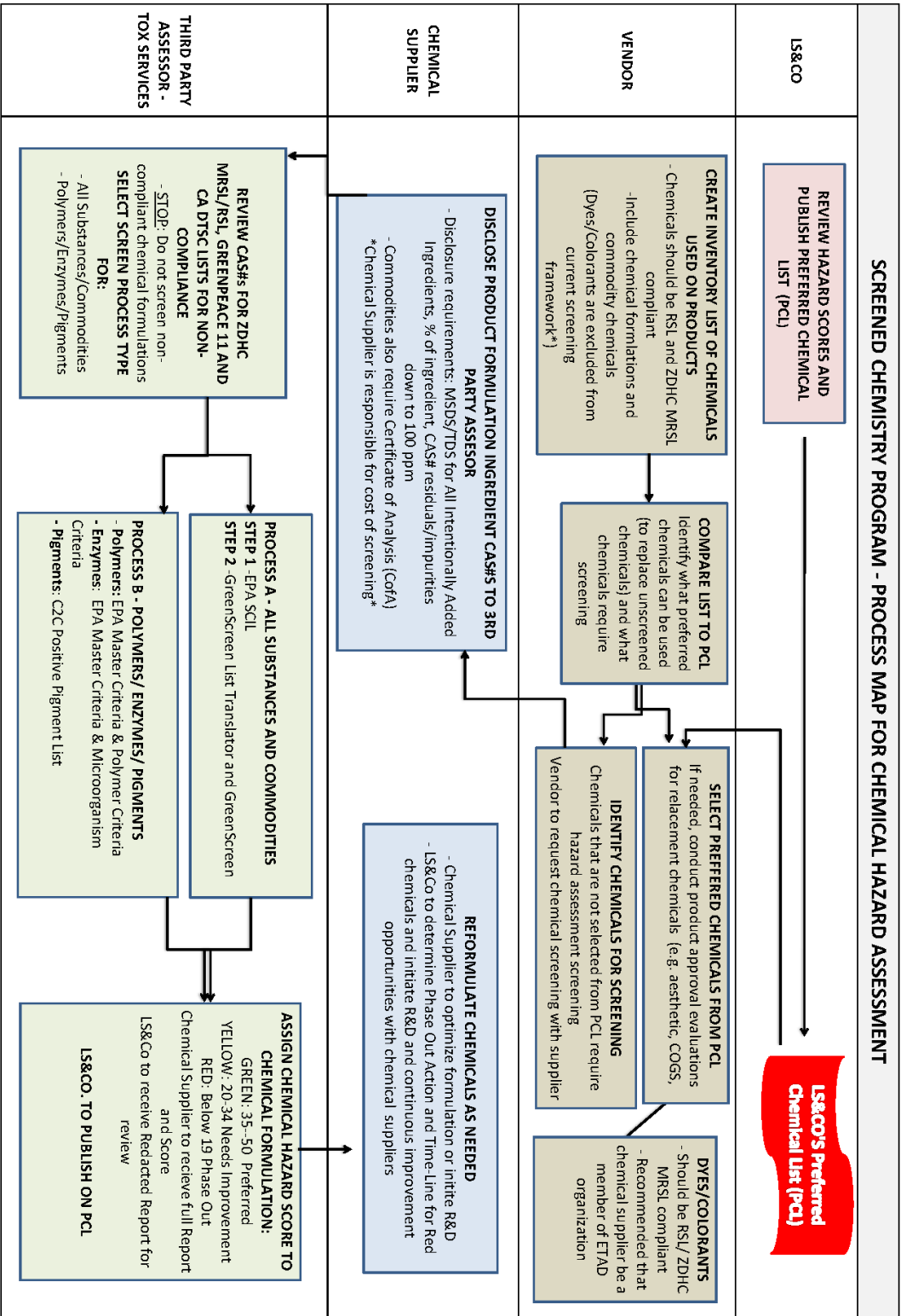
Exhibit 2 Scoring**LS&Co. Scoring Algorithm**

- Individual ingredients within a formulation are assigned a score based on their EPA Safer Choice or GreenScreen® rating and their composition percentage
- Overall score is a weighted average of the ingredient scores

CHEMICAL HAZARD SCORE	LS&CO. RATING	DEFINITION
35 to 50	Green	Preferred Chemical
20 to 34	Yellow	Needs Improvement
19 to -50	Red	Phase Out

Source: LS&Co.

Exhibit 3 Process Map



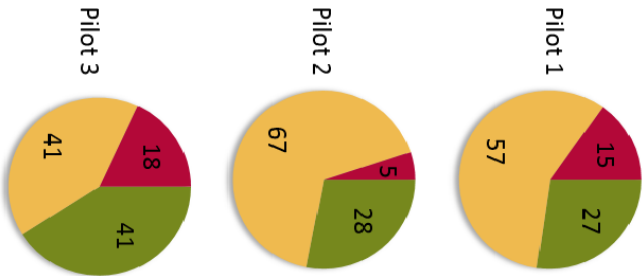
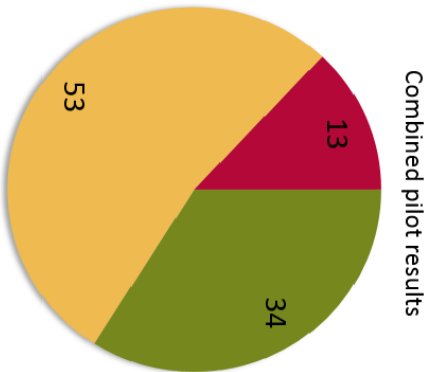
Source: LS&Co.

Exhibit 4 Pilot Results

SCREENED CHEMISTRY: PILOT RESULTS

- Pilots complete to date (Mexico and Pakistan): 3
- Chemical suppliers participated: 9
- Commodity chemicals screened: 18

SCREENED CHEMICALS	QTY	%
GREEN SCORE	45	34%
YELLOW SCORE	70	53%
RED SCORE	17	13%
TOTAL CHEMICALS	132	



- New pilots in work (including additional countries such as China): 9

Source: LS&Co.