GUIDE TO SUSTAINABLE PACKAGING

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Introduction

The global packaging industry has grown rapidly over the past two decades, largely driven by ongoing changes in the choice and selection of substrates, the introduction of new end-markets such as home delivery, and the economic boom in China and India. In fact, market research suggests that global demand for packaging will continue to grow steadily at 2.8% per year to reach \$1.05 trillion in 2024.¹

The flexible packaging market, in particular, including paper, plastics and foil laminates, has grown due to technological advancements in the last decade. Applications that were previously used for industrial purposes have now become viable for the mass market, particularly plastics. Furthermore, the lightweight and easily transportable nature of flexible packaging also makes it a desirable choice, as it prolongs the shelf life of food-based items, increases hygiene standards, and supports the growing consumer trend of the on-the-go lifestyle.

However, there is ongoing concern about the poor management of such packaging waste for consumers. Each year, the average European generates two and a half times their own weight in packaging waste. Of the 86.7 million tons of packaging waste generated in 2016, 41% was made up of paper and cardboard. Plastic and glass made up 16% each, while metal made up only 5%.²

Plastic makes up a relatively small percentage of waste, but

its recyclability statistics are the most concerning. The European paper recycling rate is 72.3%, but for plastic it is 9%. So where does the rest go? 12% was incinerated and 79% accumulated in landfills or the natural environment.³

> If current trends continue, it is estimated that roughly 12 billion metric tons of plastic waste will be in landfills or the natural environment and there could be

more plastic than fish (by weight) in the world's oceans by 2050.

With documentaries and news articles bringing these facts to light, along with government initiatives such as plastic bag and cup charges being enforced in many parts of the world, consumers are now

¹The Future of Global Packaging to 2024—Smithers. ²2019, Event Report, Recycling Metal Packaging, EURACTIV. EURACTIV is an independent pan-European media network specialised in EU policies. more eco-conscious than ever. "Reduce, reuse and recycle" is fast becoming the call to action as consumer demands increase worldwide.

Brand owners and converters are responding to these demands by seeking from their suppliers more sustainable packaging solutions across a broad spectrum of applications. On top of this, there is a push from regulatory bodies, such as the European Union's directive to eliminate single-use plastics by 2025.

These factors are driving the development of packaging, forcing the industry to invest in research and development to make flexible packaging more sustainable than, but equally robust as, existing packaging options.

Becoming more sustainable

The best route to ensure that any material used in packaging is as sustainable as possible is to promote a circular economy. As explained by

the Ellen MacArthur Foundation,⁴ a circular economy is "a new way to design, make, and use things within planetary boundaries." Achieving this involves everyone and everything, from businesses and governments to individuals, cities, products and jobs, by:

- Designing out waste and pollution
- Keeping products and materials
- safe
- Regenerating natural systems

Building a circular economy is not only about using or manufacturing less plastic, but also ensuring that plastic, or any packaging material, can be reused, recycled or composted.

But how is sustainability defined? Using printing inks as an example, a converter's definition of a successful "sustainable ink" could be as simple as how well the ink and materials interact with each other to synergise the printing process. Inks that improve productivity on press or reduce waste could be seen as "green," but the key regulatory terms commonly used in the packaging industry are "biodegradable," "biorenewable" and "eco-efficient/eco-friendly."

Biodegradability is the ability of a material to be broken down by microorganisms. More relevant for sustainability is compostability, where that microorganism breakdown occurs within a set time, and with the important parameters of water, oxygen and temperature defined.

³www.twosides.info/wp-content/uploads/2019/08/Myths-and-Facts-V10-Online-1.pdf ⁴www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy





According to the USA National Association of Printing Ink Manufacturers (NAPIM), a biorenewable ink is derived from tree, plant, insect and/or animal materials. These can include resins, gums, oils, waxes, solvents and other polymer building blocks.

Eco-efficiency refers to sustainable materials management for packaging. Many programs, such as the U.S. Department of Agriculture's BioPreferred[®] program, offer incentives for businesses to increase the usage of renewable agricultural resources in their products.

> The industry has a responsibility to innovate and develop solutions to make a drastic difference in the way plastic is consumed. Sun Chemical is already doing this. First, in its development of mono-materials for plastics, by removing the layers of different materials that make it hard to recycle. Second, by producing solutions from paper and card, the raw material of which is the most sustainably sourced in the industry. This guide outlines the latest innovations from Sun Chemical in these and many other areas of flexible packaging.

Sun Chemical/DIC's approach to sustainability

The DIC Group is dedicated to conducting its business while retaining a strong commitment to five key concepts: preserving safety and health, managing risks, ensuring fair business practices and respect for diversity and human rights, maintaining harmony with the environment and advancing its protection, and creating value for society through innovation and contributing to ongoing economic growth.

DIC Group employees will continue working to deliver the value that its stakeholders—including its customers, suppliers, local communities, shareholders and investors, and employees—expect, showing ingenuity and a sense of responsibility to sustainability for society, as well as to the conservation and improvement of the global environment.

As the world's largest producer of printing inks, coatings, pigments and polymers, Sun Chemical is constantly working with its parent company, DIC, to promote sustainable solutions.

As stated by Myron Petruch, the president and chief executive officer of Sun Chemical, "Our approach to sustainability guides the way we develop, manufacture and distribute products, as well as how we work with our customers and suppliers. Working with industry leaders, we are reducing global CO₂ emissions by increasing the use of biorenewable and recyclable materials, while promoting the value of these activities throughout the supply chain."

Sun Chemical's latest Corporate

<u>Sustainability Report</u> focuses on how its commitment to sustainability has led to new products and services that help automore improve their age



that help customers improve their eco-efficiency goals.

The 2018 report shows that Sun Chemical achieved its own recent energy and water usage goals and highlights various initiatives that have been implemented to increase the company's overall commitment to developing sustainable solutions for customers, such as:

- A long-term strategic target to reduce CO₂ levels by at least 30% by 2030
- The reduction of water usage beyond the 32% achieved in 2018
- The identification of areas to improve in driving innovation of sustainable procurements, as highlighted by EcoVadis, a leading provider of business sustainability ratings
- The company's connection to CEFLEX to promote a circular economy for flexible packaging
- Greater levels of biorenewable content in Sun Chemical products





In addition to actively participating in groups such as CEFLEX, the Sustainable Packaging Coalition and Migratox, Sun Chemical continues to drive increased sustainability through innovation

> in its products and solutions. The company's product sustainability initiatives can be categorised into

> > three themes:

1. The raw materials used and the manufacturing

processes—to increase the plant-based biorenewable content (BRC) and/or recycled content in Sun Chemical products. This reduces the products' effective carbon footprint and reduces the company's reliance on finite oil and

coal resources. Having less fossilbased carbon in packaging will help with climate change.

2. The function of our products and the environmental impact of this function—to develop solutions that help resolve societal issues, such as food waste.

3. The end-of-life of our products and how they interact with recycling processes—to assist Sun Chemical customers in making products easier to recycle and promoting the development of circular economies. Recycling can be through a mechanical/chemical route or through a biological route.

Sun Chemical's approach to sustainable packaging

In line with its overall approach to sustainability and as the company's inks form an important and integral part of the finished packaging, Sun Chemical is committed to supporting the packaging industry to achieve its own sustainability goals by, for example, trying to increase the amount of raw materials obtained from biorenewable sources. One way in which this is done is by only using soybean oil that comes from already existing soybean

⁵www.bbc.co.uk/news/business-47027792 ⁶www.twosides.info/wp-content/uploads/2019/08/Myths-and-Facts-V10-Online-1.pdf crops in fields that have been certified as not replacing other pre-existing natural biodiversity.

One of the main reasons plastic packaging is so difficult to recycle is because it is made up of multiple materials. An area that Sun Chemical is making strides towards in the aim of a truly circular economy is the ongoing advances in mono-material developments. Eliminating packaging layers and reducing complexity make the recycling and, in some cases, composting process easier.

While there are some logistical concerns about the use of paper and its robustness,⁵ its lightweight qualities do mean it is an affordable material for packaging and it is also one of the most sustainable raw materials available.⁶

Digital innovations

The majority of packaging is still printed using analogue technology.

Therefore the majority of the products Sun Chemical supplies to the industry are for use with analogue equipment. Nevertheless, in line with the general growth in the take-up of digital technology, Sun Chemical is increasingly focusing on providing products and solutions that are compatible with digital equipment to enable printers and converters to take full advantage of the benefits of the digital printing process.

Regarding products, Sun Chemical currently offers SunEvo,[™] a broad range of digital coatings and a complementary range of SunJet inkjet inks. With the SunEvo range of digital primers, overprint varnishes and lamination adhesives, Sun Chemical can help customers in flexible packaging, labels, folding carton and corrugated unleash the full power of digital printing.

In doing so, Sun Chemical also offers customers a strong sustainable value proposition with SunEvo and SunJet, which utilise water-based solutions, have the ability to emit no VOCs, and were formulated using far fewer petrochemically



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originated products. In addition, digital printing is inherently more sustainable than traditional print methods, as it can produce a final product with less waste and no make-ready, and uses a slim supply chain and lean manufacturing that facilitates a cleaner workflow throughout the process.

From a solutions perspective, SunColorBox, Sun Chemical's unique set of tools and services that enables consistent and accurate digital color communication throughout the entire packaging supply chain, has had a substantial impact on sustainability for customers through a 20% to 70% increase in ink returns usage and a 30% to 40% reduction in substrate waste.

How Sun Chemical is supporting the UN's goals for sustainable development

By recognising the importance of sustainability as a global issue, Sun Chemical is looking to align its goals with those of the United Nations in its <u>"Transforming Our World: the 2030 Agenda for Sustainable Development,"</u> which is "a plan of action for people, planet and prosperity."



To do so, Sun Chemical has identified a number of the 17 UN goals where the actions the company is taking to help develop a more sustainable packaging industry will, we believe, have a positive impact.

UN Goal #9: Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation



SunColorBox

Game changer for moving color management from inefficient analogue approval to fully digital workflow

with newly introduced digital proofing solution based on PantoneLIVE,

significantly increasing access to information and communication technology,

specifically in developing countries, upgrading technological capabilities of graphic arts industrial sector.

SolarWave[™] and SunWave[™]

The class-leading ranges of UV LED curing SolarWave flexo and SunWave offset inks, which are suitable for food and non-food applications, enable environmental improvements within industrial processes, as LED UV consumes less energy. And since less energy is consumed, cost savings can be achieved in the long run.

SunVisto[®] AquaGreen[™]

This range of biorenewable inks supports sub-goal 9.4 ("upgrade infrastructure and retrofit industries to make them sustainable"), as Sun Chemical is moving from using a fossil-based raw material, a limited resource, to a sustainable plant-based raw material.

SunPak® Organic

Comprising only raw materials that have been approved for use as food ingredients, this series of sheetfed offset inks is ideal for use by folding carton converters to print on the inside of food packaging where direct food contact is an option. By using SunPak Organic, converters can remove plastic barriers inside a box of chocolate or biscuits, for example, and still print on the inside of the box. In doing so, Sun Chemical is promoting "increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes."

SunPak[®] FSP

Sun Chemical's flagship food packaging offset inkset, SunPak FSP, is based on renewable biobased materials and has achieved a new standard in eco-friendliness through a combination of compliance and sustainability. Not only is the inkset fully compliant with all existing food packaging legislation worldwide, but it has also been independently tested by Beta Analytic, the world leader in carbon-14 measurements, to prove the high level of its environmental sustainability.

Beta Analytic measured the ratio of radiocarbon in the inkset relative to a National Institute of Standards and Technology (NIST) modern reference standard (SRM 4990C), and the results were accredited to ISO/IEC 17025:2005, the highest level of recognised quality any testing or calibration laboratory can attain.

The ratio of radiocarbon was calculated and reported as the percentage of "biobased carbon," which indicates the





percentage of carbon in the inkset from "natural" (plant-based) sources versus "synthetic" (petrochemical) sources. The test showed that, on average, 77% of the total organic carbon in the inks in the SunPak FSP range is biobased, with only 23% being fossil carbon, of which the majority relates to pigments.

UN Goal #11: Make cities and human settlements inclusive, safe, resilient and sustainable

SunStrato® Duratort

Primarily made from polyurethane resins that are free of chlorine, nitrocellulose and monomeric plasticisers, these inks are suitable for flexo and rotogravure printing.

They are commonly used for applications that require high-temperature processing, retort and sterilisation, as well as demanding product resistance requirements such as egg, detergents or aggressive cook-in

sauces. As they are PVC free, easy recycling is possible, reducing the

amount of waste packaging going to landfill.

The inks deliver the high speed, clean printing and low solvent retention required for maximum press efficiency, and provide the shelf standout and high-quality package look required in today's competitive performance packaging market.

SunUno[®] Solimax, SunSpectro[®] Solvaplast/Aquathene

Packaging is compostable if the substrate that comprises it is compostable, which is why these inks and films have been developed and certified as Vincotte-TÜV for use on "okay to compost" packaging.

Compostable packaging results in less waste going

into landfill/incineration and shows how the industry is being responsible for end-of-life scenarios. These Sun Chemical compostable inks and film solutions are solvent- and water-based and used primarily for snack food applications like energy bars, biscuits, coffee cups and waste bags.

- Aquathene is for flexographic printing of compostable films and has good printability.
- Solimax flexographic solvent-based ink is suitable for printing various plastic films intended for both external printing and lamination with adhesives. These are suitable for pasteurisation, with heat treatment.
- Solvaplast ink, which has a solvent base, is suitable for printing the exterior of polyolefin films. They have good printability, gloss and excellent mechanical strength as well as high resistance to dry dusting and scratches.

SunLam™

The SunLam family of compostable lamination adhesives consists of waterbased adhesives designed to meet the needs of all the major flexible packaging applications globally, including low-performance food and confectionary. They provide flexible packaging solutions that can replace similar adhesives and retain or improve upon mechanical strength, temperature and chemical resistance.

SunLam ensures every element of the flexible packaging facilitates the sustainable end of life of the substrate, through easy at-home composting capabilities.

UN Goal #12: Ensure sustainable consumption and production patterns

SunColorBox

Digital color management significantly reduces ink waste, substrate waste and energy consumption through prevention and reduction of press make-ready time by at least 30%.



Sun Chemical's global SunColorBox tools make it easier to ensure color production process through an integrated packaging workflow, speed to market, color accuracy and consistency, all while cutting production costs and improving efficiency.

One of those tools to help printers and converters achieve colors without needing to invest in specific spot colors is Sun Chemical's **SunECG**, a seven-process-color solution that begins with an audit process to ascertain the status of the presses and processes in place and to ensure the existing process control is of sufficient quality for expanded color gamut (ECG) printing.



For printers and converters able to take advantage of ECG printing, the benefits are significant, as there is no need to change inks on the press. All of the work is done in the prepress separation to ensure that the color required is built up across each print station.

Since the seven inks can be left in the press, the changeover and make-ready time for each new job is greatly reduced, delivering substantial cost savings. Multiple designs can also be consolidated across one web/sheet, so there is no need for individual production runs for different jobs.

To learn more about SunColorBox and all of its tools, download Sun Chemical's <u>SunColorBox Guide</u>.





Paslim Barrier

This adhesive system increases the oxygen barrier when used with monomaterial plastic, enabling durability and protection for the packaged goods from microorganisms, corrosion, moisture, air and odours. Ultimately this means increased shelf life of food and results in minimising wastage at the retail level.

SunStar and SunSys[™]—Heat-sealable waterand grease-resistant varnishes

Polyethylene (PE)-coated paper is used in many different applications to make packaging more resistant to water and grease. PE-coated paper is not recyclable in the standard collection recycling scheme and not compostable. Solutions of SunStar and SunSys varnishes replace the PE layer and enable standard paper disposal with complete repulpability, as well as open the option for compostability, both industrial and at home. This provides the opportunity for sound

opportunity for sound management of the packaging, and all its elements, throughout

its lifecycle and helps to substantially reduce waste generation.

SunBar[®] Aerobloc Reinforce

Mixed structures in plastic packaging are difficult to recycle because they are laminated together and are difficult to separate. This is why there is a move to mono materials or even mono-web in plastic packaging. However, there are specific challenges to this, especially when implementing AIOx barrier in replacement of less sustainable options such as PVdC.

Aerobloc Reinforce is improving the resistance of AIOx-based barrier structures to flex cracking. The solution is fully solvent based and can be printed full speed and in-line with inks at the printer/converter stage. The solution is available for standard and retort packages. Aerobloc Reinforce is sustaining the development of more environmentally friendly highbarrier options.

Thermaseal and Polarseal

Sun Chemical supplies a range of direct-food-contact-approved heatseal and coldseal adhesive coatings. These products provide customers with the option of applying a sealing layer to a range of substrates.

Sun Chemical has developed paper-specific coldseal adhesives that have the added advantage of containing significant biorenewable content. These can be combined with Sun Chemical's coldseal release lacquer for use on recyclable paper-based flow-wrap packaging as an alternative to conventional polypropylene structures.

Sun Chemical's water- and solvent-based heatseal coatings can also help facilitate the replacement of filmic packaging with paper-based alternatives. Again, Sun Chemical can offer paper-specific grades that ensure packing line performance and pack integrity is maintained when making the switch to paper. In addition, the company is developing heatseal coatings designed for mono-material applications such as PET lidding.

SunVisto[®] AquaGreen[™]

This range of Sun Chemical biorenewable inks supports sub-goal 12.2 ("achieve the sustainable management and efficient use of natural resources"), as it uses renewable resources instead of non-renewable, petrochemical-based raw materials.

SunBeam® Advance 5

This range of electron beam–curing inks for printing packaging and labels supports sub-goal 12.4 as, being solvent-free, it eliminates the use of volatile organic compounds (VOCs) and avoids the need for UV photoinitiators. In addition, the inks contain 30% biobased content.

AgriCure (concept product)

In line with sub-goal 12.5—to "substantially reduce waste generation through prevention, reduction, recycling and reuse"—AgriCure is a 45% biobased UV-curing ink system developed in response to the demands of brand owners (particularly luxury brands) who want cartons printed with sustainable inks that have high biorenewable content and recyclability (deinking, composting).

UN Goal #13: Take urgent action to combat climate change and its impacts

In its 2019 report concerning the progress of Sustainable Development Goal 13, the UN states: "Increasing greenhouse gas emissions are driving climate change. In 2017, greenhouse gas concentrations reached new highs,



with globally averaged mole fractions of CO₂ at 405.5 parts per million (ppm), up from 400.1 ppm in 2015 and at 146% of pre-industrial levels.





Moving towards 2030 emission objectives compatible with the 2°C and 1.5°C pathways requires a peak to be achieved as soon as possible, followed by rapid reductions.... During the period 1998–2017, direct economic losses from disasters were estimated at almost \$3 trillion. Climate-related and geophysical disasters claimed an estimated 1.3 million lives."

Sun Chemical is supporting the goal of lowering CO_2 emissions by developing biorenewable inks that will help to reduce the carbon footprint of the printing industry.

SunVisto[®] AquaGreen[™]

These water-based inks and coatings are made from a significant portion of plant-based biorenewable inks (patented technology based on plant-derived resins, starch and other natural raw materials) for natural, cleaner, greener food packaging.

The aim of Sun Chemical's sustainability initiatives relating to raw materials used and its manufacturing processes is to increase the plant-based biorenewable content (BRC) and/or recycled content in Sun Chemical products. This reduces the products' effective carbon footprint and reduces the company's reliance on finite oil resources. Having less fossil-based carbon in packaging will help with climate change. Sun Chemical offers inks with a high level of biorenewable content across many of its product ranges.

The level of BRC in an ink, coating or adhesive can be measured using carbon isotope ratio analysis. This method gives clear results as to the BRC and conforms to the ASTM D6866-18 Method B standard. Although some of the raw materials are biorenewable, manufacturing conditions of these inks are the same.

These inks are suitable for primary food packaging, resistant to abrasion, water and grease, with superior overall performance and no compromise on quality. SunVisto AquaGreen water-based inks are, for example, used on quick-service restaurant packaging.

Application examples:

- Sandwich cartons and wrappers
- Small carry-out bags
- Purpose-made bags with QR code linking to HAVI and Sun Chemical
- Paper cups for cold and hot beverages

Switching to biorenewable inks is a good way for converters, end users and brand owners to be more sustainable. As with other water-based inks, waste is minimised, since inks that aren't used on one run can be used for another.

Sun Chemical has entered into a partnership with HAVI, a global company that innovates, optimises, sources and manages the packaging and supply chains of leading foodservice brands, to bring its SunVisto AquaGreen biorenewable, natural-based inks to market.

Sun Chemical's biorenewable inks have been certified and specified by HAVI to be a recommended natural-based ink solution globally, ensuring that foodservice brands and manufacturers receive truly renewable packaging ink.

Over the past three years, HAVI has worked closely with Sun Chemical to help develop natural-based inks which not only contain significantly higher levels of biorenewable resin content, but also deliver high-quality printing on fibre-based packaging substrates. The collaboration is another example of why Sun Chemical has been a trusted innovator for 200 years. HAVI came to Sun Chemical with a unique challenge, and Sun Chemical provided a solution that HAVI has certified and specified and that's in line with Sun Chemical's own sustainability policy.

HAVI's extensive global network and relationships with package developers on all continents means that Sun Chemical's natural-based inks could be used by any of HAVI's global partners anywhere in the world.

"Foodservice and consumer packaged goods brands are putting sustainability at the forefront of their business goals, and that's pushing innovation to new and exciting levels," said Joshua Oleson, Vice President, Sustainability, Innovation, and Packaging Development for HAVI. "We are pleased to partner with Sun Chemical to deliver sustainable packaging solutions that are environmentally sound, support the goals of major brands and create an experience that we know builds even greater trust with consumers."

SunVisto® Aquasafe

Compatible with the European directive to eliminate single-use plastic by 2025, this ink is suitable for direct food contact and particularly for use on paper-based straws that can be recycled and are much more biodegradable than

conventional plastic straws. By developing an ink which can be used on paper straws, Sun Chemical is supporting the efforts promoted in the Ellen MacArthur Foundation report on "The New Plastics Economy," which estimates that by 2050, there could be more plastic than fish in the world's oceans (by weight).



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UN Goal #14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development



SunSpectro[®] SolvaWash[™] GR

Recognised by the Association of Plastic Recyclers, Sun Chemical's **SunSpectro SolvaWash GR** is a

recycling-friendly washable ink technology that can be removed without staining the flake or wash water from post-consumer printed PET packaging during the hot caustic wash step of the recycling process. Designed for crystallizable PET shrink sleeves, using these inks allows for the increased recovery of high-quality, clean, recycled PET resin flakes, and can help to boost the low 9% worldwide recycling rate and reduce the volume of plastic bottles that make their way into a marine environment.

UN Goal #15: Life on land

SunColorBox

Digital color communication significantly reduces carbon footprint by avoiding urgent physical sample deliveries for color approvals and reduces travel for press approval. Faster approval also reduces plastic and paper waste.



Along with our parent company, DIC, Sun Chemical is constantly working to promote sustainable flexible packaging solutions. Our approach to sustainability guides the way we develop, manufacture and distribute products, as well as how we work with our customers and suppliers as we look to reduce global CO₂ emissions by increasing the use of biorenewable and recyclable materials, while promoting the value of these activities throughout the supply chain.

Sun Chemical drives sustainability during the research and development phase of all products. Learn about the many products that fit our <u>2030 Sustainability</u> <u>Agenda</u> and are included as part of our **SunEco** portfolio of solutions.



If you would like to learn more about Sun Chemical's sustainability initiatives, please contact Sun Chemical at globalmarketing@sunchemical.com.





THE POWER OF SUSTAINABLE PACKAGING

Today's environment requires more than change. It demands transformation—and a partner who's willing to transform with you. Sun Chemical, a member of the DIC group, is a leading producer of printing inks, coatings and supplies, pigments, polymers, liquid compounds, solid compounds, and application materials. Together with DIC, Sun Chemical has over 20,000 employees located at 176 subsidiaries across 63 countries working every day to meet the needs of customers by improving performance on the essentials of business, such as reliable, on-time delivery and consistent product quality. Sun Chemical tailors solutions to unique customer needs and brings new ideas and the latest technology to market. As you move forward into a world of stiffer competition, faster turnarounds, more complex demands and sustainable products, count on Sun Chemical to be your partner.

CONTACTS:

Email: globalmarketing@sunchemical.com www.sunchemical.com/PowerOfFlexiblePackaging

working for you.

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