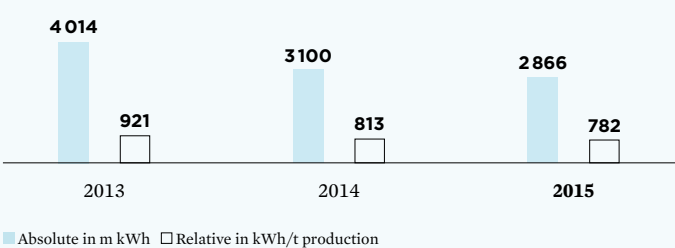


Sustainability Report **2015**

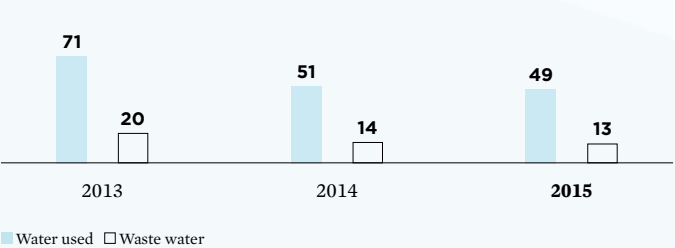
Environmental

KEY PERFORMANCE INDICATORS

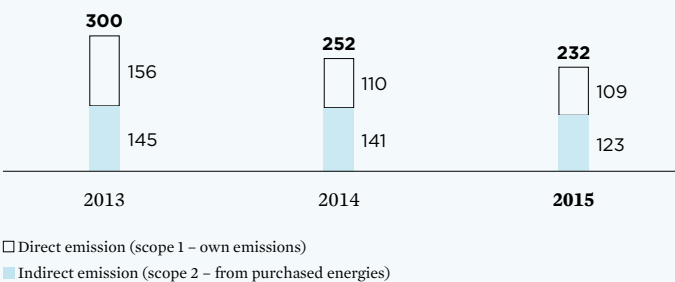
ENERGY CONSUMPTION



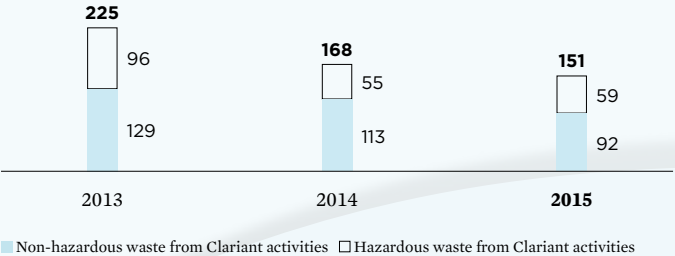
WATER CONSUMPTION in m m³



GREENHOUSE GAS EMISSIONS in kg/t production (CO₂ equivalent)



QUANTITY OF WASTE in thousand t



EMISSIONS OF GASES in t

	2015	2014	2013
Sulphur dioxide SO ₂	310	344 ¹	770
Nitrogen oxide NO _x	576 ²	872	877
Hydrogen chloride HCl	57	39	39
Ammonia NH ₃	24	22	30
Dinitrogen monoxide N ₂ O	0.07	0.1 ¹	517
Total inorganic emissions	967	1 277	1 716
Volatile organic compounds VOC	183.5	191	350
Methane CH ₄	0.2	0.2	0.4
Total organic emissions	184	191	350

PARTICLE EMISSIONS (FINE PARTICLES)

	2015	2014	2013
in t	242	262	319
in g/t production	66	69	73

MATERIAL USE AND PRODUCTION in m t

	2015	2014	2013
Material used	3.97	4.12	4.50
Production	3.66	3.81	4.36

¹ Sale of a production location with sulphuric acid plant and N₂O-producing plant

² one-off effect at one particular site

- We create value through appreciating the needs of:**
- our customers by providing competitive and innovative solutions
 - our employees by adhering to our corporate values
 - our shareholders by achieving above-average returns
 - our environment by acting sustainably

PAGE 22

»Our commitment to sustainability is owed to the simple recognition that financial performance is important, but it can only have lasting value when it is aligned with the interests of the society and the environment.«

HARIOLF KOTTMANN
Chief Executive Officer



Addressing Megatrends
and Societal Needs

PAGE 67

»With the use of ED pigments, not only is the process simplified, but the ecological efficiency and flexibility in production are also improved.«

WOLFGANG WINTER
Senior Technical Marketing Manager,
Global Competence Center Coatings

Spend on raw materials in CHF m	Spend on innovation in CHF m (2011 – 2015)	Turnover in CHF m	Spend on salaries in CHF m	Distributed per share in CHF
2300	1000	5800	1345	0.40

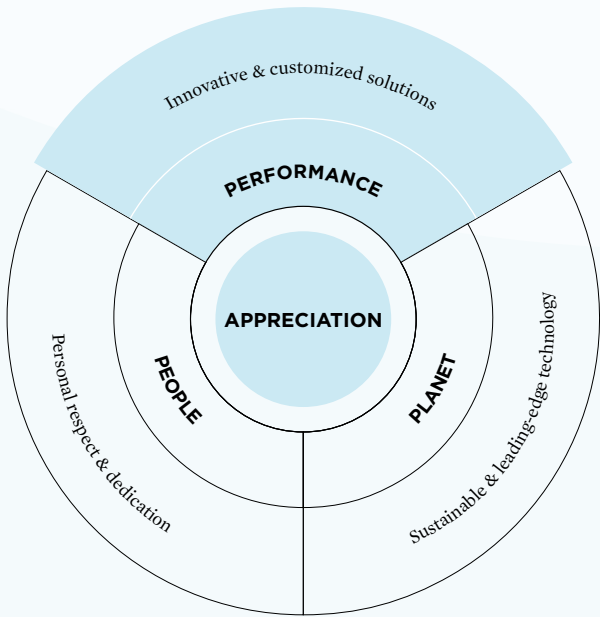
»We aim to facilitate the sustainability efforts of our customers on all levels and throughout all Business Units.«

JOACHIM KRÜGER
Head of Corporate Sustainability & Regulatory Affairs



Environmental
Protection

BRAND VALUES
and the core of the brand



Raw Materials and
Sustainable Sourcing

THE FIVE-PILLAR STRATEGY
to increase performance

- | | | | | |
|---------------------------------|-------------------------------|--|------------------------------------|---------------------------|
| 1 Increase Profitability | 2 Reposition Portfolio | 3 Add Value with Sustainability | 4 Foster Innovation and R&D | 5 Intensify Growth |
|---------------------------------|-------------------------------|--|------------------------------------|---------------------------|

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Foreword from the CEO



—
HARIOLF KOTTMANN
Chief Executive Officer

Dear Readers,

Sustainability is an important success factor for our company. That is why we announced »add value with sustainability« as a pillar of our corporate strategy in August 2014. The principles of Responsible Care® and the UN Global Compact form the basis for this.

Sustainability also plays an increasingly important role for our customers. That is why, as one of the leading specialty chemical companies, we offer products and solutions that address global challenges such as resource scarcity, climate change, energy, nutrition and environmental protection, which concern all of us.

We are gradually working to integrate sustainability into all of the company's processes, and beyond the boundaries of the company. Even the theme »sustainability along the value chain« is becoming increasingly significant: development, innovation, procurement, manufacturing and customer benefits – there are starting points for more sustainable business everywhere. We are working hard to implement the highest possible degree of sustainability at all levels.

Transparency and traceability of sources are of growing importance in the production of raw materials. Sustainability can only work if we collaborate closely with suppliers and customers to maintain social and environmental standards. This is why we carefully examine the supply chain for possible improvements. We use renewable raw materials wherever it is possible and wherever it makes sense. For example, certified, bio-based raw materials whose origin can be traced are of increasing importance for cosmetics and personal care products. We have launched the pilot project »SPOTS®« (Sustainable Palm Oil & Traceability with Sabah Small Producers) with different partners along the value chain, which provides exactly this transparency for the production of palm oil and palm oil derivatives.

Sustainability also fuels our innovation pipeline with new ideas and is an important factor for our future growth in this respect. Only with innovations we will be able to achieve the leading position in the market to which we aspire. From the beginning of the innovation process, we make sure that product developments meet our sustainability requirements. This helps us to identify opportunities for new, sustainable products early on.

As part of the Portfolio Value Program, we have screened our existing product portfolio for its sustainability performance using an extensive list of criteria. Those products that have an outstanding sustainability profile are awarded with our EcoTain® label. At the end of 2015, more than 80 products already qualified for this recognition. The program also serves to target and identify potential for improvement. Our sustainability strategy is to continuously improve the portfolio by renewing or replacing products.

On 2 September 2015, we presented our sustainability strategy to representatives from industry, government, non-governmental organizations and the media at the first Sustainability Dialog. The consistently positive feedback we have received along the way and the open dialog affirms our approach.

We have also made additional progress with regard to production processes. As part of our environmental targets, we have undertaken to improve six key environmental parameters by 30 % – 40 % by 2025 – always with respect to the amount of goods produced. Judging by the progress already achieved, this means another significant step towards more efficient production.

Top priority is accorded to the employees at Clariant and we want to be seen as the industry's preferred employer. Our values and goals should contribute to a motivating and challenging work environment. In this context, it is important to us that we can position ourselves as a responsible company. With a global roadshow enti-

tled »Accelerate Change – Discover Value« we have brought our employees worldwide closer to the issue of sustainability in the year under review.

The fact that we have successfully established sustainability as an integral part of our business activities is also reflected in our recent inclusion in the prestigious Dow Jones Sustainability Index and the ranking among the top four companies in the chemical industry. For the first time, we were also awarded a Silver Class Award by RobecoSAM, an investment specialist in sustainable investments.

We want to develop Clariant into a leading global specialty chemicals company characterized by above-average value creation. I am convinced that we can offer our customers real added value with consistent implementation of our sustainability strategy, and thus make a significant contribution to value creation over the long term for all stakeholders.



Hariolf Kottmann
Chief Executive Officer

In my **REAL LIFE**

Six Clariant employees from North America share their views on sustainability. »What does sustainability mean for my private and professional life?« The series »In my real life« shows various people and their perspectives on »sustainability« – everything ranging from corporate environmental protection to training and social responsibility.

Concept and photography by Jo Röttger
Text by Bertram Job



—
THE WOODLANDS, UNITED STATES
Shannon B. Nicoletti



TORONTO, CANADA
Luke Ng

LOUISVILLE, UNITED STATES
Robert Reeder

CHARLOTTE, UNITED STATES
Elizabeth Pullen
Joe Rhinehart

LAFAYETTE, UNITED STATES
Ralph Cormier



—
LUKE NG
CA Operations Manager,
BU Masterbatches – Toronto, Canada

Our business here is color, which definitely has everything to do with diversity. A city like Toronto is enriched by its cultural diversity. That is why we do not seek out nor exclude any particular cultural or ethnic groups in our staffing requirements. When people apply for a job at our site, we focus on ensuring that we select the most qualified person from a diverse pool of candidates. A company is more successful when its team members share diverse ideas and not just ideas that are always the same. That would be like having only one tool in a toolbox.

We have employees from Vietnam, the Caribbean nations, Poland, Ghana, the Philippines and many other countries. They are very well trained and driven by the same dream. We all have the same wishes for ourselves and our families. I myself came to Canada when I was eleven years old. My heritage is Chinese. In elementary school, I was the only visible minority, so I was a bit of a mystery to my schoolmates. I still remember well how I stood in line at the university to enroll. An Asian student came up to me and asked if I wanted to join the Chinese chess club. I declined. I feel that if you want to be accepted as a new member of society, everyone should be inclusive, including yourself.

Today, I have a strong Canadian identity and work in an industry whose products survive generations. That's why comprehensive waste management is all the more important. That's why we throw away as little as possible. Cardboard, wood, metal, electronic equipment, and plastic, our main source of garbage are given a second life through recycling efforts. We achieved our environmental targets for 2015 in 2011 and we are proud of that. Sustainability is ultimately something that needs to be put into practice now.



—
ELIZABETH PULLEN
Industrial Hygiene Management,
Corporate Sustainability & Regulatory Affairs –
Charlotte, North Carolina

I only found out later in life that I enjoy teaching. It started when I was tutoring my son when he was in high school. I was able to teach him quickly how to rely on his own potential without having to rely on teachers. Then, I heard about a program in our church where the congregation wanted to help Montagnard students, an ethnic group from the Vietnamese highlands. I immediately offered to give them tutoring in science and mathematics. There's so much that needs to be done, and that was just my part.

Initially, we wanted to meet each Saturday at the library. Sometimes I found myself alone there and had to pick up some of my students from home first. Since then, they ask me over Facebook or via text message if they need help in chemistry or another subject on a certain day. This works much better. Many of them are in classes with twenty or thirty students. They need this one-on-one time. It makes me happy when they stop thinking they won't understand the material. Once they realize their potential, their self-esteem improves.

To me, they are very special, warm-hearted people. They often invite us to their homes so we can taste their food or enjoy their festivals. They also inspire a certain amount of patience in me, making me realize that you shouldn't worry too much. These people supported the American army in Vietnam. Now there is an opportunity to help them – and in a way that allows them to help themselves. This also contributes to a more sustainable society.



—
JOE RHINEHART
Customer Service Manager North America,
Global Business Services – Charlotte, North Carolina

I have always been blessed. My father worked for forty years in this company, and I was still in college when I started here, taking odd jobs during school breaks. I like my role in customer service. I'm always required to come up with creative solutions when I'm in touch with people. I think my life is good and that's exactly why I would like to do something for others. That's why I am involved in our employee-run volunteer committee to support good causes. We organize a lot of in-house fundraising events and come up with a lot of funny themes for them.

A former colleague once asked me if I could participate in an event. I challenged him and said I would collect more donations than him. That actually worked because I put on a costume with goggles, a swim ring, and fins. I made a real show out of it. After that, I never stopped changing roles. I've been a snowman, a gnome, a racer, a parrot, and I even once wore a jacket and gloves like Michael Jackson. It probably makes it easier for me to stand up and talk in front of people when I have a costume on.

These moments are special. I often get goosebumps. But first, it's pure stress. Like a choreographer, I want to make sure that all the details of my presentation are just right and that everyone has fun. I've never received any negative feedback. People come up to me and say thanks because they were able to laugh and take a step back. That's the best reward for me.

It can sometimes get boring for my coworkers to always be sitting behind the computer. That's why we do these things. At the same time, it's an opportunity to give something back to our neighborhood in Charlotte by helping those who are less fortunate.



—
RALPH CORMIER
Business Development Specialist,
BU Oil & Mining Services – Lafayette, Louisiana

The first animal I hunted with a bow and arrow was at the age of 23 or 24 and I haven't lost my excitement for it since. Meanwhile, I've gotten almost all my clients hooked. It's an honor for me to show them how to do it. It's not that easy to hit a target from 30 to 40 yards away. If you aren't certain that you'll make it, you're better off not taking the shot. We only hunt a few animals at my camp because the number one rule is: if you don't want to eat it, you shouldn't shoot it.

The oil business is a small world. I was on a rig in 1976 as a standard laborer. It's hard to describe how close you get with your coworkers out there. You make friends quickly because you need one another. Some colleagues are now plant managers for big oil companies. When I come into their offices to talk about business, most of them have already decided to go with me. I know what these people want. I've been there for ages.

Integrity, honesty, trust: these are the values I stand for. There is no recipe for success in this job. You need to find out how to build and maintain relationships yourself. Some people want to see me once a week, others once a month. Then we do what they like to do: fishing, golf, clay pigeon shooting, hunting. Recently, a customer absolutely wanted to cook for us. Most of them don't want to be treated as something special, and that makes it really fun.

My two grown boys are the most important thing to me. They've never given us any trouble. I've been married to the same woman for 37 years, have lived in the same house for 37 years and have worked for a previous company for 26 years. That's my sustainability. I am very proud that I have hardly lost any customers in all these years. I love what I do and would do it for free. Just don't tell anyone.



—
SHANNON B. NICOLETTI
Human Resources Partner North America –
The Woodlands, Texas

I grew up in a family of firefighters and police officers and I also have some of that in my blood. In my work, I become a go-to person for most areas I touch. If someone falls down at a live concert, I'm the one who ends up caring for them. My parents are typical Californians, progressive and environmentally conscious. Being willing to help so that everything turns out okay is a way of life for us.

Mom made her cleaning supplies herself, using mostly vinegar for them. I think I inherited this mind-set that you can do a lot of things for yourself. At college though, I took the easy way out and just did like everyone else. But once I was out on my own, I was reminded of what I was taught while growing up. Today, I also make a lot of things myself: hair products, lotions, deodorants, and lip balm. My husband and I try to live as organically as possible. We buy most of our food from local farms and preserve as much as possible from the last harvest.

After I had my daughter, it became clearer to me how many everyday items we throw away. We spent a lot of money on eco-friendly diapers from overseas, since the childcare center could not use the cloth variety. And we made all her baby food at home and jarred it for storage. Eventually, I'd like to run a childcare center and preschool where the food comes from local farms and all items are reusable. This generation of parents wants sustainable things for their children, which will open up new markets. For these reasons, I am happy to be part of a company that has a vision for sustainability and that provides solutions that have less impact on the environment.

For example in Business Unit Masterbatches, in the beginning, I was teased a bit when I asked if we had any solutions to color bioplastics. Since then, our technical and marketing groups have been working with the producers on solutions in which the plastic is lighter or is biodegradable. It's also clear in other Business Units, that there is a push to provide more sustainable solutions. So I'm not the only one who cares, and I appreciate that this is being considered by others. It makes the world a better place.



—
ROBERT REEDER
Apprentice Training Supervisor,
BU Catalysts – Louisville, Kentucky

When I heard about the new program we have for training apprentices, I put my name in right away. The apprentices are eighteen years of age on average, and it's a pleasure to accompany them as they become the future leaders of the company. The areas we focus on are not limited to technical training. We also focus on work ethics, safety and how to conduct oneself in the working world. You can't help but feel like a father in some ways. I know the opportunities that are available here, and I want to help young people take advantage of them.

Through a Christian-based rehabilitation program, I also help young men who have encountered problems due to drug or alcohol abuse. Many of the young men in the program have lost everything, including hope. So we talk with them about how you can improve your life by changing your attitude. The success rate is quite high because it makes a difference when you feel that someone is really interested in you and understands your needs and troubles. Certainly I've made some bad choices in my youth, so I would never pass judgement. It's rewarding to see that no matter how shattered a life may seem, it can be put back together again.

Our farm would be a good therapeutic center for many people. It's something about nature and animals that calms the inner man. As soon as I come home, I change my clothes and tend to the animals. I have owned horses, goats, sheep and chicken, but I currently raise cattle, mainly hybrids of Charolais and Angus. I'm trying to buy more land. Our great-grandfather from Georgia had a lot of land, most of which was sold over the years. I want to instill the value of land ownership into my children. At the end of the day, I want to be able to say I made a positive difference in this world.

In my Real Life AROUND THE WORLD





—
»IN MY REAL LIFE«
is an artistic undertaking, presenting
the views of Clariant employees
from all over the world in the Sustainability
Reports from 2012. Discover more.
www.clariant.com/InMyRealLife

Sustainability

STRATEGY

Sustainability is not only a prerequisite for long-term profit maximization, but is also essential for reasons of environmental protection and social responsibility. In the last few years, Clariant has increasingly focused its business strategy on sustainable management and has set the goal for itself of becoming the world's leading specialty chemicals company through above-average value creation.

Sustainability management means an environmentally compatible, ethical, socially responsible and forward-looking action, the careful use of raw materials and the fair treatment of customers and employees. Clariant's claim of sustainability is not limited to selected departments, but extends across the three dimensions of environment, society and economy and includes the entire value chain: from the purchase of raw materials, to the production process, to the use of the products by the customer, and finally to the recycling or disposal of the product.

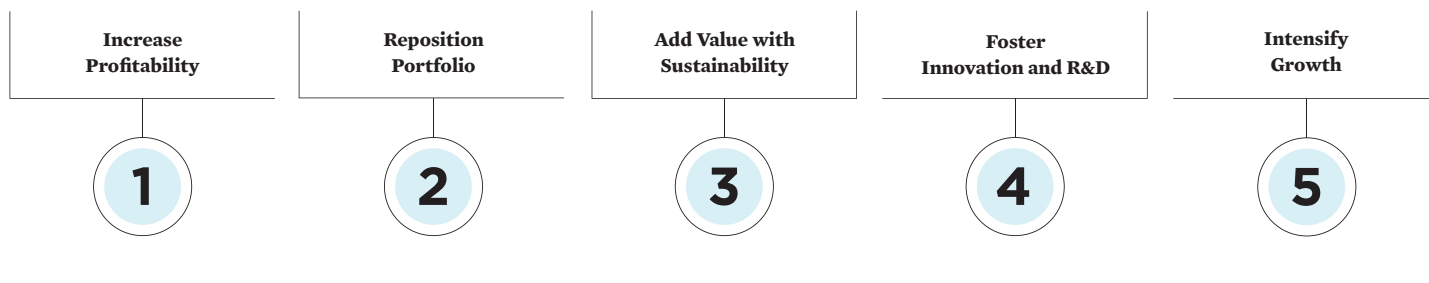
Clariant attaches great importance to sustainability when revising the properties of its products, as early as the research and development phase. At the same time, the existing product portfolio is continuously reviewed and refined according to sustainability

criteria. The safety of employees and customers is of paramount importance. The percentage of renewable resources is gradually increased where possible and appropriate. With extensive control mechanisms, procurement places a priority on the obligation of suppliers to do sustainable business. In production and logistics, a high level of safety and environmental protection is given, and material and resource efficiency is also viewed with special importance. In the application phase, the Clariant products should provide the maximum benefit for customers and consumers.

Add value with sustainability

Against this background, Clariant integrated the sustainability strategy into the business strategy. It is only in this way that the individual company success and growth can be aligned with the needs of society, individuals and the environment. The integration is an continuous process in order to optimally combine the demand, production, availability of resources and the technological and institutional changes with one another. Adding value with sustainability is one of the five pillars of Clariant's corporate strategy – in addition to increasing profitability; repositioning of the portfolio; fostering research and development, and in the process, fostering innovation; and finally, concentrating on growth markets.

THE FIVE-PILLAR STRATEGY to increase performance



»Our commitment to sustainability is owed to the simple recognition that financial performance is important, but it can only have lasting value when it is aligned with the interests of the society and the environment.«

HARIOLF KOTTMANN
Chief Executive Officer

Portfolio Value Program

Global megatrends such as climate change, energy, demographic changes and resource scarcity induced Clariant to launch the »Portfolio Value Program« (PVP) in 2013. With this program, the foundation was laid in the past three years for systematically and continuously improving the sustainability performance of the company together with employees, customers, suppliers, and other stakeholders.

With 36 criteria in the areas of environment, society and economy, products in the Clariant portfolio are analyzed for their strengths and weaknesses in terms of sustainability over the entire life-cycle of the products. The actual sustainability performance of a product and the relative sustainability in comparison with its competitors are both assessed.







The result of this analysis indicates products that already meet the intended sustainability standard set by Clariant or where there is room for improvement, and it shows how the entire product portfolio can be specifically optimized from a sustainability perspective. Through the end of 2015, Clariant has analyzed more than 80 % of the portfolio sales under the above criteria. Of these, 76 % meet the definition of sustainability set out by Clariant.

EcoTain® for sustainability excellence

Clariant excels products that are best-in-class in sustainability with the company’s own EcoTain® label. These products have an excellent sustainability profile and thereby exceed market standards – throughout the entire life-cycle from the raw material, to the production process and use, to recycling or disposal. By the end of 2015, more than 80 products from all business areas were awarded the EcoTain® label.



EcoTain® thus makes use of the holistic concept of the Portfolio Value Program, from development to the end use of a product. The goal is high-performance products, which, for example, are made from harmless ingredients or using renewable raw materials wherever possible and reasonable. An efficient production process is another part of the EcoTain® concept. Chemical reactions in production, for example, are to be optimized as part of this approach.

PEOPLE	PLANET	PERFORMANCE
 Safe Use, Transparency and Information	 Environmental Protection	 Integrated Sustainable Business
 Addressing Megatrends and Societal Needs	 Raw Materials and Sustainable Sourcing	 Performance Advantages

At the same time, the benefits of the product during processing, application or use are highlighted to the customer. The product should not only meet the desired function, but also contribute to a performance improvement in the final product, be safe to use, and provide a benefit to society.

Another component of the EcoTain® concept deals with the reuse, recycling or disposal of the product and the resulting impact on the environment and society. With regard to disposal, it is a matter of waste avoidance, and if unavoidable, of environmentally compatible waste recycling. The EcoTain® concept also takes into account the environmental characteristics of a product such as its biodegradability. Safety-related properties of products and their benefits to society are also taken into account.

With the first Sustainability Dialog in 2015, Clariant launched a platform that also promotes direct exchange with customers, suppliers, partners, policy-makers, and the media. Around 150 participants attended the event at the Clariant Innovation Center in Frankfurt (Germany) in September 2015. Clariant's sustainability strategy and the commitment to continuous improvement – in close collaboration with its business partners – were the focus of the event. Other key topics of the event were the state of Clariant's sustainability efforts in India and China for supply chain collaboration, for example.

CONCRETE MEASURES UNDERSCORE THE SUSTAINABILITY COMMITMENT

As part of the Clariant Sustainability Dialog, initial measures in the Clariant sustainability roadmap for continuous improvement of the product portfolio were communicated. The measures, which the company has committed to in a first step, include the following points:

- to obtain palm oil from sustainable sources, to set a guideline for the procurement of raw materials that avoids deforestation, to ensure the transparency across the entire value chain and to meet the criteria for mass balance certification by the Roundtable on Sustainable Palm Oil (RSPO)
- to proactively promote value chain collaboration with customers, suppliers and other parties in order to enhance the sustainability of Clariant and the customers
- to replace heavy metal-based pigments in masterbatches and chromium (VI) catalysts in the near future; Clariant underscored its willingness to substitute individual products and product groups that have been identified as critical

»We aim to facilitate the sustainability efforts of our customers on all levels and throughout all Business Units.«

JOACHIM KRÜGER

Head of Corporate Sustainability & Regulatory Affairs



—
**JOACHIM
KRÜGER**

Head of Corporate
Sustainability &
Regulatory Affairs

EcoTain® has now been transformed from a former initiative of the Business Unit Industrial & Consumer Specialties (BU ICS) to a company-wide best-in-class sustainability label. What is the intention behind this step?

—
JOACHIM KRÜGER We wanted to provide all our Business Units with a solid, transparent and credible tool, on which to found their marketing activities and enable Clariant to differentiate in the market. For us, sustainability is a very serious matter and our utmost objective is ensuring that our claims for sustainable product offerings are substantiated. Therefore, we support the BUs with a proofed screening tool and aim to facilitate the sustainability efforts of our customers on all levels and through all BUs.

The success and positive experience with the EcoTain® label within the BU ICS motivated us to use this approach as the basis for further developing it towards a corporate initiative.

What challenges did you face in creating the new company-wide EcoTain® approach? What makes it special?

—
JOACHIM KRÜGER We needed an approach flexible enough to cover products and services, as well as topics ranging from material sourcing to indirect effects in applications. In addition, the »Triple Bottom Line« of sustainability—People, Planet, Performance—had to be covered for sound judgement. Therefore, a comprehensive set of 36 environmental, social and economic criteria was developed in cooperation with the Centre for Sustainable Consumption and Production (CSCP), an internationally renowned, non-profit organization. An important element was the inclusion of representatives from all Clariant Business Units and Corporate Functions as well as the involvement of other key stakeholders, e.g. customers, suppliers, policy makers. With

the Portfolio Value Program (PVP), we now have a completely new, transparent and credible system with clearly defined, standardized, company-wide criteria to assess the sustainability of our product portfolio.

And what does the future hold for the EcoTain® label and the Clariant approach to sustainability?

—
JOACHIM KRÜGER We have currently awarded more than 80 products with the EcoTain® label – and this figure continues to grow. We are determined to keep expanding the number of EcoTain® products and to steer the product portfolio towards increased sustainability and continuous improvement through innovation. Based on the transparent information from the PVP, Clariant will develop a »Sustainability Roadmap«, which will enable us to further drive the integration of sustainability into our processes, our production and our products and solutions.



www.clariant.com/ecotain

Increasing importance of renewable raw materials

The use of renewable materials is becoming increasingly important in the chemical industry because of the growing demand from customers and consumers as well as to meet its own sustainability claims. With forward-looking research and innovation efforts as well as through programs with project partners, Clariant is working on identifying, developing and using renewable raw materials. As a result, valuable resources are conserved, energy is saved, waste is avoided and emissions are reduced. Clariant already uses several of such raw materials in production.

LIFE-CYCLE THINKING AT THE PRODUCT LEVEL

Sustainable development means the design of harmless and secure products based on sustainably sourced raw materials. A sustainable process is the responsible use of resources and production under safe conditions. Sustainability for customers means the safe and efficient use of innovative products, which are characterized by maximized application properties. Sustainability for the environment includes the ecological integration of these products, which means the reuse, recovery or degradability, and its undetectable impact on biodiversity (diversity of species).

This results in new sustainable products that replace the petrochemical raw materials (from crude oil). Possible applications for this are in the field of adhesives, waxes and derivatives from carbohydrates such as surfactants or emulsifiers.

Fatty acids produced from renewable raw materials and the fatty alcohols and fatty amines derived from them form the basis for developing new stabilizers for plastics. Clariant also develops enzymatic additives for the detergent industry to replace organic substances. In the personal care sector, completely bio-based emulsifiers and surfactants are increasingly designed to meet the client demand for natural and very skin-friendly products.

With new approaches to innovative sugar-based products

Innovation is an important element to enable sustainable value creation. In order to use resources as efficiently as possible and save time and costs in the development process, all innovation projects at Clariant undergo an analysis and planning process – from the initial idea to market readiness. Customers are also involved in this process early-on to determine their needs. There is close exchange with the customers throughout the entire development process. Sustainability aspects of course already play a central role in this phase, both for the customers and for the developers at Clariant.

A good example of this integrated innovation chain approach is the glucamide product platform. The novel sugar-based surfactants can be used in diverse applications in personal care, home care and crop protection. They are also attractive in terms of their price-performance ratio. Very important sustainability and customer aspects were taken into account in their development, such as a high proportion of renewable raw materials. In addition to raw materials made from glucose, glucamides are also made from natural oils that aim to be certified both in the origin as well as in the processing.

Close cooperation across the value chain

Balancing cost efficiency, high product quality, environmental standards, social standards, and a sustainable security of supply is sometimes a challenge in an increasingly globalized value chain. Ever-closer relationships with suppliers and customers provide the opportunity to secure supply chains and create sustainable added value across the value chains.

Clariant for example minimizes risks such as reputational damage or service and supply interruptions with a holistic sustainability strategy, close collaboration and concrete measures and thus continuously improves its supply chain.

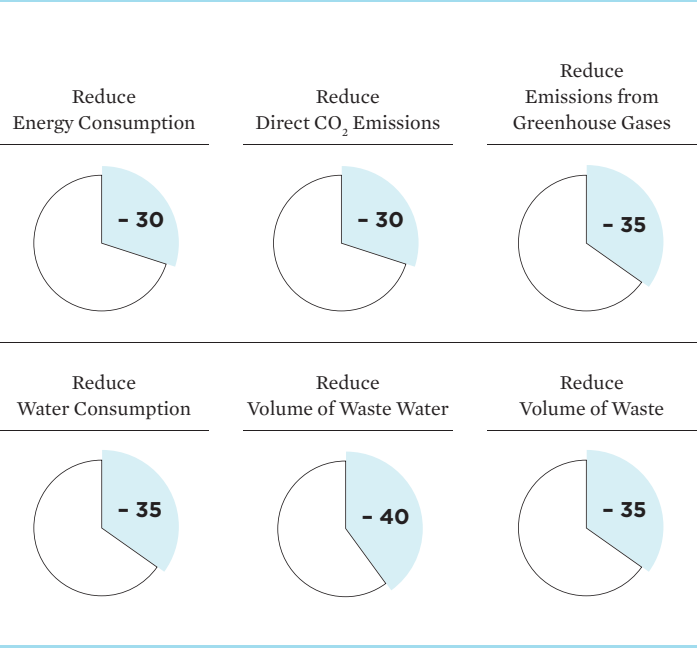
Cooperation takes place at all levels. Clariant has launched the initiative »Open Innovation at Clariant« to foster research and development. This initiative was developed in collaboration with the Universities of St. Gallen (Switzerland) and Stanford (USA) to improve the use of knowledge even outside the company because the flow of ideas into the company is often underestimated and therefore a neglected factor in innovation activity. Even large companies may not have as many meaningful ideas arise as in groups that work to an equally intensive degree with the respective topics. The exchange in the spirit of partnership across the value chain is therefore important, not only with customers but also with suppliers and researchers.

Clariant’s sustainability strategy is primarily focused on producing energy and material-efficient high-quality and innovative products that also meet the strict social and environmental standards across the entire value chain. Clariant customers can thereby purchase products which have a high added value compared to their competitors, products and they in turn allow increased sustainability performance (page 29).

Environmental targets

By 2025, Clariant wants to achieve significant improvements in six major parameters compared to the base year 2013. With respect to quantities produced, energy consumption and CO₂ emissions should be reduced by 30 % within the next 12 years. The emission of greenhouse gases should be reduced by 35 %, to the same extent as the amount of water used and the volume of waste. The waste water volume should even be reduced by 40 % over the next 12 years.

ENVIRONMENTAL TARGETS 2025 in % (per t produced goods)



Clariant does not intend to become more sustainable in the long-term with the implementation of a multitude of isolated solutions, but rather with a holistic approach – including social responsibility. All regulations, precautions and measures intertwine across the entire life-cycle of a product (page 59).

CLARIANT EXCELLENCE AS AN INITIATIVE FOR CONTINUOUS IMPROVEMENT

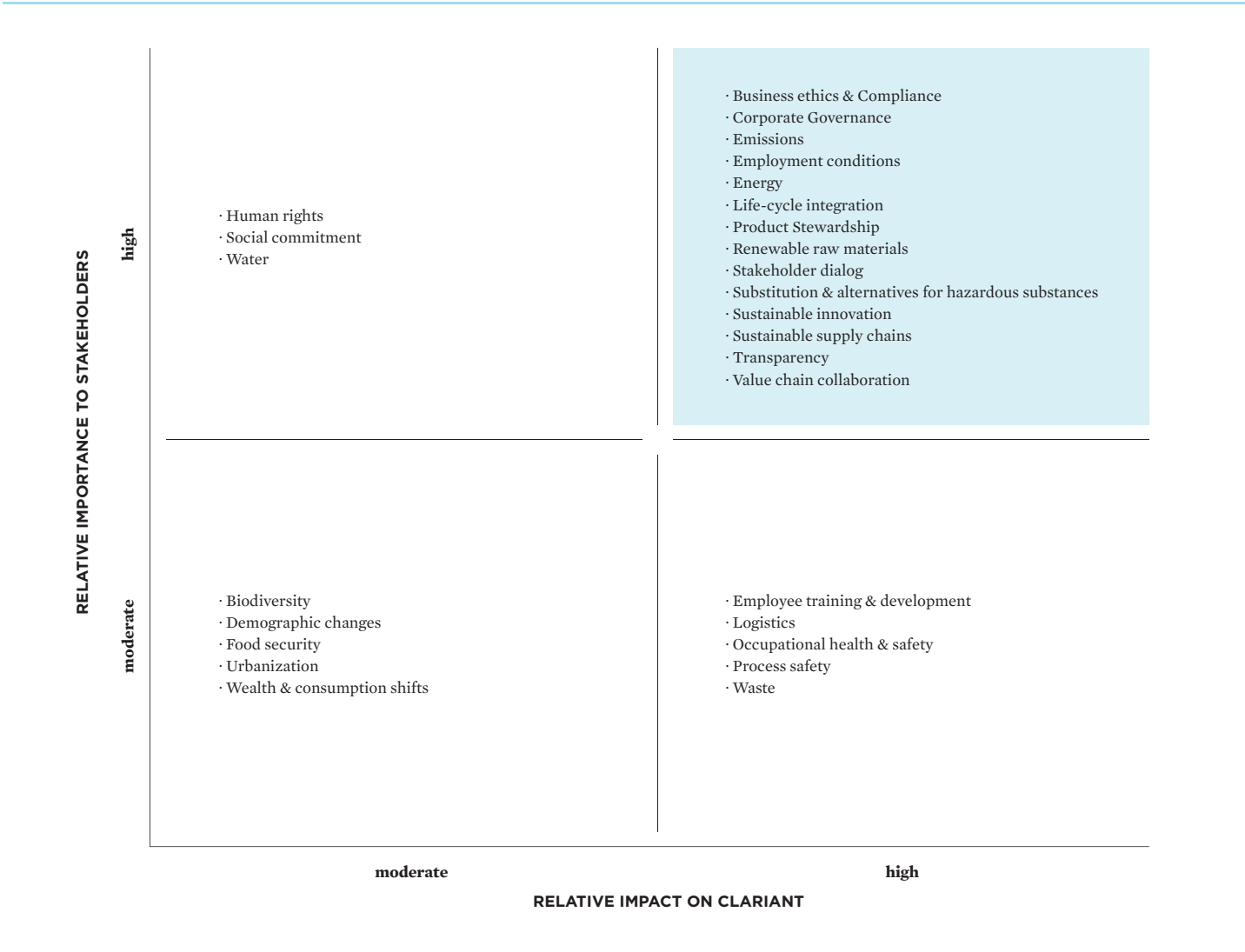
Clariant launched the group-wide Clariant Excellence initiative in 2009 to implement the corporate goals with a sustainable increase in value. Clariant Excellence is the core concept for continuous improvement. It includes the four areas: Operational Excellence, Commercial Excellence, Innovation Excellence and People Excellence. Clariant Excellence provides working methods and tools for the optimization of production processes, cost structures and the supply chain. Clariant Excellence also provides measures to improve profitability through a clear focus on margin and price. It provides for a lasting improvement in competitiveness and the consistent implementation of a profitable and, above all, sustainable growth strategy. As an example, around CHF 144 million could be saved in the group in 2015, and cumulatively over the past five years, the savings amount to CHF 564 million.

Materiality Matrix

The key issues for Clariant in terms of sustainability are shown in the »Materiality Matrix«. This matrix is the result both of a comprehensive stakeholder and trend analysis by Clariant itself and by external experts, and the evaluation of survey data from customers and other interest groups (»stakeholders«). The »Clariant Materiality Matrix« summary shows not only topics of fundamental or even great interest for Clariant and its stakeholders, but it also shows (in the right half of the matrix) the sustainability fields that are of relative importance for companies and stakeholders.

Clariant conducts these market analyses and stakeholder surveys regularly. The results and analyses are used in prioritizing the themes identified and in designing the respective measures. The Clariant Sustainability Council, the central steering committee for sustainability chaired by the CEO, evaluates the results and determines those sustainability issues and fields that currently have relevance or that are important with respect to the projects and objectives of the company. Regional sustainability committees ensure that the sustainability strategy is adopted accordingly in the regions and uniformly implemented.

MATERIALITY MATRIX by Clariant



Awards and recognition

In 2015, for the second year in a row, Clariant China received the »Responsible Care® Chairman Award« for extraordinary sustainable management from the Association of International Chemical Manufacturers (AICM). The AICM is an association of 60 foreign chemical companies operating in China, and with the prize, awards the efforts for »Responsible Care®« – an initiative of the global chemical industry in the areas of environment, safety and health to voluntarily go beyond what laws and regulations require.

In 2015, Clariant was added to the Sustainability Guide 2015 of the renowned Brazilian business publication »Exame Magazine« for the first time. The guide recognized Clariant as one of the most sus-

tainable companies in the Brazilian chemical industry. The »Portfolio Value Program«, in which Clariant analyzes the entire product portfolio systematically in terms of sustainability, was highlighted in an especially positive light.

Clariant was the first company in Guatemala to receive the »Oficina Verde« distinction, which is awarded by the country’s Cleaner Production Center. The Cleaner Production Center is a foundation which is supported by the United Nations Environment Programme (UNEP) and the UN Industrial Development Organization (UNIDO), among others. The sustainability performance of Clariant’s locations were awarded in the areas of energy consumption, waste, raw material consumption and raising awareness among employees.

A HOLISTIC VIEW ON SUSTAINABILITY



In mid-2015, sunliquid®, an innovative technology developed by Clariant that converts agricultural residues like straw into cellulosic ethanol and sugars, has been awarded third place in the Automobility category at the GreenTec Awards, Europe's renowned environmental-business award which honors innovative projects that point the way to a cleaner future. Biofuels from agricultural residues offer savings of up to 95 % in greenhouse-gas emissions, reduce the particle emissions by half and do not compete with food or feed production.

RECOGNITION OF THE SUSTAINABILITY PERFORMANCE BY INVESTMENT SPECIALISTS

Efforts by Clariant to do business more sustainably are also noticed by the financial market. In 2015, Clariant was again admitted to the European and the global Dow Jones Sustainability Index (DJSI). This internationally renowned sustainability index group selects listed companies based on economic, environmental and social criteria. For DJSI World, the 2500 largest companies in the industry are invited to participate in the review. In order to be listed on the DJSI, Clariant was required to demonstrate outstanding economic, environmental, and social achievements. Clariant is thus in the top four percent of companies in the chemical industry worldwide in terms of sustainability. Clariant also received the best evaluations in the disciplines of social engagement, environmental reporting and strategy for the prevention of antitrust violations. For the result it achieved, Clariant was awarded the Silver Class Award for the first time by RobecoSAM, who performs the sustainability review for DJSI.



Strategic approach at product level

Clariant focuses on enhancing the sustainability performance of its product portfolio and innovation pipeline through the holistic Portfolio Value Program (page 22). This continuous improving of the sustainability performance results in benefits not only of the company, but also of customers and consumers, e.g via lower resource input, higher eco-efficiency or performance advantages. Each Business Unit has a number of proof points how with sustainable products added value is generated in this way.

BUSINESS UNIT INDUSTRIAL & CONSUMER SPECIALTIES Glucamides – all-purpose agents from sustainable raw materials

The Business Unit Industrial & Consumer Specialties is one of the largest suppliers of specialty chemicals and application solutions for the consumer goods sector (personal care, cleaning and crop protection, for example) and for the industrial sector (lubricants, additives for paints, coatings and de-icing fluids for the aviation industry, for example). Clariant intends to use more and more renewable raw materials as starting products in these product fields. These include, for example, glucamides made from palm oil or coconut oil. With this approach, Clariant is continuously expanding the product range of innovative sugar-based surfactants, in personal care products and cosmetics, among other areas.

→ pages 35, 52, 57, 82

BUSINESS UNIT CATALYSTS Catalysts combat harmful emissions

The Business Unit Catalysts is one of the world's leading suppliers of catalysts. Catalysts initiate the acceleration, change or triggering of chemical reactions and processes. With catalysts, chemical processes are more efficient and less energy intensive. Clariant has developed numerous catalysts for various chemical and fuel-related

processes – including applications for exhaust gas cleaning and the efficient use of alternative energies. These include EnviCat® and Zeolites.

→ pages 38, 82

BUSINESS UNIT OIL & MINING SERVICES **Hydraulic fracturing – environmentally compatible**

The Business Unit Oil & Mining Services is one of the most important suppliers of additives and services for the oil and gas sector as well as the refining and mining industries. Oil & Mining Services supports customers on game-changing innovation solutions that ensures oil and mining companies alike can produce more efficiently, economically and sustainably.

For Oil Services the product range is broadly diversified with hydraulic fracturing being a focus for innovative chemical technologies that improve efficiency and have an excellent environmental profile.

→ pages 39, 82

BUSINESS UNIT FUNCTIONAL MINERALS **Specialty chemicals based on bentonite**

The Business Unit Functional Minerals is a market leader in bentonite-based specialty products and solutions to improve product properties for various industries. These include, for example: bleaching earths or additives for foundries; additives for fabric care, ceramics and paper making; materials for tunneling and civil engineering; and protective packaging. The key raw material for these solutions and products is always a natural clay material: bentonite.

→ pages 40, 68, 80, 83, 88

BUSINESS UNIT ADDITIVES **Innovative technology for better recycling**

The Business Unit Additives is a major supplier of flame retardants, polymer additives and waxes for plastics, coatings, printing inks and other special applications. As such, patented non-halogenated additives as flame retardants offer an environmentally compatible alternative to flame retardants made from bromine. Halogen-free additives are also very good for protection in housings of smart-phones, tablets, plugs and circuit breakers.

With the novel AddWorks® portfolio the Business Unit Additives offers customer specific tailor-made solutions for a broad spectrum of applications for a variety of sectors and industries like agriculture, automotive and transportation, electrical & electronics, construction, packaging as well as textile & fibers. For example Addworks® light stabilizer solutions enable to extend the lifetime of agricultural films, thus reducing material waste. The Clariant material Lico-cene® as a component of technical textiles, carpets and artificial turf facilitates the recycling of these products considerably and therefore makes them more sustainable.

→ pages 40, 83, 91, 102

BUSINESS UNIT PIGMENTS **Pink going green**

The Business Unit Pigments earns a leading position worldwide as a supplier of organic pigments, pigment preparations and colorants for coatings, printing inks, plastics and other special applications. Clariant is the first pigment producer to offer high-performance quinacridone pigments based on bio-succinic acid, a renewable raw material.

→ pages 41, 54, 66, 84

BUSINESS UNIT MASTERBATCHES Packaging as high-tech products

The Business Unit Masterbatches is a leading manufacturer of pigment and additive concentrates as well as technical compounds for the plastics industry, which also supplies the packaging, consumer goods, healthcare, textile and automobile sectors. Specially developed masterbatch concentrates and compound solutions are used in the medical device and pharmaceutical packaging fields to fulfill very important functions. For example, the packaging must protect the drug or device against light, moisture and oxygen, and materials should not have a negative interaction with the drug or the patient.

→ pages 41, 69, 85, 105

NEW BUSINESS DEVELOPMENT Liquify the sun

Biofuels made from agricultural residues play a key role in making mobility more sustainable worldwide. Clariant has developed the sunliquid® technology for the production of cellulosic ethanol and sugars.

Using the sunliquid® process biofuels and bio-based chemicals made from agricultural residues such as straw are produced sustainably and economically without competing with food or feed production. These non-edible renewable raw materials accrue regionally as a by-product during agricultural practices and do not use additional agricultural land. The production of cellulosic ethanol is virtually CO₂ neutral.

In collaboration with Mercedes-Benz and Haltermann, Clariant has successfully tested a fuel of the future, sunliquid®20 – a premium-grade E20 blend that contains 20 % cellulosic ethanol, in a fleet test with Mercedes-Benz series vehicles. The fuel shows excellent performance and sustainability properties: the cellulosic ethanol content exhibits particularly high greenhouse gas savings across the entire value chain and gives the fuel a high knock resistance with 100 octane (RON) and guarantees optimum efficiency. At the same time, particle emissions were reduced by 50 %.

Innovation **FOR GLOBAL TRENDS**

Companies need to anticipate future trends and developments in time to be economically successful in the long term. Clariant achieves this through close collaboration with customers and in some cases also with consumers. Results from »innovation workshops« for example are incorporated into product development and ensure sustainable value creation. Clariant wants to optimally serve future markets with above-average growth potential and has launched an Open Innovation initiative for this purpose in 2015: Ideas and solutions are developed in collaboration with external innovation specialists.

Clariant has already designed the innovation process itself based on sustainability perspectives. The Sustainability Index for research and development projects (CSIR&D) was established, in order to make projects comparable and to assess their degree of advantageousness. An assessment of the relative sustainability of new products under development is possible using this index, which is mandatory for all major research and development projects. In this manner, Clariant wants to pursue the most sustainable ideas and approaches, but at the same time ensure that all products developed today are still viable and competitive tomorrow.

The CSIR&D is used to assess the products to be developed based on the criteria of cost-effectiveness, environmental compatibility, and social responsibility. This evaluation includes the use and origin of raw materials, production processes, energy efficiency as well as the sales volume potential and societal benefits of use. The results allow a comparison of projects with cost-benefit ratios

and sustainability levels. The index provides transparency and competition between projects and motivates project managers to align their projects with sustainability goals from the start – from the initial idea through to market readiness and market launch.

Investment in research and development

The Clariant Innovation Center (CIC) is a state-of-the-art competence center for global chemical research and process technology at Clariant's largest production site in Frankfurt-Höchst (Germany). Equipped with research and application laboratories for several business units and the most up-to-date analytics, the CIC is also where the Intellectual Property Management (use of patents) and New Business Development departments are located.

The CIC is an important part of the global research and development network of Clariant which includes more than 60 R&D centers in Europe, North and Latin America, India and China, with a total of about 1100 employees. The CIC also integrates external partners. In the »Open Lab« within the center, Clariant works on innovation projects together with customers and other development partners. In addition, Clariant participates in more than 130 scientific collaborations with universities, research institutes and external partners.

CHF 1 billion

Clariant invested over the past five years in R&D

Research and development are of paramount importance for Clariant. Additional sales growth of 1 % to 2 % per year is expected to be achieved in the coming period from the introduction of new innovative products alone. To do this, Clariant's »innovation pipeline« is filled with more than 300 projects across all business units at the start of 2016. About 60 projects are »class-one projects« with sales potential in a double-digit million range in Swiss francs.

Clariant invested more than CHF 204 million in research and development in 2015 alone. For the past five years, this amount was CHF 1 billion. Research-intensive areas such as Clariant's Business Unit Catalysts spend more than 7 % of their sales revenue on R&D. Over 7 000 patents underscore the advanced technological expertise within the Group.

Various events and information platforms also served to capture the (individual) needs and requirements of customers. The efficient Clariant innovation management allows customer needs to be served in a targeted, accurate fashion with value-added products and solutions. For this purpose, Clariant also uses synergies in research and development across all business areas with the four technology platforms – Chemistry & Materials, Biotechnology, Process Technology and Catalysis. These platforms include all forward-looking chemical technologies and deliver customized and sustainable solutions. The solutions are increasingly based on renewable raw materials using microorganisms, optimized enzymes and high-performance catalysts. As a result, natural resources are used optimally and the pollutant and greenhouse gases are continuously reduced.

INNOVATION FAIR PROMOTES NEW IDEAS

The second Innovation Fair was held at the CIC in Frankfurt in early October 2015. Nearly 100 representatives of international start-up companies, universities and research institutions as well as Clariant experts participated in the event. The focal points of the one-day program were issues of sustainability, renewable resources and environmentally compatible technologies. With the motto »Green Chemistry«, the event also aimed to examine possibilities for new collaborative partnerships for Clariant. In doing so, the technical and scientific dialog with international experts was intensified while Clariant was presented as a company with a focus on sustainability and innovation.



Glucopure is made of 95 % biological raw materials. This results in an extremely powerful, almost 100 % renewable surfactant

Innovative agents made from sustainable raw materials

The glucamides produced from renewable raw materials have a wide range of applications. In the field of dish washing, they are responsible for long-lasting foam and superior cleaning performance. This means less detergent with the same performance. It is also gentle on the hands. But their main advantage is that they have an excellent environmental profile in addition to their special performance.

GLUCAMIDES

Excellent performance together with environmental compatibility

Palm oil is – besides its most frequent use in food industry – a raw material that can be used, for example, in the manufacture of surfactants, which help in cleaning. A surfactant consists of a water-friendly and a water-repellent area. The water-repellent area binds with the dirt particles while the water-friendly area binds with the water used for cleaning. As a result, the particles detach from the surfaces to be cleaned much more easily.

Conventional (petrochemical) surfactants are made from crude oil and are electrically charged. An alternative are sugar-based surfactants produced from vegetable fats. These surfactants are described as »non-ionic« because they have no electrical charge. Non-ionic surfactants have advantages: They can be made entirely from renewable raw materials instead of crude oil. Non-ionic surfactants are also gentler to the skin, non-toxic and readily biodegradable. Surfactants from Clariant made from renewable raw materials such as palm oil therefore contain neither aggressive sulfates nor polyethylene oxides. They are very mild and well tolerated by the skin.

Glucamides made from palm oil are surfactants, which are used as a raw material in a variety of specifications for the most diverse applications and products for body care and cosmetics. Modern surfactants should have an excellent environmental profile, a high proportion of renewable raw materials, in addition to very good product properties. They should also be cost-effective. The glucamides are novel sugar-based surfactants, which are made of up to 95 % renewable raw materials and a high percentage of non-tropical biomass. The products are also readily biodegradable. Glucamides do not contain sulfates or ethylene oxide (EO), which is suspected of causing allergic skin reactions.

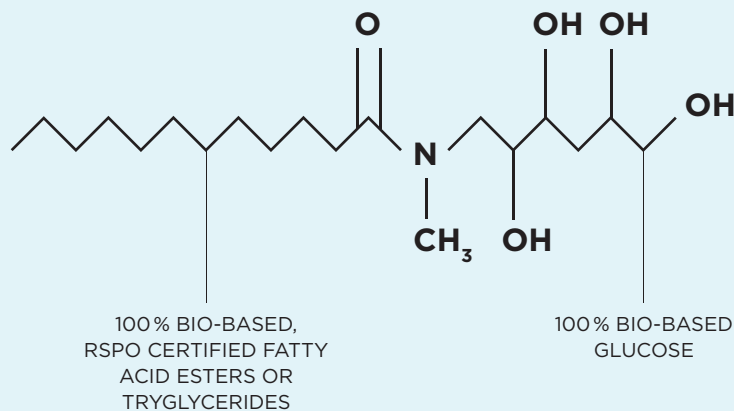
A key success factor in this innovation was the interaction between the various disciplines within Clariant. This development was only possible due to the intensive exchange between experts in the fields of cosmetics, detergents, crop protection and oil production along with colleagues in application technology and research.

»With our innovative co-surfactants
Glucopure the perfect balance between
ecology and performance is achieved.«

CHRISTINE MÜLLER

Application Development Manager





Are there any dishwashing liquids on the market that are 100% green?

—
CHRISTINE MÜLLER To the best of our knowledge, no. Even the vast majority of green brands contain a certain percentage of petroleum-based ingredients.

Why then do some green dishwashing liquids print »from renewable resources« on their bottles?

—
CHRISTINE MÜLLER Generally, those claims are quite correct, and such products actually all contain natural-based ingredients. But there is no law stating how large the percentage of the »green« share must be in order to make such a claim.

Could you put into layman's terms where these essential »non-green« parts are found?

—
CHRISTINE MÜLLER Dishwashing liquids are usually composed of at least two types of surfactants: a primary surfactant, consisting of an anionic head group and a hydrophobic tail, and a secondary, or co-surfactant. The most commonly used primary surfactant is sodium lauryl ether sulfate (SLES). In green products, the hydrophobic part of all surfac-

tants is usually based on biological resources, but the hydrophilic head groups are still mostly synthetically prepared.

And what about the co-surfactants?

—
CHRISTINE MÜLLER Some market products contain the highest possible amount of green surfactants. However, these dishwashing liquids perform poorly in tests compared to their standard counterparts. The co-surfactant that we developed at Clariant is made from 95 % bio-based materials, with the remaining 5 % containing a petroleum-based molecular structure. The result is an incredibly powerful, nearly 100 % green surfactant. With this innovative co-surfactant, the perfect balance between ecology and performance is achieved. We call it GlucoPure, as it is sugar, or glucose, based.

Can't we just stop using petroleum entirely?

—
CHRISTINE MÜLLER Unfortunately, the small petroleum-based part is an essential structural element of our co-surfactant. At present, this cannot be produced using natural-based raw materials, and our researchers have not yet found an adequate alternative.

How has GlucoPure fared in tests?

—
CHRISTINE MÜLLER It is twice as effective as the current market-leading, completely green co-surfactant and achieves comparative results to conventional surfactants like cocamidopropyl betaine or amine oxides. But we are not about to rest on our laurels!



ECOTAIN®

GlucoPure fulfills the criteria of EcoTain®, our approach to sustainability on product level.

Would you like to learn more?



www.clariant.com/GlucoPure



Clariant offers solutions that meet the needs of current and future generations.

IMPORTANT STEP TOWARDS BIOECONOMY

Clariant strengthens its commitment to the field of bioeconomics at the Bavarian locations of Straubing and Planegg. In Straubing, the position in the field of renewable raw materials will be expanded with the construction of another biotechnical pilot plant. The new building will expand the existing, very successful biotechnological pilot plant in which the biofuel ethanol is obtained from unusable plant residues such as wheat, barley and corn straw using the sunliquid® method – the largest plant for climate-compatible second-generation bioethanol thus far.

The special feature of this plant: Interested parties from all over Germany will be able to test their ideas and implement research results in the field of biotechnology in products there. There is a great demand for sustainable products. Therefore, Clariant has decided to open the new facility to all research-based companies that manufacture biotechnological products such as biopolymers or enzymes.

Companies have already signaled keen interest in Straubing in the planning phase. For example, materials for detergents will be tested there that promise gleaming white linen even at low temperatures, or materials for plastic bottles and diapers made from renewable raw materials. What was previously explored in laboratories on a small scale can now be developed here on a larger scale for application readiness. This creates a showcase project that does not exist anywhere else. The Bavarian government supports this facility with funding of EUR 20 million.

Clariant intensifies the development of bio-based products and fuels, meaning those based on renewable raw materials, with a new Biotechnology Center and more than 100 employees in the Bavarian town of Planegg. In addition to the Clariant Innovation Center in Frankfurt, the new facility is another important global research center. Biotechnology is a key technology in the shift away from fossil fuels.

Innovative product solutions



CATALYSTS

Combat harmful emissions

Catalysts can help reduce pollutants in the air. The most familiar application is in automotive exhausts. Hydrocarbons, carbon monoxide and nitrogen oxide are converted from the exhaust gas in the presence of a catalyst. A less-known source of pollution is the nitrous oxide (N_2O) – more commonly known as laughing gas – created by industrial processes. After methane gas, nitrous oxide is the third most harmful greenhouse gas and is responsible for about 6 % of man-made climate effects.

Nitrous oxide is about 300 times more damaging to the climate than the same amount of carbon dioxide (CO_2). Nitrous oxide results mainly from the production of nitric acid, which is used in the production of fertilizers and other processes. The innovative catalysts EnviCat® N_2O and EnviNOx® developed by Clariant reduce the nitrous oxide in the production process to harmless nitrogen (N_2) and water (H_2O).

In an ingenious process, the catalyst EnviCat® N_2O extracts from the exhaust gas of nitric acid plants nearly all the nitrous oxide and converts it into the harmless substances oxygen, nitrogen and water in two stages. In addition, different variations of EnviCat® have generally been proven as very successful in the elimination of nitrogen oxides in the exhaust air of industrial production processes.

→ page 82

ENVICAT®

90 %

less greenhouse gases are exhausted
due to neutralization with EnviCat®

Q HYDRAULIC FRACTURING Environmentally compatible

Increasingly the extraction of oil and gas requires innovative chemical technologies that support production from harsher environments such as extremes of temperature and pressure. Additionally regulation and the concern of the public regarding the use of chemicals in the environment is driving a need for more environmental and sustainable solutions.

Unconventional resources are a good example of where innovative technology has enabled oil and gas to be extracted economically through horizontal drilling and multi-stage hydraulic fracturing (fracking). The hydraulic fracturing market is constantly under pressure to reduce cost, increase efficiency and address regulations and public concerns over the application of environmentally harmful chemicals. To support the application of technologies that address these points Clariant has developed the unique HOSTA-FRAC™ product line.

Hydraulic fracturing involves pumping water, sand and chemicals at high pressure into the rock causing fractures. These fractures create paths for the released hydrocarbons that are produced to surface.

The function of the chemicals added to the sand and water is to improve the ability to pump high volumes by reducing viscosity and to prevent damage from bacteria or solids formation. While these chemicals do not come into contact with groundwater, it is desirable that they be non-toxic as they form part of the liquids that are retrieved and processed at the pumping site to prevent any environmental harm should they inadvertently come into contact with ground water sources.

HOSTAFRAC™ technology adds value by greatly improving the ability to pump the fracturing fluids and to recover the same fluids once the well is brought onto production following the fracturing operation. Increasing the efficiency of pumping the fluids and the rate and volume at which they are recovered is beneficial by reducing energy costs from pumping. Furthermore, the benefit in producing a higher volume of fracturing fluid back to surface which means the well can produce oil or gas more effectively and the water flowed back can be re-used for further fracturing operations.

HOSTAFRAC™ is an EcoTain® technology. EcoTain® products are those that are both sustainable and environmentally acceptable, and therefore benefit hydraulic fracturing by replacing otherwise toxic and harmful chemicals. One example is the replacement of 2-butoxyethanol (2-BE) with HOSTAFRAC™.

IMPROVING OIL AND GAS PRODUCTIVITY

Improvements to hydraulic fracturing operations can be made in two ways. The first is to improve the efficiency of the rate at which the fracturing fluids can be pumped into the formation. The second is to ensure fast and complete removal of fracturing fluids from the reservoir when the well is brought onto production, thus improving the productivity of the well. HOSTAFRAC™ technologies are proven to modify the conditions in the formation to improve these inflow and outflow efficiencies above current market technologies, with the added value that the fractured wells are more productive, cost efficient, and sustainably developed.

HOSTAFRAC™ allows a better return flow of oil, gas and water to the surface. This is achieved by reducing the surface tension and adhesion forces of the liquids that are pumped in. This way water, additives, oil and gas can flow more easily through the fine cracks and tubules of the rock.

To create the fractures, a fluid is pumped at a rate which generates such a high pressure in the oil and gas bearing rock that the fracture gradient or the pressure at which the rock breaks is exceeded causing them to crack or »fracture«.

The viscosity of the fracturing fluid is a key differential factor in achieving the fracture geometry. The current practice is known as »slick-water« treatments, and additives that create a low-viscosity of the fluids pumped. HOSTAFRAC™ also has the properties that it can be applied to reduce the viscosity of the fracture fluids and has also been proven to be more effective over conventional »slick-water« polymers in reducing surface tension and improving the rate at which the fluids can be pumped having an overall benefit on the efficiency and effectiveness of the fracturing operation while applying a technology that is environmentally compatible.

→ pages 82

BENTONITE

A natural all-purpose raw material

Bentonite is a clay material that is quite abundant on earth. It was and is still formed in nature by weathering of volcanic ashes and subsequent sedimentation. Bentonite properties are determined mainly by the amount and type of smectite-type layer silicates, for example montmorillonite.

These minerals consist of stacks of platelet-like crystals that can fully disintegrate in water and form viscous slurries. They also exhibit a high specific surface area and cation exchange capacity, and can thus adsorb and bind quite a variety of molecules. All these properties, and many more, vary from one bentonite deposit to the other, and they can all be influenced by an appropriate treatment of the clay by various processes.

Careful selection of the right bentonite and the right processing make it fit for a plethora of applications – from edible oil purification, foundry sand binders, and feed additives to drilling fluids.

→ pages 68, 80, 83, 88

LICOCENE

Innovative technology for better recycling

Licocene® has an excellent environmental and health profile, since it is completely non-toxic, unlike other adhesives such as those that are polyurethane-based. Unlike latex materials, Licocene® does not trigger any eye or skin irritation and has no allergenic potential. Furthermore, significantly less volatile gases are generated during production and in the finished product.

Licocene® has a positive environmental and economic balance because it facilitates the raw material-efficient and energy-efficient production of homogeneous composites. The latter helps the automotive industry to meet the increasing recycling targets: Since in contrast to water-based latex materials, the adhesive itself is a thermoplastic material, carpets made from polymers bonded with Licocene® can be completely recycled. Licocene® as carrier material, fibers and adhesives is made exclusively of polypropylene, up to 100 % of which can be recycled as a homogenous composite without items having to be separated beforehand.

The advantages of Licocene®

- Improved productivity
- Significant savings on water and energy
- Increase of adhesive strength
- Colorless and odorless
- Negligible VOC values
- Reduction on production costs
- Fast setting
- Excellent wetting of fillers/filling material
- Excellent sound insulation and vibration damping properties
- Excellent fiber bonding
- 100 % recycling

→ pages 83, 91, 102

PIGMENTS **Pink going green**

Since 2014, Clariant has integrated renewable raw materials into their quinacridone pigments, which are produced at the Frankfurt-Höchst plant. Clariant was therefore the first pigment manufacturer to offer high-performance pigments based on the renewable raw material named bio-succinic acid.

The market launch of these pigments based on renewable raw materials was preceded by intensive research and development activities of Clariant and Myriant, the supplier of the bio-based succinic acid. The quinacridone pigments from Clariant cover all fields of application of the pigment industry. With this innovative step, Clariant helps its customers to improve the sustainability profile of their products.

→ pages 54, 67, 84

HEALTHCARE AND PHARMACEUTICAL PACKAGING

Packaging as high-tech products

In addition to its passive protection, healthcare packaging can also provide active protection – with substances for controlling moisture and oxygen. Protection is often accomplished through desiccant, oxygen scavenging and high-barrier packaging solutions, whether they are dropped-in, integrated or embedded in the product package. This could include setting specific equilibrium relative humidity level depending on the packaging application.

»Smart packaging« is a focus area in the field of Open Innovation, where innovative ideas and approaches are continually sought from external innovators. An example of this field of application is dry capsules for medical and pharmaceutical products.

→ pages 69, 85, 105

Performance

THE SKILLS OF LOUISVILLE

Photography Jo Röttger, Text Bertram Job

In Louisville, the largest city in the US state of Kentucky, both old and new alike can be found, and often close together. Houses in need of renovation change in quick succession with newly refurbished facades; dissolved businesses provide the backdrop for newly established stores and cafés. Entire neighborhoods that had to struggle in the past are in the process of recovering. They are »in between,« as the locals would say in reference to a phase of radical change.

On the corner of South 12th and West Oak Street, just along the Southern Railway tracks, this feeling of progress and change is especially evident. From early morning until late into the evening, bolting, welding and other construction work are being performed at a new facility for the production of a new-generation catalyst. The massive structure consisting of several steel braces and colorful cables growing straight out of the ground into the future.

The new plant symbolizes Clariant's strategy in the US: Maintaining proven production processes while constantly innovating to add new ideas and improvements. Here in Louisville, two catalyst manufacturing facilities are already fixtures in the community. They produce catalysts for use in various industries. The use of these catalysts enable companies to drastically reduce the consumption of energy and raw materials needed to make chemicals, and thereby minimize waste and greenhouse gases. Laboratories for research and development are located near these Clariant facilities to provide synergies between production and innovation.

In this center of excellence for catalysts, capacity for additional growth with marketable innovations is being created. The substantial investment project of the company is being developed and implemented in cooperation with CB&I, a market leader in the energy infrastructure sector. Hans-Peter Gabski, the German site manager who is responsible for the production of Clariant's Business Unit Catalysts in the US, explains: »The entire Business Unit is oriented toward growth, and its largest site in Louisville will need to support that growth.«

On the construction site, no time was wasted. At peak times, three hundred craftsmen, all from US contracting companies, worked six days a week in 10-hour shifts. Armed with safety helmets and a sense of humor, they rose to challenges faced, got their job done on time, and were always optimistic. »Get the job done safely« was their most important guiding principle.





»The process of linking various skills together and the intercultural challenge appeal to me.«

BERND HIRSCHBERG

Project Director, BU Catalysts



»Theoretically, Sunday shifts would also have been possible,« admits Project Manager Bernd Hirschberg who has already managed construction projects in multiple business units, »but then efficiency would have decreased.« And that would have affected what, quite possibly, he holds closest to his heart: carrying out such a project in a way that both eliminates accidents and conserves resources. Gabski agrees. »Deadlines should be kept,« explains the site manager, »but not by compromising occupational safety and environmental protection goals. We made this message clear right at the beginning.«

Sustainability and safety are prioritized in every phase and on all levels of the site. In the past two years, no accidents with downtime were ever recorded at the site – and this is their safety standard. The dedication to this project is obvious – Hirschberg and Gabski, despite being top managers, don their personal protective equipment at least once daily to check in on the construction site. They enjoy, as Gabski describes it, »the challenge of helping to erect such a facility.«

»This is no small feat,« he says, »and the work leaves its mark. But my motivation is fueled by countless experiences of achievement. I am an engineer. I am fascinated by the way in which such facilities are built and put into operation.« For Hirschberg, on the other hand, the »team experience« is the appeal of his mission – and in particular, the intercultural process »of linking the various skills together.«

Throughout the process, the European mentality has collided with the less formal culture in Kentucky on more than one occasion. Gabski explains that Clariant Excellence helped to ease the





»It's extremely exciting to collaborate
with the policy-makers here.«

HANS-PETER GABSKI

Head of Production Americas, BU Catalysts



friction and increase efficiency throughout the collaboration. It has been no simple undertaking to »change the way we work.« This is the motto stated on the sign displayed in the »Louisville Clariant Excellence Mission Control Room«, which cannot be missed. For Gabski and the team, it has been a challenging process in which only change has remained the constant.

The process forced Gabski to re-think his firm attitudes: »Sometimes, people can no longer stand hearing when someone explains that something is done in such and such a way in Germany. But: our colleagues and co-workers here in Louisville let us know about this and we can then put that perspective aside.«

Changing oneself while also acting as an agent for organizational change is probably one of the most credible ways of showing one's commitment to the mission. Today, Gabski is no longer a foreigner in »The Ville« but a citizen. His four children go to school here, and he and his wife make use of the many cultural offerings, from the theater to the Louisville Orchestra, which they support. Moreover, he has pushed to found a Community Advisory Panel with neighbors and stakeholders of the industrial plant to strengthen important relationships for the company and to further bring this great city, as Gabski calls it, forward. That also means: further towards structural growth.

The reinvention of Louisville had already begun years ago. Large amounts of public funds have flowed into the renovation of the infrastructure – for instance into bridge construction and the international airport, where a logistics giant operates its Worldport and employs over 20 000 workers. The Ford Motor Company has also invested USD 800 million into its two factories. Pharmaceutical and medical technology industries are developing large research centers, centers of excellence, and rehabilitation centers in the area.

In this context, Clariant's initiative is arriving at just the right time. New high-quality jobs will be created at the production plant, increasing the head count for all three Louisville locations at 12th Street, Crittenden Drive and West Hill Street significantly. For Mayor Greg Fisher, this is »a strong signal of confidence in Louisville,« as he emphasized before the beginning of the construction work. His office provides a great deal of support, as Gabski comes to experience again and again: »It's extremely exciting to collaborate with the policy-makers here.«

In this manner, Clariant's project could become a catalyst on multiple levels – accelerating growth for both companies involved, as well as for the development of the Louisville metropolitan area. In any case, the chemistry between the participating parties is just right for sharing the expected success.

Procurement **AND LOGISTICS**

Clariant is procuring products and services from around 25 000 suppliers worldwide every year. This requires significant strategic and administrative efforts, not only in a purely economic and management sense, but also to reach and maintain an optimal degree of sustainability for the products and services procured every year. To this end, Clariant has also set strict standards for sustainability in procurement.

The corresponding standards are established in the procurement strategies, procurement policies and in Clariant's general framework directives. These regulations include sustainable minimum standards expected by suppliers that need to also commit to a continuous improvement process, a steady increase in the proportion of renewable raw materials, a strict energy management with continuous optimization and active waste management at all Clariant production sites including the selection of a suitable disposal company.

Clariant's suppliers are an important part of the worldwide Clariant network. For this reason, Clariant expects a noticeable commitment to sustainability from suppliers. Suppliers and partners are expected to apply the same standards in the areas of human rights, employment conditions, environmental protection and corruption prevention as Clariant applies itself. This is achieved by an increasingly closer collaboration across the value chain.

PURCHASES IN THE BILLIONS

Clariant bought goods and services worth approximately CHF 4 billion in 2015. Of this, roughly CHF 2.3 billion was allotted to raw materials from around 5 300 suppliers and around CHF 1.7 billion was allotted to other products and services such as technical equipment or energy from another 20 000 suppliers approximately. Clariant purchases over 14 000 raw materials, where one-fifth of the total raw materials are represented by 15 major commodities and approximately half are represented by around 200 other products. In total, 2 700 raw materials make up 98 % of the purchased volume. Around half of the purchased raw materials currently originate directly or indirectly from crude oil, more than 20 % are derived from natural raw materials such as bentonite and about 5 % are from renewable raw materials.

Selection of suppliers

As a producer of specialty chemicals, Clariant needs raw materials, packaging, capital goods, services, and other inputs such as energy which are sourced from suppliers from around the world. To accomplish this, Clariant selects its suppliers, outsourcing partners and service providers based on extensive criteria. The selection is based on economic and product-specific performance aspects on one hand, and explicitly based on non-financial and sustainability aspects on the other.

Sustainability standards are incorporated into procurement strategies and in general and specific guidelines (such as the Supplier Code of Conduct). For Clariant, sustainability does not begin with the production, but in the selection of suppliers. In the process, the sustainability standard should also be continuously increased along the supply chain at the product level and in relation with the customer.

Clariant assesses suppliers in a comprehensive program based on sustainability factors such as employment conditions, respect for human rights, complaint management, environmental aspects, safety standards and creditworthiness. The criteria also include funda-

mental aspects such as the presence of certified management systems. Clariant expects all material suppliers and service providers to be committed to these high legal, ethical and moral standards for their own processes and to comply with them. The standards form the basis of the Supplier Code of Conduct. Compliance with this code should minimize the environmental and negative social impact that may arise from business operations. If these standards are not followed by business partners, Clariant reserves the right to terminate its business relationship with these suppliers.

**PURCHASING CRITERIA FOR
SUPPLIER SELECTION AT CLARIANT**



SUPPLIER CODE OF CONDUCT

Based on the Clariant principles of sustainability and the principles of the UN Global Compact, the Supplier Code of Conduct is an essential part of the relationship with business partners. The Code of Conduct is a central component of the electronic ordering system and the contracts. The goal, even for upstream links on the value chain, is to respect human rights, prevent discrimination against employees, exclude forced and child labor, ensure freedom of association of the workforce, comply with environmental standards, accept product stewardship and ensure fair competition.

Joint supplier review for more efficiency and consistency across the entire chemical industry



Clariant cannot undertake these screenings by itself with the necessary scope and timeliness for the great number of suppliers. For this reason, Clariant joined the »Together for Sustainability« (TfS) initiative and thus elevated the supplier sustainability monitoring to a significantly higher level. TfS was founded in 2011 as an initiative of six chemical companies to comprehensively and reliably assess and improve the chemical industry’s supply chain in terms of sustainability through a global assessment and audit program. This collaborative approach is based on state-of-the-art sustainability methodologies and an efficient exchange of data from assessment and audit results and scores. By strictly adhering to confidentiality, the initiative is always compliant with anti-trust regulations.

»The Together for Sustainability initiative allows us to leverage an industry-wide approach and state-of-the-art capabilities – significantly enhancing the sustainability evaluation of our suppliers while saving cost, time, and resources.«

NORBERT MERKLEIN

Head of Group Procurement Services

As part of the Tfs initiative, the sustainability performance of a supplier is assessed according to a predefined set of assessment and audit criteria that are tailored to the requirements of the chemical industry. The criteria are based on the principles of the UN Global Compact, the principles of Responsible Care®, the standards of the International Labour Organisation (ILO) and national laws. The scope of a Tfs audit or a Tfs assessment includes all critical aspects – from administration and corporate management, including ethics and corruption, environment, health and safety, to labor and human rights, which includes working conditions and freedom of association. Thanks to Tfs, Clariant has access to assessments of almost 4 500 suppliers in more than 100 countries and to the results of almost 500 audits carried out by third party auditors on behalf of Tfs. By matching the scorecards generated by all Tfs Members and available on the EcoVadis platform with Clariant's supply base, more than 50 % of the yearly direct spend is covered with a sustainability evaluation of our suppliers.

RAW MATERIAL PROCUREMENT ACCORDING TO REGIONS in CHF million		
	2015	2014
Asia/Pacific	480	529
Of which with local suppliers ¹	449	486
Number of local suppliers ²	1 704	1 964
Europe	1 097	1 276
Of which with local suppliers ¹	960	1 148
Number of local suppliers ²	1 357	1 526
Latin America	337	384
Of which with local suppliers ¹	249	261
Number of local suppliers ²	784	847
Middle East & Africa	60	85
Of which with local suppliers ¹	32	42
Number of local suppliers ²	303	506
North America	278	296
Of which with local suppliers ¹	241	263
Number of local suppliers ²	414	571
Grand Total	2 252	2 570
Of which with local suppliers ¹	1 931	2 200
Number of suppliers ²	5 431	5 414

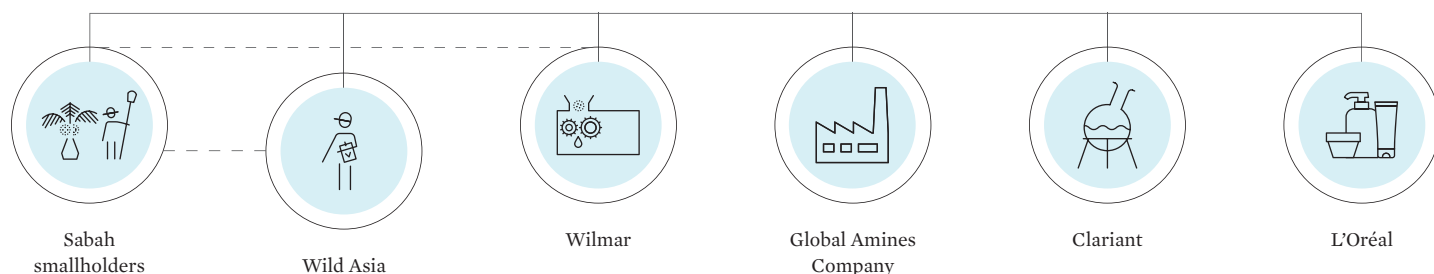
¹ Spendings on raw materials of Clariant production sites in this region

² Number of suppliers in the region that supplied Clariant (production) sites

REGIONAL BEFORE GLOBAL

Clariant favors purchasing goods and services within the region in which the respective company or the respective production site is located, as long as it is qualitatively compatible and technically and economically feasible. In doing so, Clariant's activities support the economic development of the respective regions.

However, the cooperation with suppliers is not just about monitoring. Clariant always considers suppliers as partners. To strengthen this approach, Clariant hosts various events such as the so-called Supplier Days. As part of this, Clariant presents its sustainability program and its objectives, and strives to introduce measures to implement the program together with its partners. The reaction to



these supplier events in China or India, for example, has been extremely positive. In addition and most importantly, as of 2016 Clariant is going to engage with its supplying partners in Consequence Management, a joint risk management program to leverage the learning of the assessment results in order to further improve the sustainability performance across its entire supply chain.

Initiative for sustainable supply of palm oil

Bio-based chemicals have the potential to significantly reduce greenhouse gas emissions and to reduce dependence on fossil fuels. Clariant therefore strives to use bio-based raw materials, where this makes sense from an economic, environmental and social point of view. Palm oil is the most widely used renewable raw material at Clariant, particularly in personal care products and household cleaners. Clariant uses chemicals based on natural oils from palm fruits and palm kernels in surfactants, emulsifiers and preservatives; as an additive for crop care; and in industrial applications. The use of renewable raw materials can contribute to a more sustainable profile of the products. However, palm oil is a topic of public debate because of negative environmental effects and adverse social impacts with cultivation. Clariant thus has intensified its efforts to ensure the sustainability of palm oil sources and is going to focus on three work pillars to achieve sustainable sourcing of its palm materials:

1. RSPO Supply Chain Certification,
2. Traceability, which is to a large extent outside of the RSPO supply chain scope,
3. Value chain collaboration projects to implement and push both: RSPO certification and traceability.



Clariant has teamed up with Wilmar International Ltd, their joint venture The Global Amines Company, Wild Asia a local social enterprise and L'Oréal to educate Malaysian palm oil small producers on sustainability, certification and supply chain traceability – and increase productivity by 20 percent until 2020.

Over five years the project partners will not just enable 500 palm fruit farmers in the Sabah, Beluran District in Malaysia to achieve their RSPO certification. SPOTS® – Sustainable Palm Oil and Traceability with Sabah small producers – will also connect independent palm oil and palm kernel oil producers to the global market by purchasing RSPO Mass Balance certified material. The project aims to ensure economic development of small-scale producers by giving them access to global markets, introducing better cultivation practices and creating environmental benefits by engaging small producers in sustainable palm trees cultivation through RSPO certification.

In addition, SPOTS® is working to increase traceability in the complex palm derivative business, paving way towards enhanced transparency demanded by today's consumers of Personal Care products. For the first time, it links competent global market players with small producers in Malaysia through all stages in the supply chain, from the palm feedstock to the final cosmetic product. While there is increasing pressure for smallholders to be more sustainable, the companies which buy palm oil from growers also have to pay the price premium for certified palm oils. SPOTS® smallholders sell their harvests to Wilmar mills, and L'Oréal in turn buys the palm oil to fulfill their zero-deforestation and sustainable sourcing policy.

SPOTS® has been initiated as part of L'Oréal's solidarity sourcing programme allowing small producers to improve their living standards and achieve the partners respective commitments to sustainability and »Zero deforestation« ambition.

SUSTAINABLE PALM OIL AND TRACEABILITY WITH SABAH SMALL PRODUCERS (SPOTS®)

Sabah smallholders

500 smallholders in Sabah (Malaysia) are part of the SPOTS® Initiative, which enables them to produce RSPO-certified palm oil while securing their standard of living.

Wilmar

Asia's leading agribusiness is committed to sustainable agriculture. Wilmar's strategy is based on the prevention of deforestation, land reclamation, and exploitation. With the support of small farmers, the company secures their livelihoods, the environment and its own supply chain.

Global Amines Company

The joint venture between Clariant and Wilmar combines technical expertise with the integrated agribusiness of the two companies.

Clariant

Clariant is committed to the sustainable sourcing of palm-based ingredients by developing traceability and a zero-deforestation approach. With strong partnerships, the company is working on the right balance of economic, social and ecological interests.

L'Oréal

Since 2012, the global cosmetics leader has made 100 % of its palm oil purchases according to the RSPO standard. L'Oréal's goal is to exclusively purchase palm oil from sustainable sources by 2020 and not use products that might be linked to deforestation.

Wild Asia

The non-profit company supports smallholders by ensuring that social and environmental aspects are met by the global partners and the farmers can achieve RSPO certification.

At the same time, Clariant will certify all relevant locations that process products made from palm oil according to the RSPO mass balance criteria by the end of 2016. This certification attests to the locations' monitoring of the quantity of certified palm oil in the production process in such a way that a certain mass balance between certified and non-certified palm oil can be met. The German plant in Gendorf was the first to be certified in 2014 in accordance with this standard. This is an important step towards completely separated raw material streams. Clariant aspires to organize and certify the locations by 2020 in such a way that the complete separation of certified and non-certified palm-based raw materials can be met. This also allows the company to continuously meet the requirement from customers who increasingly request certified products.

Safety regulations for transportation

Clariant takes great care in protecting the safety of humans and the environment in its packaging, storage and transport of goods, especially of chemicals. To prevent negative impacts in these areas through transportation as much as possible, Clariant has issued strict rules to ensure safety. Service providers who are responsible for further transport handling are subject to the same rules. For safety reasons, Clariant destroys defective packaged goods at its own cost rather than returning them to the supplier in the damaged packaging.

As part of the development and implementation of product-specific logistics concepts, transportation safety is a key factor. This includes choosing the best means of transportation and the environmentally compatible bundling of traffic flows. At Clariant, strict internal guidelines apply to the storage of raw materials and products worldwide in order to minimize the likelihood and potential impact of fire or uncontrolled leakage of chemicals.

Discover Value **QUINACRIDONE**

»With bio-succinic acids, we can reduce the carbon footprint by up to 90% compared to petroleum-based products.«

DAVID LEBLANC

Head of Global Sales and Marketing, Myriant



90%

of all currently produced chemicals
can be produced with renewable materials

Pink going green

As the first manufacturer of the high-performance pigment quinacridone, Clariant uses bio-based succinic acid in the production process. Clariant obtains the bio-based succinic acid from Myriant, a leading manufacturer of chemicals made from renewable resources. It was especially important for Clariant that the bio-based succinic acid used does not compete with food, that it reduces CO₂ emissions, and also has the same performance characteristics as conventional raw materials.

OUR MOST VALUABLE INGREDIENT: BIO-SUCCINIC ACID

What challenges did you face when developing bio-succinic acid based on renewable materials?

—
DAVID LEBLANC There were several challenges we had to face. First and foremost, how could we convince a historically conservative industry to embrace a new technology? Especially one that would require significant changes to established product lines. Secondly, we had to overcome the negative perceptions that typically follow »green« products, such as performance deficits with natural materials, their lack of economic viability compared to petrochemical products or that they are in direct competition with the food chain. Luckily, Clariant was one of the first to see the total value proposition: no green premium, non-food based, higher performance and low carbon footprint.

What raw materials do you use?

—
DAVID LEBLANC We use natural renewable sugars extracted from carbohydrates. These include corn, sorghum and any other readily available, high-volume agricultural crop. An additional source is waste cellulosic materials, which are extracted from residual parts of crops that would be otherwise discarded. These natural materials include cornhusks, leaves and stocks, as well as the fibrous matter left over from processed sugar canes.

What are the benefits of producing bio-succinic acid with renewable materials?

—
DAVID LEBLANC Our succinic acids have several advantages over the competition. As bio-succinic acid has the identical physical properties to petro succinic acids, there is no performance drop-off. In some cases, there are fewer impurities in bio-succinic acids, which lead to higher value derivatives. There is added price stability as there are fewer price fluctuations with sugars and carbohydrates than with crude oil. And with bio-succinic acids, we can reduce the carbon footprint by up to 90 % compared to petroleum-based products. Furthermore, one of our unique innovations at Myriant is the process that allows us to capture and use carbon dioxide as a raw material and thereby reduce the amount of greenhouse gases released in the atmosphere.

What potential do you see in bio-based materials like bio-succinic acid? Is the demand growing?

—
DAVID LEBLANC In the next decade alone, we expect 10 % of currently produced chemicals to be based on natural materials. But that's only the tip of the proverbial iceberg, as over 90 % of all currently produced chemicals can be produced with bio-based materials, meaning there is plenty of potential for the industry to do more with renewable materials. Finding solutions that provide performance without straining the environment is also key, as we know consumers prefer »green« products to petrochemical products when all things are equal.

In addition to pigments, what other products use bio-succinic acid?

—
DAVID LEBLANC Bio-succinic acid is what we in the industry refer to as a »platform chemical«. This means it is used in downstream products, such as urethanes in paints, plasticizers, adhesives, medical devices, etc. However, bio-succinic acid is also used in a host of other products, such as bath salts, metal plating chemicals, paint solvents, pharmaceutical and agricultural products, cosmetic ingredients, the list goes on. Its versatility and ability to replace petrochemical materials makes it potentially worth billions. Therefore, it is no exaggeration to say that the potential for bio-succinic acid is massive.



ECOTAIN®

Quinacridone pigments fulfill the criteria of EcoTain®, our approach to sustainability on product level.

Would you like to learn more?



www.clariant.com/Quinacridone

Safe handling of hazardous goods

Clariant stores key information such as classification and labeling data for each product in an electronic ordering and delivery system. All the parties in the transport chain are then informed automatically and the transport documents are issued with the hazardous goods information prescribed by law. The selection and determination of suitable packaging for hazardous materials are also integrated into this IT solution.

Only experienced and reliable companies are used to store, pick, schedule and transport the goods. This ensures that staff, organization and equipment all comply with legal requirements. A basis for this is, for example, the freight forwarder's requirement profile established by Clariant, which defines the requirements for reliable partnerships with forwarders.

In Europe, the SQAS standard, a system to review safety and quality for transportation, is mandatory. In other regions, similar standards are applied. The safety of hazardous goods transportation is critically dependent on the qualifications and diligence of the people involved. Regular task-related and on-going training of Clariant employees contributes significantly to overall safety.

Clariant plant safety officers in charge of hazardous materials conduct regular inspections of filling operations and dispatch areas. In addition, road vehicles and tankers carrying hazardous materials

are randomly checked before they leave the plant premises. When receiving deliveries, vehicles with safety defects or with insufficiently secured loads may not drive into the plant premises.

Use and recycling of packaging material

Clariant generally does not supply end customers, only processing companies. Therefore, many products can be shipped in tank trucks and rail tank cars in bulk form (bulk goods). Moreover, cleanable and reusable packaging is used where possible and accepted by the customer. In a number of cases, however, customer requirements or other factors require that packaging has to be used that is not immediately reusable.

Dealing with non-reusable packaging materials made of steel and plastic is quite different internationally. For instance, in Germany, the majority of product quantities are being transported in silos, tank vehicles and in recyclable packaging. The proportionately larger product quantities in non-recyclable packaging are being exported to European countries. Wherever possible, packaging is recycled for material purposes or, especially in the case of hazardous materials, used to generate energy.

Clariant works preferentially with international packaging manufacturers for an optimal implementation of these measures in the course of the worldwide purchasing process. The international standardization process is increasingly promoted via these partners and their network connections. Parallel to this, reuse, such as recycling, is being supported and also implemented now worldwide in



Increasingly using renewable raw materials improves the sustainability profile across the product life-cycle.

the non-European markets in the context of established and expandable circulation systems. Clariant participates in programs for the return of packaging for safe incineration or disposal. The provisions of the European Union are considered standards (page 90).

PILOT PROJECT FOR NEARLY CO₂-NEUTRAL TRANSPORTATION

At the Brazilian location of Suzano, Clariant has operated three trucks that are fueled exclusively with ethanol as fuel in the internal plant fleet since 2015. This ethanol is produced from organic residues, namely through the fermentation of sugar cane into alcohol. As a result, these three vehicles overall emit 92 % less CO₂ than conventional diesel-powered transport vehicles because the sugarcane has previously bound large amounts of CO₂ in the growing process. These three trucks are the first vehicles in Latin America that run purely on biofuels.

Products made of renewable raw materials

GLUCAMIDE

Innovative agents from sustainable raw materials

With intensive research, Clariant was able to develop a group of surfactants which are produced from renewable raw materials and have an excellent environmental profile. The group of glucamides are sold under the trade names GlucoTain®, GlucoPure and Synergen GA and can be used as a cleaning agent in personal care, crop care and even in oil production. The glucamides consist partly of fatty acids and partly of sugar. They are therefore referred to as sugar surfactants and these products can be described as natural surfactants.

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Production **OPTIMIZATION**



Growing significance must be attached to the productivity increase in industrial production processes against the background of increasingly scarce or limited natural resources. Quality, safety and resource efficiency are the key objectives for Clariant in the production of specialty chemicals. Production is to take place in a manner that ensures worker safety, and conserves resources and energy to the greatest extent possible. To this end, Clariant has continuously reduced emissions, waste and waste water in the past years – both relative to production volume as well as in absolute terms. Occupational accidents could be reduced over the past years significantly.

This success is the result of numerous individual measures. As a result, production processes were continuously optimized; high-performance, energy-efficient machines were employed; more sustainable raw materials with better performance properties were used. Clariant ensures the safety of the production systems through mandatory processes and continuous monitoring, and regularly tests these processes for optimization potential. This commitment also pays off economically – for example, with lower energy or material costs for the manufacturing of the corresponding products. The efficient organization of the production system helps Clariant to be prepared for future conditions that define the regulatory context in which Clariant operates.



Energy savings with eWATCH

In the past years, Clariant has developed an extensive energy efficiency program under the name »eWATCH« which identifies savings potential through the calculation and analysis of energy

consumption. This potential results from an optimized use of machines and systems. Machines are incorporated and used in the production process so that they run at or near the best level of efficiency. This is supplemented through a sharpening of the energy awareness of employees and through training in the areas surrounding energy-saving possibilities.

In addition, the management of energy supply and consumption is coordinated across the Group. A better coordination should on the one hand result in savings, and on the other hand, allow a better assessment of cost-benefit ratios from investments in savings, because an important additional condition of the investments required for energy savings is an amortization period of only a few years, generally three to five.

In the last ten years, Clariant has achieved impressive success with eWATCH. Through large projects, but also through many smaller projects, energy consumption per kilogram of manufactured products has decreased by more than 50 %, or by 7.5 % annually on average. The emission of CO₂ and other greenhouse gases decreased to about the same extent. And despite higher production, even the absolute numbers for consumption and emissions fell. Energy consumption and CO₂ emissions were in each case reduced by 4.5 % per year on average, and thus by around 38 % over ten years.

Clariant has already identified and achieved high savings potential. Now, additional savings will be attained by means of numerous small projects.

EXAMPLES OF EWATCH PROJECTS

	Investment costs	Amortization period	Savings (kWh/Y)
The fan upstream of a blow dryer could be switched off and bypassed when drying a newly introduced less dense product.	EUR 1 000	0.5 Y	18 000
The output of an air blower was too high to accommodate lower loads. To supply low air flows, some air was bypassed and discharged. The purchase of a controlled smaller blower allows regulated air supply.	EUR 22 000	1.2 Y	143 000
A heat-recovery system heats product tanks and piping. However, the recovery did not suffice, 9 000 tons of steam needed to be produced in addition. This is now eliminated with the use of an additional heat exchanger that recovers reactor off-heat (5 190 t of steam saved).	EUR 5 000	<0.1 Y	3 100 000
The disposal of a bi-product from pilot reactors in a catalysis laboratory was significantly simplified using a catalytic post-combustion unit, saving energy and water.	EUR 60 000	2.2 Y	370 000
The technical optimization of a steam generator with the incorporation of condensate recovery significantly reduced energy consumption.	EUR 39 000	1.9 Y	400 000
The use of comprehensive LED lighting at the new location of the Biotechnology Group reduces day-to-day operating costs noticeably.	EUR 45 000	0.8 Y	191 000
The renovation of the exterior lighting of a location with the replacement of the metal-halide bulbs with LED bulbs reduces energy consumption and maintenance, and allows for better illumination with an adjusted output.	EUR 45 000	3.3 Y	97 000

Investment costs include all expenditures that are allocated to the sustainability effect of a purchase. The amortization period gives the duration in years (Y) in which the reduced costs compensate for the investment costs. The savings indicate the reduction in energy consumption in kilowatt hours (kWh) per year (Y) made possible by the sustainability investment. The energy-saving measures initiated within the scope of eWATCH in 2015 will lead to an annual cost reduction of approximately CHF 6.3 million.

EMPLOYEES' IDEAS REDUCE COSTS AND PROTECT THE ENVIRONMENT

The experiences and knowledge of employees are a valuable source of ideas for continuous improvement of production processes. Clariant promotes the suggestion system at many locations and thus saves money year after year, for example, by reducing energy consumption or waste water pollution.

Through the optimization of the production process of pigments, effluents were able to be reduced by approximately 50 % and waste water pollution (COD¹) by approximately 20 %. A team of employees of the departments involved in the production process developed the suggestion for the improvement together. Ideas were generated, assessed, and selected. The new production specification was then drawn up and implemented.

By changing the production process in the production of a pigment, the batch quantity was nearly doubled. Through the new process, the amount of liquids used in production have been cut in half, which leads to significant reductions in energy consumption. The result is a reduction of the steam consumption by 40 % per kilogram of pigment and a reduction of the requirement for electricity and ice by 50 % per kilogram of pigment.

¹ The Chemical Oxygen Demand (COD) is as a summation parameter a measurement for the sum of all substances present in water and oxidizable under certain conditions.

Increase in productivity

The proprietary optimization program Clariant Excellence deals with the area of Operational Excellence with all steps of product and service creation. This includes order receipt, production planning, production itself, the delivery of products to customers as well as the entire sales process and subsequent customer care. As components of Operational Excellence, the Clariant Production System (CPS) supports the best possible development of these steps in relation to the production environment at Clariant. Important instruments in the process are the standardization, simplification and modernization of processes, thereby creating the highest

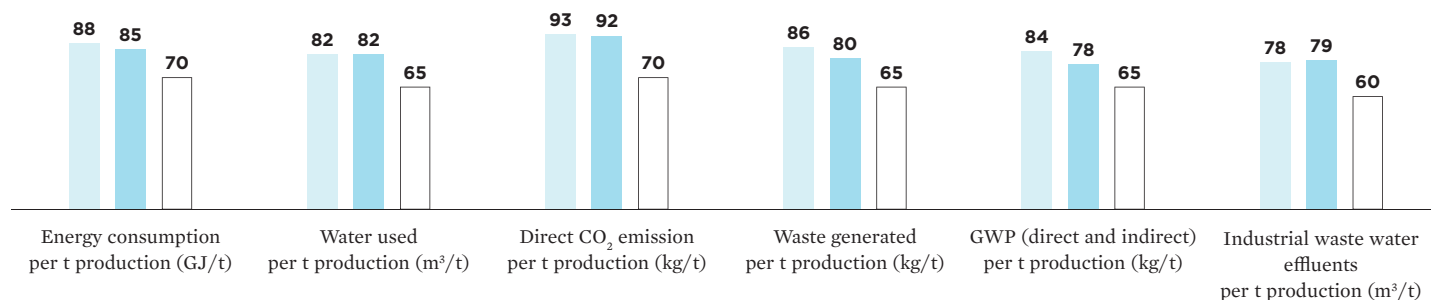
possible productivity and providing for an above-average financial result in all operating units. As a result of the measures, CPS is expected to increase productivity by 3 % to 5 % per year.

With this optimization, particular attention is given to the use and application of raw materials, energy, and environmental technology (Yield, Energy, Environment: YEE). Approximately 80 % of expenditures are allocated to these categories in the business units of Clariant. In this way, a decreasing purchasing volume of YEE components despite the same production facilitates corporate planning because the prices appear comparatively volatile in this case. After thorough investigation of the operating processes with YEE, savings potential of approximately CHF 60 million was identified, of which CHF 39 million were already achieved in 2015. Approximately 70 % of this volume is allocated to the raw materials category.

Improvement of environmental key indicators

A declared goal of Clariant is the continuous improvement of important environmental indicators. This includes energy consumption, carbon dioxide and other greenhouse gas emissions, water use as well as waste and wastewater generation. In 2011, Clariant had defined specific corresponding target values for 2020. These values were already achieved three years later. Now, new target values have been set for 2025. To this end, energy consumption and CO₂ emissions must each be reduced by 30 % per ton of produced goods in comparison with 2013. Greenhouse gas emissions, the amount of water used, and the amount of waste volume each must also be reduced by 35 %, and effluents must be reduced by 40 %. The achievement of these yet very ambitious goals becomes increasingly more expensive. For additional improvements, above all, increasingly smaller measures must be implemented (environmental key indicators, F2).

2025 TARGET FOR ENVIRONMENTAL KEY PERFORMANCE INDICATORS in %



2013 = 100 % ■ 2014 ■ 2015 □ Target 2025

Changes in the portfolio and in the company structure can create improvements or impairments in the environmental performance without anything having changed in actual environmental behavior. However, in goal-setting and projections, Clariant considers such effects. Sometimes, the positive and negative effects that are caused by such changes cancel each other out. If Clariant attains the most recent goals in 2025, the Group will have accomplished improvements for central environmental parameters between 62 % and 76 % – within only 20 years.

Occupational health and safety

Occupational safety is key. Employees and workers need to be able to feel safe at their workspace and get appropriate instructions and training accordingly. In addition, the prevention of downtime, lost work days, production stops and employee motivation have direct economic impacts on the company. The efforts for the prevention of workplace accidents are an essential component of production activity for Clariant. The goal is always »zero accidents«. To this end, the program AvoidingAccidents@Clariant led to a significant reduction of accident numbers and consequences in the past years.

The success of these activities and the associated efforts resulted in a decline of workplace accidents (with a downtime of at least one day) from 79 accidents in 2010 to 32 accidents in 2015. At the same time, downtime caused by accidents decreased. The »Lost Time Accident Rate« (LTAR) decreased in the aforementioned time period from 0.45 to 0.17 (social key indicators, F7).

AvoidingAccidents@Clariant allowed a distinct group-wide safety culture to come into being. The introduced measures demonstrate success and are rigorously improved and implemented. With the additional recording of all safety deviations, conclusions are expected to be drawn from potential risks that have not been considered up to the present. If the corresponding measures are developed in the process in order to reduce and avoid risks, the number of actual accidents will once again decrease.

Every month, the accidents and safety deviations that occur within the company are published with a corresponding analysis and assessment. This practice allows for the exchange of knowledge acquired from accidents and safety deviations, the correction of behavior and operation (where necessary), and the promotion of a preventive mindset throughout the entire company. Locations that use the same equipment and the same processes can in this way benefit directly from active safety measures and prevent the recurrence of accidents or incidents.

The health of Clariant employees is examined on a regular basis. Depending on the workplace, sometimes extensive health checks are carried out in order to detect signs of illness as early as possible. For some activities, special health certificates and vaccinations are required, and attention is paid to ensure that these are used correctly and complied with.

COMPREHENSIVE PLAN FOR THE PROMOTION OF OCCUPATIONAL SAFETY

- Analysis of accidents and safety deviations
- Development of measures for the future prevention of such incidents
- Regular inspections of all operating sites by the health and safety officers, and sometimes together with representatives of public authorities
- Implementation of workplace measurements and the establishment of work area analyses
- Development of EHWAs (Evaluation of Health Hazards in the Work Area) in the safety and health protection of workers at work
- Assessment of machines and new equipment from the perspective of occupational safety and application of machinery guides
- Provision of guidance to the businesses in all questions of occupational safety and health by industrial safety experts
- Training of all employees in occupational safety and health by supervisors
- Regular internal and external safety training courses for employees
- Implementation of safety discussions

PROGRAM FOR THE PROMOTION OF HEALTH

In Latin America, Clariant offers its employees the VIVAZ program – for a better quality of life by a healthier lifestyle and the prevention of illness. On a voluntary basis, the health situation of the employees is first determined in collaboration with an external partner. Based on this information and data, individual health plans are created for the employees with specific health tips. At the same time, general advice is distributed to all employees via intranet and e-mails. VIVAZ is being further developed in the coming years and supplemented with special campaigns such as partnerships with fitness studios.

REGULAR TRAINING COURSES: THE ABERDEEN PROJECT

Clariant sensitizes and informs its workforce in the business areas worldwide, and continuously regarding safety issues. In this manner, for example, a current safety or health-related theme is selected as part of the »Aberdeen Sustainability Project« of the Business Area OMS (Oil & Mining Services), and comprehensively presented to its workforce as part of the »SAFe Week« (Safety Affects Everyone). In 2015, information on proper ergonomics in the workplace was given to employees over five days through e-mails and film material. This includes the most frequent causes of accidents and sensible prevention. As a result of these measures, over many years the Business Unit OMS recorded no accidents with time lost within one year.

REGULAR TRAINING COURSES: ASIAN SAFETY WEEKS

In Asia, Clariant organizes educational weeks that deal with safety issues. Over a period of five consecutive days, moderators present frequent accidents with machines as part of discussion rounds and movie presentations, and communicate the importance of proper operating. The goal is to attain a greater awareness of the hazard of the improper handling of technology at the workplace. Deviations from the target situation, which can later lead to accidents, are expected to be recognized as early as possible.

HIGHER SAFETY STANDARDS IN CHINA

In China, Clariant started the »Good Practice Sharing« program. For a sustainable corporate development and continuous improvement of processes, Clariant seeks to transfer sensibly organized processes that were identified at specific locations to other operating sites in order to bring the safety levels of each location in line with each other. For example, Clariant's catalyst production in Shanghai requires special conditions due to the properties of the materials and the demanding monitoring of the processes. Based on a full-scale analysis, the risk profile of the workplaces was determined. In addition to the optimization of employment conditions at these workplaces, special measures for emergency cases were established. This knowledge can now be transferred to other locations.

High degree of plant safety

The production locations of Clariant in Germany are subject to the requirements of the German Hazardous Incident Ordinance; the European locations are subject to the EU Seveso II ordinance; and the non-European locations are subject to comparable regulations. In this manner, the corresponding reports are created in which the safety management system and the system-related measures for safe plant operation are described. The proprietary guidelines of Clariant are updated in the event of significant changes, or every five years at the latest.

Every release of a substance, each explosion and each fire with actual or potential impacts on the health of the employees or people in the vicinity, and with damages to equipment and the environment, as well as the release of harmful substances above the established threshold quantity, are systematically recorded, assessed and reported. In addition, in the past, Clariant developed a plan from the analysis of hazardous incidents, with which the recording of occurrences even below the official regulatory threshold of the obligation to report is supported.

The safety of people and the environment is of paramount importance for chemical companies. To guarantee this safety, it is imperative to have an effective process safety management that identifies risks in the production process, assesses and monitors risks through suitable measures, and reduces or even completely prevents risks. An important part of this system is the recording, analysis and assessment of process disturbances of such occurrences. So that the chemical industry as a whole can benefit from this knowledge, this may not be done from company to company or even within the companies in a varying manner. For the comparability and assessment of hazardous incidents in kind, scope and impact, a uniformly implemented system is required.

Recording of safety-related incidents

The system of the European Chemical Industry Council (CEFIC), which supplements the processes that were introduced based on the Seveso guidelines in the European Union, guarantees a comprehensive comparability of process disturbances. With this system, occurrences that can lead to a substance or energy release are uniformly and properly recorded. In this manner, the process and plant safety can be assessed with the help of the hazardous incidents recorded, the Process Safety Incidents (PSI). The system records unintended releases of energy or substances that exceeded certain threshold values.

The vast majority of the released substances can be collected with the corresponding retaining systems. The predominant number of incidents is to be traced back to misconduct. Through the recording and assessment of safety-related incidents, the task is now to identify and implement suitable measures to prevent such incidents. Luckily, considerable operational disruptions are very rare at Clariant – which is the result of continual work by participating function owners, especially operations managers, operations engineers and safety experts.

PROCESS SAFETY EVENT RATE ¹				
2011	2012	2013	2014	2015
0.31	0.40	0.25	0.22	0.26

¹ Process Safety Event Rate: Incident rate every 200 000 working hours (according to the criteria of the CEFIC)

Education and training for employees

Global employment markets are increasingly becoming a reality. Accordingly, global challenges result in the search for qualified employees. In 2020, the world economy could be faced with an absence of approximately 40 million college graduates. The recruitment and linking of employees thus become important factors for lasting business success.

In a competitive environment such as the chemical industry, the employees of Clariant are crucially important for the success of the company. Their performance lays the basis for the company's commercial strength and competitiveness. It is an important matter to

Clariant to provide employees with a professional work environment in order to promote employee health and satisfaction on the one hand and overall company performance on the other. In the process, the motivation and the skills of each individual employee, the commitment to the quality of each individual's deliverables, and the observance of environmental protection, safety and protection of health are promoted both individually and on a departmental level.

INDIVIDUAL EDUCATION WITH CUSTOMIZED TRAINING OFFERS

With the My Learning online platform, Clariant offers a global system that allows employees to search for the best tailor-made continuing education option. The tool provides employees with a full-scale overview of all educational offerings enabling them to compile their individual programs and follow their personal development. The offering includes traditional seminars, language courses, online trainings or special educational events.

In 2015, nearly 8 000 employees took part in Clariant training courses, attending a total of about 140 000 hours of training. About 15 % of this training occurred in the Clariant Academy programs with an emphasis on leadership and sales competencies, with about 6 500 hours and 500 participants each, and local training offerings with emphasis mainly on language courses, communication and presentation skills, as well as environment, health and safety (ESH).

The concept of Clariant Excellence is also used in the realm of Human Resources in order to create a culture of continuous improvement. The core of the concept is a process of the effective and lasting change in thought that each employee develops and promotes for him or herself on all levels. This change in thought is expected to increase the competitiveness of Clariant through gains in efficiency, and in the process create added value.

GLOBAL ROADSHOW FOR THE ACCELERATION OF CHANGE

How can Clariant accelerate change and integrate sustainability into its own processes in order to become the leading specialty chemicals company with above-average value increase? This question stood at the center of the global roadshow under the motto »Accelerate Change – Discover Value.« In numerous workshops, the importance of sustainability for the company was emphasized and elaborated, how each individual employee through successful actions can contribute to creating added value in the future for all stakeholders – customers, employees, shareholders, and the society.

People Excellence seeks to improve the continuing education of employees by providing them with the required skills and resources. So that these improvements are also ensured in the long term, Clariant intensively promotes succession planning and talent management. Clariant offers suitable education programs for employees to improve their employment opportunities and thus promote the innovative, future-oriented continuing development of the company.

The continuous training of employees within the framework of the internal talent management process ensures well-functioning succession planning for important positions within the company: About 85 % of the senior management positions can be filled internally.

At the end of 2015, more than 20 % of the individuals hired at the top four management levels were citizens of the country in which the hiring part of the Group was located.

Sustainable value creation for all its stakeholders and for Clariant as a whole requires the alignment of all business on central factors that are inextricably linked and built upon each other. A common set of values sets the foundation for continuous performance improvement. To this end, the conduct of the employees should always be oriented toward the well-being of Clariant, and in the process, the well-being of the entire workforce, as well as that of the stakeholders.

The Clariant Code of Conduct defines responsible conduct and applies equally to all employees. It concerns first and foremost the avoidance of conflicts of interests. The Code of Conduct governs the realm of fair competition, freedom of association, the right to collective bargaining, corruption, discrimination, child labor and forced labor (www.clariant.com/en/Company/Corporate-Governance/Codes-of-Conduct). See Clariant Annual Report, page 111.

Discover Value **EASILY DISPERSIBLE (ED) PIGMENTS**

»With the use of ED pigments, not only is the process simplified, but the ecological efficiency and flexibility in production are also improved.«

WOLFGANG WINTER

Senior Technical Marketing Manager,
Global Competence Center Coatings



How ED Pigments optimize the manufacturing process

ED pigments are surface modified organic pigments. The dispersing additive on the ED pigment is incorporated during the manufacturing. These additives, highly efficient and widely compatible, facilitate wetting and separation of pigment particles during the dispersion process. Furthermore, the optimum amount of additive is present on each ED pigment surface to achieve the necessary dispersion properties. As a result, ED pigments can be dispersed with a high-speed dissolver, eliminating the need for the traditional bead-milling step. By simplifying the dispersion step, ED pigments can significantly improve the eco-footprint

in paint manufacture. The processing time is shortened leading to increased production capacity, while simultaneously realizing savings in electricity consumption and generation of waste water.



ECOTAIN®

ED pigments fulfill the criteria of EcoTain®, our approach to sustainability on product level.

Would you like to learn more?



www.clariant.com/EDPigments



Increased material efficiency
in production processes reduces
the footprint of products.

Efficiency at product level



PIGMENTS

Pink going green

Based on long experience in pigment manufacturing, Clariant has focused on using renewable raw materials in the manufacturing of quinacridone pigments. The high quality of Clariant's pigments is very well received by customers. The exceptional quality of Hostaperm® Pink E sets the standard in today's market.

Only steering every step in production leads to high quality pigments with the desired crystal structure and the right particle size distribution. As bio-succinic acid has the same chemical and physical behavior than petroleum based succinic acid it is possible to manufacture high performance pigments without compromising on quality. Nonetheless, it is essential to have a similar cost effectiveness in producing quinacridone pigments like Pigment Red 122 and Pigment Violet 19 based on renewable raw material.

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BENTONITE

A natural all-purpose raw material

Clariant obtains several million tons of bentonite per year from its worldwide extraction sites. About one quarter of these mines are located in Germany, and about one half are located in Europe. Important European surface mining operations of Clariant are located in the south of Bavaria, in Sardinia, Spain, and Turkey.

In Gammelsdorf, Germany, 15 distinct qualities of bentonite are mined. These are transported to Moosburg, the largest site of the Business Unit Functional Minerals, and further processed into various products such as bleaching earths, foundry and drilling additives and paper additives.

Unlike in the deposits of other ores (e.g. lignite), the bentonite layer is on average only 1.5 meters thick, and extraction leaves behind only barely visible depressions in the topography. After extraction, the re-naturation of the land begins. Layers of stones, gravel and topsoil are poured with a bulldozer back into the minesite in their natural order. During the process, it is very important that the water supply and drainage are maintained before the land is re-cultivated. The last step consists of depositing of carefully layered topsoil and the shaping and cultivation of the land.

In moderate climates, bentonite must be dried by means of thermal heating. This process has been successfully converted to solar drying at a mining site in Sardinia, Italy. Because of this, emissions of 2 000 tons of CO₂ per year are eliminated in a first step. Additionally, the number of required truck trips were reduced in the process by a distance of 40 000 kilometers because sundried bentonite exhibits smaller volume. In addition, dependence on fossil fuels and their price fluctuations were eliminated for the future. This process will be extended to additional suitable individual locations.

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HEALTHCARE AND PHARMACEUTICAL PACKAGING

Packaging as high-tech products

Packaging for medical and pharmaceutical products must satisfy the strictest requirements for quality and control of changes. In addition, the packaging must also exhibit the functions that are adapted to the specific claims of the products, including oxygen barrier, moisture adsorption and regulation, light barrier, aroma enhancement, odor adsorption, anti-bacterial and anti-static.

Ideally, active and passive components are already integrated in the packaging during manufacture. In the process, components such as sachets or canisters are added to the existing packaging or in some cases functionality can be mixed into the polymer used to produce the packaging component using a masterbatch (concentrate) in a single layer or one layer of a multilayer structure. This functionality can be combined with colors.

For modifying the polymer used packaging material, Clariant offers with MEVOPUR® a range of solutions for this area. MEVOPUR® is manufactured in production facilities on three continents. In all facilities, the strict separation of product lines is observed. This helps to reduce the risk that products contain undesired material traces, and thereby functions that are not expressly intended. At these designated sites, the processes are verified and validated under the ISO standard 13485 for the design and manufacture of medicinal products. This drives a closer collaboration throughout the entire value chain consistently delivers the impulse for improvements for Clariant, for suppliers and for customers.

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People ON ANOTHER LEVEL

Photography Jo Röttger, Text Bertram Job

It is barely after noon and the water is already up to the necks of Derwood Arsement and Kyle David. The two Clariant employees, along with a few others, are strapped into a helicopter cabin that is lowered into a swimming pool via a remote-controlled mechanism, until the water reaches the collar of their overalls, and even their heads. It seems as exciting as a movie, except that they are now a part of it themselves.

A moment later, on command, the cabin is tilted with a jerk and at the same time sinks lower. Now everyone must work as quickly as possible to free themselves: out of their seats, through a removable window and into the water. Seconds later, they all emerge, swim to the edge of the pool and hear the rough voice of the trainer while they climb out: »Not bad, guys. Let's do it again.«

And then again and again. You need to have reasonably good nerves for this procedure in pool 1 of the Maritime Survival Training Center (MSTC), a facility in the immediate vicinity of the Lafayette airport in Louisiana. The »Helicopter Underwater Egress Training« (HUET) is an integral part of a course for people who work off-shore such as on floating oil platforms, like Arsement and David, two account managers in the Business Unit Oil & Mining Services in the Gulf of Mexico.

All day long, both employees were made familiar with precautions and emergency measures on the high seas at the MSTC, an institute of the University of Louisiana. The course starts at eight in the morning with presentations and written tests and ends, if successful, with the presentation of a certificate. However, in the middle of all of this coursework are these two to three hours in the pool in which the participants are prepared for the »worst case« scenario. What do you do if the helicopter lands in the ocean instead of on the platform?

Just now, the group practiced how best to throw oneself into a life raft or, if one is not available, how to form a circle on the high seas to stay together, and how to rescue someone who is injured or unconscious. That was pure group dynamics, which are a good way to get to know each other. But in HUET, it is everyone for themselves. It's all about not reacting in a panic. The only thing that helps is if you have already completed the course like the two Clariant employees already have.





»The regular training gives you
an extra sense of security.«

KYLE DAVID

Sales Representative, BU Oil & Mining Services



He is fortunate to never have had to use it, says Kyle David, a sturdy 30-year-old man. Nevertheless, it gives you an extra sense of security, a confidence boost, when you complete the training regularly. Arsement, the bigger of the two and three years older, agrees unreservedly: »You feel a little safer.«

Albert Crownover likes to hear these kinds of statements. The MSTC president lets the group repeat the quick escape from the helicopter a total of six or seven times per group. The fatigue is evident in all the students at the end. Only then is Crownover certain that they take away enough from this exercise to react appropriately in case of emergency.

»We can help if someone panics,« he says with a gentle smile of an expert, »this is not like in the army, where people are being yelled at.« As a result, there are hardly any participants who do not complete the one to two-day courses successfully. Only in extreme cases, when simply nothing would help, someone would have to look for another job, unfortunately.

A certain level must be met if you want to be safe. This is the guiding principle in the training center, which was founded on the initiative of a lecturer for occupational safety in 1987. The facility, which was also financed by donations from the oil industry, is now worth over a million dollars, estimates Crownover. Today, the center employs nearly a dozen people, all employees of the university. This is the only way to guarantee that the requirements of the Offshore Petroleum Industry Training Organization (OPITO) – a global consortium founded by the industry – are met.

Under its umbrella, advanced education and safety training can be established with uniform standards and structures to build a sustainable, competent workforce to work in the oil and gas industry. In this way, it should be ensured »that quality, innovation and partnership underscore everything that we do.« Each year, more than 250 000 participants at more than 150 locations around the world take part in the certified courses – in Lafayette, the capital of the »Cajun Country« on the Vermillion River, or elsewhere.

These include Arsement and David as well as all others who work for Clariant in the Business Unit Oil & Mining Services in the Gulf of Mexico. At least every three or four years, they are prepared to withstand storms and water once again in one of the training centers – regardless of whether they are used on the platform for





»We are constantly looking for new ideas in order to reduce the number of accidents at work further.«

MICHAEL A. TEAGUE

Head of Regional Sustainability & Regulatory Affairs North America



weeks or just for a day or two as a technician or consultant. After all, the »safety and security of worldwide activities« are among the most urgent objectives, as was bindingly established in 2013 in the Clariant Sustainability Policy.

The ambitious principle has become standard on several levels: overall in the security concept AvoidingAccidents, as well as specifically for the volatile working environment of oil exploration and mining in »Safety Affects Everyone« (SAfE), which provides clear rules of conduct for all employees. This is based on two guiding beliefs: »All accidents and occupational illnesses can be avoided« and »Safety is everyone's responsibility.«

This safety culture and the continuous reduction of accidents and occupational illnesses is implemented in Clariant's extensive Environmental Safety and Health Affairs (ESHA) program. »Never before has such content been so unreservedly supported at a management level,« assures Mike Teague, Head of Regional Sustainability & Regulatory Affairs North America. This reflects a clearly positive trend in the growth and maturity of our safety culture.

Especially in the last ten or more years, according to Teague, »very good results« in reducing accidents at work have been able to be recorded. Nevertheless, there is no reason for euphoria, because »we are not at zero.« Still, there are many opportunities to share concepts and procedures among the experts from different companies: »We are constantly looking for new ideas, both internally and externally, in order to reduce the numbers further.«

Do not slack off, never be inattentive: Derwood Arsement and Kyle David also heard this frequently at the MSCT in Lafayette. The two customer advisors have mastered the practical training as well as the theory at the end of the course. Like all the other participants, they have received the certificate with Albert Crownover's signature and can venture out by helicopter again in the future. Out to where they are needed.

Each of them probably assumes that they will never have to use the material they have learned, says Arsement, hair still wet before saying goodbye, »but you feel prepared.« This is what someone sounds like who has been through it all.

Collaboration with **CUSTOMERS**



Clariant maintains continuous contact with the customers in order to support them in the application and the use of Clariant products. For specific questions, the appropriate Clariant laboratories are available. The service offering also features comprehensive product information, in particular with respect to optimum and safe application, health risks, waste disposal and handling of packaging.

Safety data sheets with the relevant material data, information on safe handling and storage of the products and measures to be taken in case of emergency (product release or fire) are provided by Clariant to all those who work with the further handling of the materials. Clariant safeguards compliant delivery of its products and use information of its portfolio along the entire life-cycle using sophisticated global IT system. This system guarantees that Clariant products do not get into the wrong hands and cannot be misused.

Product stewardship

Clariant offers, via its Group Product Stewardship organization, professional service for customers and all Business Units. With these activities Clariant contributes to a high safety of products and prevents the business and customers from reputational or legal damages. The responsibility for the protection of consumers and the environment in the use of the products is given the highest priority. Thus Product Stewardship gives added value to the business and sustainability.

In the course of product development and product design, properties are evaluated with regard to the safe and environmentally compatible use of a material. Before a product is produced and market-

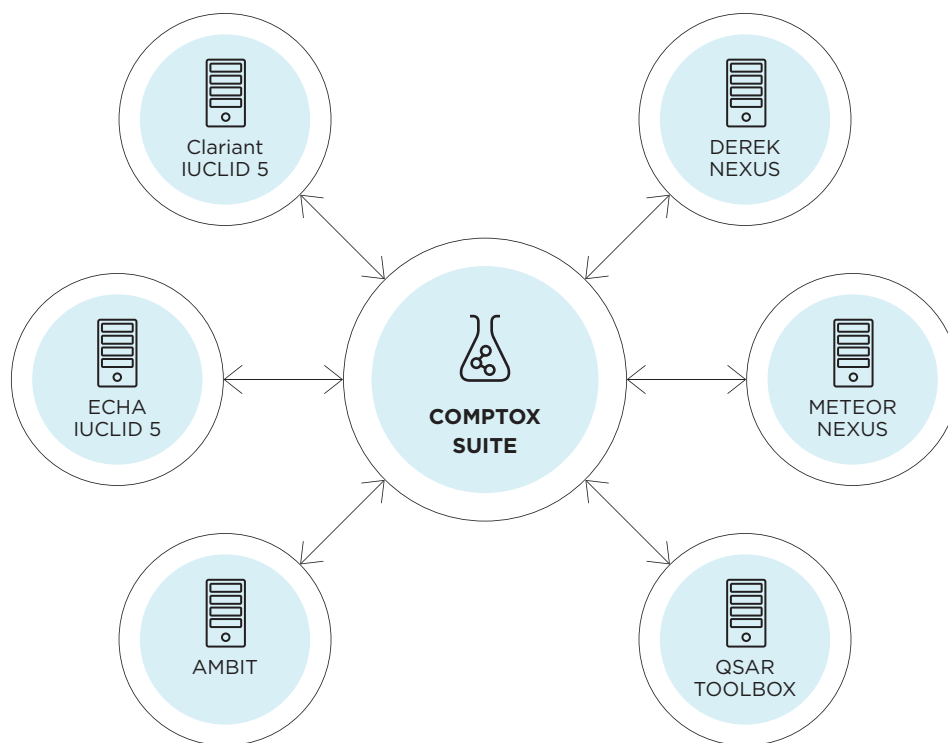
ed by Clariant, it undergoes a series of screenings according to and going beyond legal requirements. This is done to make sure that the product can be used without causing any harm to people and the environment during its entire life-cycle. Anyhow, the expertise in the Product Stewardship area ensures that Clariant products comply all relevant national and international chemicals legislation.

SAFETY THROUGH ASSESSMENT

Since 2007, the European Union (EU) has required that all chemical substances manufactured inside the EU and imported into the EU are being assessed in regards to the impact of these substances to humans and the environment (dossier). The EU authority ECHA (European Chemicals Agency) in Helsinki coordinates the recording, assessment and continued approval of all chemical substances on the basis of the dossiers (presented test results). To do this, it requests verifiable and authoritative statements from the chemical industry. The research methods must be perfectly reproducible and is normally associated with considerable effort and expense. Clariant is committed to fully completing these requirements on time and thereby strives for the highest levels of cost-efficiency while undertaking as little animal-testing as possible, as permitted by regulation.

The CompTox Suite – assessment of chemicals without additional animal studies

Chemicals must be registered to protect humans and the environment. A registration requires substance data, proof of safe use of the substance and submission of substance data and assessments to the competent authorities.



DEVELOPMENT

- Forecasts of chemical safety profiles, product composition and improvements
- Targeted development by means of excluding harmful structures
- No (animal) testing

SUBSTANCE EVALUATION

- Use of existing data on similar chemical structures
- Filling of data voids based on read-across and QSAR¹ methods
- Support for category approach (registration of element groups)
- No (animal) testing

BENEFITS

- Avoidance of animal testing
- Reduction of research and testing costs
- Faster research and development of new products
- Improved performance of laboratories and businesses
- Standardized reporting format

¹ QSAR: Quantitative Structure-Activity Relationship

REACH (Registration, Evaluation, Authorization and Restriction of Chemicals), the chemicals law of the European Union, is one of the most stringent sets of regulations for the authorization of substances worldwide. With data generated for a REACH registration, the requirements of other countries can essentially also be fulfilled with only a few exceptions. The required toxicological data are mainly determined by extensive animal testing which are time and cost intensive.

For registration, the legal demand, as well as Clariant's own animal welfare policy of minimizing animal testing must be followed. This can be done by using existing data on the substance itself or on similar substances.

The toxicity profile of a substance is determined by its chemical structure. Computational toxicology is a process that aims to predict toxic properties of chemical substances based on available data and thereby avoid animal experiments.

Clariant has been working for years to replace the required animal testing with alternative methods. The innovative approach taken by Clariant with its CompTox Suite comprises several elements, the first is that it combines and integrates the functionalities of the computational methods of AMBIT with high quality (eco)toxicity data from the REACH database IUCLID.

»The CompTox Suite marks a milestone in the assessment of chemical substances.«

RÜDIGER WALZ

Head of Product Stewardship

AMBIT is an open source software with attached database for data management and investigation of chemical structures and partial structures, developed by LRI¹ and CEFIC². It helps with the development of substances giving the possibility of modelling and simulation.

The AMBIT database contains more than 450 000 chemical structures and their identifiers (CAS, EINECS, InChI) as well as information about molecular descriptions, investigational data, literature references and REACH relevant PBT descriptions.

The software can also communicate with other programs and access data of different external quality assured and REACH relevant databases. These data are assigned to certain chemical structures or partial structures and stored accordingly. Frequently repeated actions can be automated.

¹ LRI (Long Range Research Initiative) is a research program to assure the safety and harmlessness of chemical products for humans and the environment, initiated by CEFIC² and ICCA³.

² CEFIC is the European Chemical Industry Council. It represents 29 000 companies in Europe with 1.2 million employees.

³ ICCA is the International Council of Chemical Associations.

In addition, the CompTox Suite links also computational toxicology prediction tools with Ambit. This link enables the prediction of toxicity from chemical structures, structural moieties, metabolites and allows read-across and category approaches as useful techniques in the safety (hazard and/or risk) assessment of chemicals. In the last step of the CompTox Suite experimental verification is possible using analytical methods to detect predicted metabolites in urine or blood samples – if required. As a result, the number of animal experiments, especially long-term studies to be carried out for the assessment of chemicals, can be significantly reduced.

Proactive product safety assessment of innovation projects by CompTox contributes to innovation strategy, sustainable products and competition advantage: health risks and other hazardous properties of substances in new developments can be recognized or even additional assessments of already existing compounds can be recognized and taken into account more easily from already available data.

Major contribution to improving animal protection: The CompTox Suite uses existing toxicological data of similar substances and modern calculation methods to fill data gaps for registrations and thereby minimizes animal experiments.

Added value for customers

Clariant wants to be the world leader in specialty chemicals. Continuously better products and services are being developed to this end, especially in terms of sustainability. The desired quality is defined primarily by assessment criteria that customers request from Clariant, and are to be met as fully and cost-effectively as possible:

- Excellent and reproducible product properties
- Reliability of supply
- Attractive cost-benefit ratio
- Specific commercial and application-specific technical support
- Superior product safety
- Product features and services that open up new opportunities for the customers

The quality and performance of Clariant products help customers achieve sales success in their markets – and thus form the basis for their own success. Clariant is interested in a collaboration based on partnership with its present and future customers. The cooperation allows comprehensive understanding of the relevant markets and early recognition of new requirements for products and processes. Customers and consumers receive important information and assistance, if requested, from Clariant regarding safe, environmentally sound processing, storage, transportation and disposal of chemical products.

Discover Value LE TECHNOLOGY



Great product benefits for customers

Clariant markets bentonite-based additives used in green sand molding, an important industrial sand metal process, for example in the manufacture of automotive components. The new low emission products GEKO®LE und ECOSIL®LE (LE = low emission) are part of Clariant's latest innovative developments that lower emissions of health hazards like xylenes, toluene and ethyl benzene by between 75 and 99 %, benzene emissions by up to 88 %.

THE LE TECHNOLOGY IN ACTION

The vast majority of iron flows in green sand molds for automotive parts, such as engine blocks, transmission parts or brake discs. How does changing to LE Technology influence the production process? To get the inside scoop, we asked Eric Bonin, Laboratory Manager, Peugeot Automobile.

How did it come to be that Peugeot Automobile began using LE Technology?

ERIC BONIN As the environmental authorities officially requested us to lower our BTEX¹ emissions outside the chimneys, we studied what Clariant offers as a solution.

What were some of the issues you were having with your previous product?

ERIC BONIN There is no real existing issue except a lustrous carbon generator level in the premix.

When did you become convinced of LE Technology?

ERIC BONIN Thanks to the various presentations done by Clariant and their BTEX tests on molding sands.

How complicated was it refitting the foundry for LE Technology?

ERIC BONIN Some precautions must be taken. At the implementation phase, it is important to define the first recipe to be used, and then decrease the lustrous carbon generator rate percent step by step.

Would you recommend LE Technology?

ERIC BONIN Yes, because using it contributes to improving the quality of our environment. The implementation of LE Technology is easy but more controls of the sand system are necessary during the product changeover steps. This technology helps reduce the consumption of premix.

What concrete benefits does it provide Peugeot Automobile in the production process for ventilated break discs?

ERIC BONIN Basically the benefits are a reduction of the BTEX emissions, improvement of the molding and mold release accuracy and reduction of the premix consumption.

To what extent have your emission levels improved since you started using LE Technology?

ERIC BONIN Based on the latest analysis, we confirm a reduction of the emissions, the extent of which remains to be concretely evaluated thanks to a complementary analysis we are currently working on.



ECOTAIN®

LE Technology fulfills the criteria of EcoTain®, our approach to sustainability on product level.

Would you like to learn more?



www.clariant.com/LETechnology

¹ BTEX stands for benzene, toluene, ethylbenzene, and xylenes

»With locations around the world,
we can offer personalized expertise and
are in a prime position to react quickly
and meet customer needs.«

DERYA OZER

Technical Marketing
Manager EMEA





PERFORMANCE ADVANTAGES

Added value for customers means to offer tailored solutions with outstanding performance features.

Tailor-made solutions

🔍 GLUCAMIDES

Innovative agents from sustainable raw materials

The surfactants from palm oil developed by Clariant not only have excellent product characteristics, but their raw materials are also certified for their sustainability according to RSPO. Clariant aspires to organize and certify the locations by 2020 in such a way that the complete separation of certified and non-certified palm-oil-based raw materials can be ensured. This also allows us to meet the requirements of customers who increasingly request certified products. With the sustainable surfactant technology of GlucoTain®, a relatively low-cost product is available that carries the EcoTain® label thanks to its outstanding sustainability profile.

→ page 29

🔍 CATALYSTS

Combat harmful emissions

Options exist for removing laughing gas (N₂O reduction) from nitric acid production processes. The most effective and efficient method for use in large production plants for nitric acid is the tertiary method – which also removes nitrogen oxide (NO_x). For this, Clariant offers EnviCat® N₂O. And with the recently developed EnviCat® N₂O-S, Clariant offers a catalyst for plants of any size to remove nitrous oxides in the secondary stage of chemical production.

SIGNIFICANT REDUCTION OF NITROUS OXIDE

EnviCat® N₂O reduces the nitrous oxide emissions of a nitric acid plant by more than 90 %. With this concept, Clariant reduces the global emissions of CO₂ equivalents by approximately 12 million metric tons per year, which corresponds nearly to the amount of greenhouse gas emissions of four million cars per year. With the evolution of EnviCat® N₂O, this reduction continues to reduce.

→ page 29

🔍 HYDRAULIC FRACTURING

Environmentally compatible

Clariant offers customers innovative technologies that are more efficient and environmentally compatible. HOSTAFRAC™ is an innovative sugar-based surfactant sourced from natural renewable raw materials and is non-toxic. HOSTAFRAC™ was awarded the EcoTain® label due to its leading sustainability profile.

HOSTAFRAC™ is applied to improve the efficiency of both pre-flush and flow-back applications for hydraulic fracturing. Flow-back is a key process in bringing an oil or gas well onto production following fracturing. HOSTAFRAC™ is a proven technology that has greatly improved the rate and volume of the fracturing fluids to surface allowing the well to produce more efficiently, and enabling greater volumes of the water that is flowed back to surface to be re-used for other fracturing applications.

An example of where HOSTAFRAC™ has been proven to be beneficial is in the replacement of 2-butoxyethanol (2-BE). Significant value was added to the customer through a significant increase in gas production as compared to the more conventional technology, 2-butoxyethanol (2-BE). A yield of 11 million m³ of gas was achieved within 145 days in wells pretreated with 2-BE. In wells pretreated with HOSTAFRAC™ the yield in this period was 16 million m³ of gas, which represents an increase of over 40 % with an otherwise identical use of resource.

→ page 30

BENTONITE

A natural all-purpose raw material

Bentonite has a wide range of applications. For example, Clariant is a market leader in bleaching earth (TONSIL®) for the purification of edible oils. These bentonite products prevent undesirable impacts on odor or taste and remove impurities from fats or vegetable oils that are used in the food industry.

In food processing, bentonite serves as a natural clarification aid for beverages (for the removal of haze in wine or fruit juice) or visual improvement of fatty products. With Clariant bleaching earth, the raw material for the production of biofuels is purified, thereby increasing its productivity.

Bentonite can also be used as a desiccant for export packaging (Desi Pak®). For containerized goods Container Dri® II is basically the gold standard in the international transport of goods for the safe use against moisture, humidity and the resulting infestation of mold.

→ page 88

LICOCENE

Enable better recycling

With regard to transport and mobility, two aspects play an important role: Means of transportation must always be lighter (lower fuel consumption) with the same functionality and performance and their material balance for manufacturing and recycling must continuously improve. One aspect of this is the use of carpets in cars, trains, ships or aircraft. Textiles that are glued with latex-based adhesives can no longer be separated at the end of product life-cycle – which makes separation for recycling impossible.

The use of polypropylene instead of latex allows the production of 100 % thermoplastic based textiles which doesn't need to be separated for recycling. Licocene® of Clariant has considerable advantages, even during processing by the customer. While the conventional methods – water-based latex dispersions and hot gluing technology with formulated polymers and adhesives – are certainly relatively

inexpensive in the use of materials, they either require large equipment and large quantities of water and they release volatile organic compounds (VOCs), or they only have limited chemical, mechanical and thermal resistance – which can cause yellowish discoloration of the adhesive as well as unpleasant odor during processing and in the finished product. In both processes, the carpets cannot be recycled into their textile components. Especially coated carpets cannot be recycled economically, so they get incinerated.

Licocene® Performance Polymers have clear advantages in these points: Superior mechanical strength combined with easy malleability. Licocene® is tailor-made according to customers' wishes because its properties, such as hardness, melting point, transparency and viscosity, can be selectively adjusted. The low melting point of Licocene® and its viscosity enable optimum processing at lower temperatures and a lower dosage compared to other adhesives. In carpet manufacturing – as well as later when the carpet is installed in the vehicle – Licocene® is liquefied at about 80°C and applied to the carrier material with the woven fibers.

→ pages 91, 102

PIGMENTS

Pink going green

Clariant is working to use renewable raw materials in pigment production wherever this is possible and useful. The demand from downstream users is certainly there; the desire to be more sustainable is increasing. Clariant wants to develop a unique selling proposition in the pigment production market with this strategy. However, the prerequisite is that pigments must be able to provide the same performance without compromising on economic viability. Because even if sustainability is welcomed, industrial customers as well as consumers often remain price-sensitive.

Assuming efficiency in the production and processing, bio-succinic acid is very attractive not only from an ecological standpoint, but also from an economic perspective. By 2020, it is expected that approximately 20 % of the chemicals currently produced will be made from bio-based materials. Theoretically, more than 90 % of all chemicals currently produced could even be made with bio-based materials.

STILL NO COLORANT DIRECTLY FROM NATURE

Extracting natural pigments directly from nature, such as chlorophyll for green colors or iron oxide for red colors, is practically impossible even today, although there are some dyes and pigments from natural resources that are already in use. However, these products are not suitable for bright and chromatic colors in the most diverse applications. They do not meet the high-performance standards required in the market, such as in the architectural or automotive industry. Optimized pigments are needed here to meet the expectations for shelf-life and provide constant dye tones over a longer period of time.

→ page 31

CLOSING LIFE-CYCLES

90 %

of all chemicals currently
produced could be made with
bio-based materials

HEALTHCARE AND PHARMACEUTICAL PACKAGING

Packaging as high-tech products

Healthcare and pharmaceutical solutions have arisen mainly as a result of close contact and a lively exchange between all participants – Clariant employees from Research & Development, Production, Sales, Customer Service on the one hand and the customers' experts on the other. This has made a proposition of precisely targeted product solutions for the medical and pharmaceutical fields possible in the design phase.

Clariant dedicates itself to high product quality and consistent customer service, Clariant provides full, seamless documentation to certify that its products meet or exceed product specifications and all relevant compliance standards.

→ page 105

Recycling **AND DISPOSAL**

Sustainable handling of raw materials that are used for the manufacture of products is not only beneficial for the environment for obvious reasons, but is also important with regard to cost considerations and the reduction of supply shortfalls. As in future fluctuations in raw material prices can be expected, a transition to a circular economy in the procurement, consumption, and disposal of products is recommended, in which residues and wastes become the source of new products. The simplest way to avoid costs and reduce environmental impacts is to use the smallest possible amount of raw materials.

Clariant gives top priority to the avoidance of waste: »Avoidance before reuse before disposal.« This is why consideration is taken to generate the least possible amount of waste in the development and manufacture of products. Unavoidable production waste is recycled or disposed of properly. Each type of waste is recorded, analyzed as precisely as possible, and described. In this process, the aspects of waste from production, recycling, waste from the utilization phase as well as biodegradability of products – where this is necessary and makes sense based on the product criteria – are also considered by the Portfolio Value Program as part of the screening (page 22).

Waste management

Proper disposal must be proven and documented in internal records. It is important to know the plant from which the waste originates, the amounts that accrue and the time period during which they accrue, the properties of the waste components, whether the waste can be classified as hazardous, and how it can be recycled or disposed of. The total amount of waste produced by Clariant has decreased significantly in recent years.

Waste data at each individual site is assigned to the respective producers and waste disposal companies and evaluated. Waste disposal companies are chosen and reviewed according to strict quality controls. The reviews are recorded and the information is exchanged among Clariant's specific sites. These measures, taken together, ensure continuous monitoring and control of all waste streams at the locations.

No longer treatable materials, such as filter dust or distillation residues, are disposed of in special landfills or incinerated. The quantity of these substances is constantly falling thanks to improvements in the manufacturing process and continually reduced amounts of waste.

Recycling before disposal

Clariant tries, wherever possible, to use recycled materials in production. However, due to the specific conditions in the industry, this share is small because recycled raw materials for specialty chemicals, as Clariant manufactures them, usually cannot be utilized due to the high demands on the level of purity and for safety reasons. Clariant therefore uses almost entirely new and – where possible and where it makes sense – increasingly renewable raw materials for direct intermediate products.

It is a different picture for auxiliary materials, for product purifications and separations of materials during the production process. In these instances, there is quite often an internal recirculation, meaning materials are being used multiple times. However, the tracking of these corresponding quantities is not possible in a meaningful way due to the recirculation of materials integrated in the processes.

Discover Value

SEDIMENT MANAGEMENT



»The Clariant Invoque™ system enables problem owners to boost the process of dewatering sediments, to improve the quality of filtered water and to optimize the energy consumption in liquids-solids separation processes.«

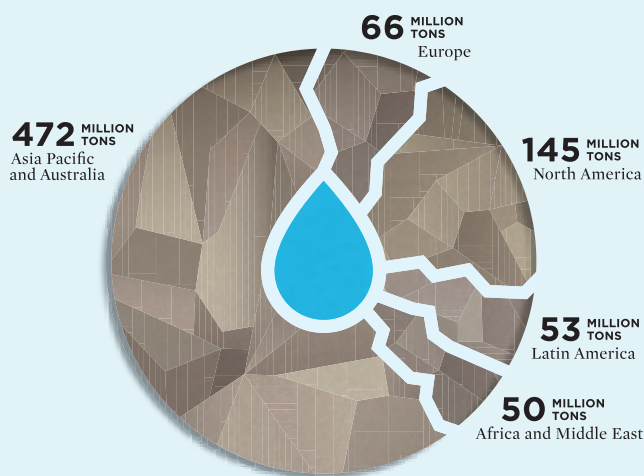
MICHAEL SIEVERS

Head of Department, Waste Water Process Engineering, CUTEC Institute

Thorough dewatering of silt and sediment

Year after year, around 800 million tons of water-borne sediments – accumulations from shipping channels, port basins, mining activities etc. – are processed worldwide. Of this, approximately 30% may be polluted with toxins (fertilizers, pesticides and other chemical pollutants and heavy metals). Such sediments may not be used, but nevertheless require costly dewatering, with the associated risk that some contaminants will be released in the filtrate water. Retaining contaminants within the sediment and producing a drier transportable material, while generating a cleaner filtrate can dramatically reduce water treatment and sediment disposal and storage costs.

Some temporary storage structures, such as mine tailings dams represent a substantial risk, a fact that was demonstrated in an environmental disaster in the fall of 2015 in Brazil, where a large iron ore tailings dam failed. This released over 60 million m³ of contaminated water, containing arsenic, aluminum, lead, copper and mercury, among other elements into the Rio Doce and is one of the worst environmental disasters in Brazil's history.



Costly dewatering and decontamination

Dewatering can be an expensive activity, especially where required for contaminated and/or difficult-to-dewater sediments. Systems may range from spoil-fields and/or lagoons, to expensive processing plants with associated separation, thickening, pressing and storage areas. Many such sediments require chemical coagulation and flocculation prior to or post thickening, to promote effective filter cake formation for the dewatering process. However conventional conditioners can increase the environmental burden in the supernatant water and/or residual solids, leading to increased water and energy requirements as well as other downstream costs and complexity. The total cost of treating and disposing of such sediments can be in the hundreds of euros per ton in some cases.

A cost-effective and efficient alternative

As an alternative, Clariant has developed an innovative method by which dewatering performance, sediment dryness and water quality are substantially improved: Invoque™. Invoque™ uses patented mineral technologies that are safe for the environment and that facilitate enhanced dewatering performance while simultaneously binding trace contaminants within the filter cake. Each Invoque™ solution is specifically tailored for the individual sediment requirements, to achieve the maximum balance of dewatering and contaminant management. Invoque™ uses high specific surface area mineral conditioners that combine to destabilize and flocculate sediments and adsorb contaminants.

Invoque™ is added to the dredged silt and sludge where it »captures« the finest pollutants and particles, causing them to agglomerate into small flocs that hold less water than conventional floc structures and are easier to dewater, forming a dense matrix. The conditioners employed in Invoque™ are benign to the environment and so cause no additional environmental burden beyond what is

already included within the sediment. The Clariant technique is highly efficient and simultaneously very affordable, with lower operating cost and increased opportunities for reuse of water and sediment – and, with a more intense dewatering of the sediment and a more powerful filtering out of contaminants, it provides better results than other solutions. In certain cases, Invoque™ has achieved sediment solids of up to 94 % in just 24 hours, producing an absolutely clear filtrate that is approved for immediate return to the environment.

Less water in the sediment leads to lower weight by volume and the more dense material also results in lower absolute volume. This results in lower space requirements for storage, and fewer vehicle movements (lower logistics costs). Furthermore, the use of minerals generally improves the mechanical properties of the sediments, making them more readily available for second use applications.

The use of Invoque™ for dewatering mine tailings in copper ore mining, for example, led to such good results that the customer was able to substantially offset environmental water discharge concerns and make the recovered material available for re-mining. For the dewatering of coal sludge, Invoque™ also yielded a sediment with a high dryness and high calorific value, which could be recovered for steam generation. Using Invoque™ technology, a large port operator was able to fully offset disposal costs of around EUR 100 per m³ associated with approximately 20 000 tons of sediment, by improving sediment dryness and stability, enabling it to be recovered and reused as a concrete additive in the construction of the container terminal, leading to savings in material costs.



ECOTAIN®

Invoque™ fulfills the criteria of EcoTain®, our approach to sustainability on product level.

Would you like to learn more?



www.clariant.com/Invoque

Cost reduction through intelligent packaging

There is sometimes considerable potential for improvement, even in supposedly simple processes, particularly from the standpoint of sustainability. Up to now, a Clariant operation at the location in Hoechst (Germany) has packaged loose pigment granules manufactured for paints and coatings first in paper bags and then placed several of these 10 kg to 25 kg bags upright in cardboard boxes. Twelve of these boxes were placed in a double row on a wooden pallet and then wrapped with plastic film. These pallets were usually transported from the Clariant warehouse by truck to the customer. The customer opened the boxes, removed the paper bags and poured the contents into their storage container.

This method has required lots of boxes up to now, which led to high costs and produced a significant amount of waste. In addition, the boxes could not be filled without gaps, so a lot of air was also »transported«. Moreover, the boxes made of cardboard were only stackable to a limited extent and one pallet could not be placed on top of another. Each box had to be opened by the customer individually and by hand – which created a risk of injury that should not be underestimated. Moreover, unpacking the boxes meant significant use of staff resources and time.

A project team thus began a pilot project for more economical and sustainable packaging. The starting point was an annual cost in a low single-digit million amount for packaging and transport.

As a solution, instead of boxes, only trays made of cardboard are used now. The paper bags are no longer placed into the cardboard boxes, but merely placed horizontally in a transport tray and then covered with another of the same. After wrapping with plastic film which protects it from water, the result is a very stable construction. Packaging material is saved by eliminating the boxes, then the required storage capacity in warehouses is reduced by 30 % to 50 % because up to three pallets can be stacked on top of one another,

and likewise the unpacking process was simplified for the customer. Higher truck loads through double stacking additionally lowers costs and CO₂ emissions per transported kilogram. At the same time, risk of injury for employees decreased significantly.

The packaging and transportation costs were significantly reduced. Further potential exists by sharing this concept with units currently using similar packing and shipping concepts.

SAVING COSTS IN RECYCLING

The application of Clariant high-performance products allows closing material cycles to a large extent. A very good example is the de-icing fluid Safewing® for aircrafts that fulfills highest sustainability standards. Furthermore, Clariant provides on-site or off-site recycling systems for aircraft de-icing fluid depending on individual airport requirements, with a full service package available from engineering and installation to commissioning, management and operation.

An airport the size of Munich airport with about 400 000 takeoffs and landings per year and about 40 million passengers, using the Clariant closed-loop system, can consequently reduce the expenditures on aircraft de-icing activities by around one million euros per year on average. This approach does not only cut costs, it also reduces waste water and greenhouse gas emissions. On average, 60 % to 70 % of the aircraft de-icing fluids are recycled. Thus, carbon dioxide emissions fall by 15 000 metric tons per year, this corresponds to the emissions caused by a passenger with nearly 30 000 return flights from Munich to London.

Clariant provides not only Munich, but also Oslo's airport with its Safewing® aircraft de-icing fluid as well as its off-site recycling process for aircraft de-icing fluids. As a result, Oslo airport reduces carbon emissions by roughly annual 3 000 metric tons that equals the emission of 4 400 return flights from Oslo to London.



INTEGRATED SUSTAINABLE BUSINESS

Close collaboration with the customers lead to value-added solutions and new business models.

Value-added product characteristics

🔍 LICOCENE

Enables better recycling

The key to environmentally compatible logistics lies in Research & Development. As of 2015, the European automotive industry, for example, must ensure that at least 95 % of the weight of a newly commercialized vehicle is recyclable at end of its life-cycle. In order to achieve the highest possible recovery rate and to make the recovery process itself as energy-efficient as possible, it is certainly important to pay attention to good recyclability of the individual components when building vehicles.

The automotive and aerospace industries require materials that can not only be easily recycled, but are also light, resistant and durable. A vital component in the building of vehicles and aircrafts is carpeting that provides comfort, slip resistance and noise insulation in automobiles and planes. Clariant's research has also developed innovative, sustainable products in this area.

Conventional carpets consist of an average of four layers. The upper layer, also known as the wearing surface, consists of various fiber materials such as wool, cotton or plastic. The primary backing, mainly latex, or acrylic based, to lock the fibers for abrasion resistance and durability. The secondary backing, a cushy foam, or non-woven for comfort and installation purpose, is attached on the reverse side either by water based, reactive, or hot melt systems. This layer construction of different types of polymers does not allow subsequent separation of materials and thus must be disposed of or incinerated.

In contrast, Licocene® Performance Polymers from Clariant, multi-functional polyethylene and polypropylene waxes, eliminate the disadvantages of conventional carpeting (poor recyclability) while simultaneously providing enhanced comfort features. Without

compromising any mechanical or other properties, they can also reduce the weight. When used as hot melt adhesives, these polymers possess an extraordinarily high adhesive strength, bond quickly physically and hence accelerate the bonding process. Automobile or aircraft carpets produced and bonded with Licocene® hot melt adhesives can easily be almost 100 % recycled as pure composites of thermoplastic materials.

Licocene® are a 100 % solid system and do not require any drying equipment. The drying of water based systems is a very energy intensive process which require huge equipment and up to 10 times more energy than the melting and cooling of a hot melt system. Additionally, there is no contaminated waste water involved.

As compared to a traditionally water based textile production, Licocene® does only need a small amount of water for cooling and no energy for drying. While latex dispersions contain up to 70 % of water, there is an additional need for stabilizers and preservatives for anti-mold and anti-bacteria purpose, so it needs to be depolluted after the drying process. 46 500 liters of water and 34 000 kWh of electricity can be saved during production of every one million square meter of a Licocene® reinforced textile.

THE ADVANTAGE OF LESS WEIGHT

The weight saving by using Licocene® is sometimes enormous and contributes significantly to savings in fuel and the resulting environmentally harmful emissions. In an Airbus A380/800, around 70 000 liters of kerosene or 170 000 kilograms of CO₂ emissions are saved in one year by the use of carpet backing made from Licocene®. The low density of Licocene® enables to produce ultralight carpets for aviation with outstanding durability, soundproofing and vibration-absorbing properties in just one coating step.

→ page 102

Planet

FLOWING CHANGE

Photography Jo Röttger, Text Bertram Job

There are days when this river does not look like a problem at all. On the contrary, in fact. As Sam Perkins starts the freshly fueled motor boat in the first light of morning, the water is clear and smooth in front of him. On the blue border between North and South Carolina, the river fills Lake Wylie, a large reservoir, as it travels further south – where a giant carpet of water lilies floats. The water flows past densely overgrown banks, from the Blue Ridge Mountains down to Lake Marion, and passes by the Charlotte metropolitan area during its 320-mile course.

Close to two million people live in the catchment area. Perkins points out that these two million expect almost everything from the Catawba River – everything from contemplative peace to unlimited water for industries, households, and recreational purposes. Perkins, who has a degree in marine science, is a kind of inspector here. »You have to keep an eye on everything,« he says as he pulls a wide headband over his ears to counter the sharp wind. »Otherwise, one day we will potentially have bigger problems here.«

Despite all the joys of being outdoors and in the nature, these excursions are not leisure trips. They are aimed at determining the state and the quality of the river water, which Perkins regularly checks on behalf of a non-profit initiative, the »Catawba Riverkeeper«. It is his employer and his home in spirit, which also provides the boat that he now maneuvers against the current – past two fishermen on a wooden pier, and then past the Clariant factory premises. Once Perkins is near a wastewater treatment plant, he takes a routine water sample.

»I would be cautious about eating the fish caught here,« he says. For him, this concern stems from a variety of sources, including contaminated ash from the last soon-to-be-discarded coal power plants, frequent soil erosion flushing more toxins into the river, and the discharges from some outdated sewage treatment plants.

This has not led to an urgent problem yet, Perkins believes, but there is a reason that the Catawba was at the top of a list of most endangered rivers in the United States a few years ago. In addition, so many people have moved to this area recently, and more continue to come. That's the big challenge. That is why the Riverkeeper brings the region's collective awareness to the issues by holding numerous activities throughout the year. Organizing information days, summer festivals and community garbage removal events.





»Your river depends on you as much
as you depend on the river.«

SAM PERKINS

Riverkeeper, Catawba Riverkeeper Foundation



But having a clean-looking river has more benefits than the aesthetics. This is starting to be understood slowly in the backyard of Charlotte, the second most important financial center in the United States. Beyond the tall office towers in the city of 800 000 residents, a retreat area has become alarmingly popular. The daily flow of commuters feels as intense as that of megacities around peak rush hours. Similarly, the real flow, the one with water, needs to put up with a lot. It also simultaneously needs to give a lot, because so many use it: around a dozen power plants, 24 counties in two states and countless companies.

The Clariant factory is also located directly on the Catawba River. A plant with approximately 150 employees, it is located in Mount Holly, not even 20 miles away from its main office in Charlotte. Intermediate products for personal care, household cleaners, and de-icing materials are manufactured in three production halls. On the opposite side of the river, in Mecklenburg County, Clariant,



or, to be more precise, its previous companies, operated a second plant in which dyes and other agents for jeans and textiles were made until production was stopped in 2005. The facility was retired partially due to environmental problems, such as inherited liabilities from previous operations.

That was the right decision to make, especially for someone like Michael A. Teague, Head of Regional Sustainability & Regulatory Affairs for Clariant in North America. »Industry makes a positive contribution to the economy, but historically, it often left residual impacts on the environment,« he says in retrospect. The Doctor of Chemistry remembers that the Catawba was once called the »Rainbow River« because the textile mills operating at that time allowed their colored waste water to drain into its bed untreated. He was one of the »Change Agents« in the company who continued the dialog early on with the authorities and citizens' initiatives such as Riverkeeper. In doing so, a new path was forged in which profitability and environmental protection were considered equal – for the sake of sustainability.

»We want to be certain that our production does not compromise the river,« says Michael. »We have a footprint here, and we have an obligation.«

These are clear signals of a paradigm shift. Over the years, internal sewage treatment equipment and detention reservoirs have continually been upgraded at the remaining plant in Mount Holly. Here, the waste water is first thoroughly filtered before it is released to the municipal wastewater authority for additional treatment, before ultimately entering the river in a harmless state.

The area around the retired factory is now devoted to new uses. Michael's satisfaction is quickly felt when he shows visitors what has developed in the area since the factory shut down.

ReVenture Park is located there, which builds on the infrastructure of the former factory: an invitation to eco-industrial start-up companies to expand on favorable terms on the repurposed





»We want to be certain that our
production does not compromise
the river.«

MICHAEL A. TEAGUE

Head of Regional Sustainability & Regulatory Affairs North America



grounds. To this end, an independent project manager has entered into a rent-to-buy agreement with Clariant. Gradually, young companies are beginning to settle there. Green duckweed, a biomass source for the production of alternative energy, shimmers on the surface of a heated pond. Silkworms are raised on a plantation with mulberry bushes. Their thread can even be used to strengthen body armor for the US armed forces. There are forward-looking projects made as sustainable as possible in every way.

Closer to the river, there are rolling hills amongst forests and meadows – a nature reserve to which Clariant has also entrusted several hectares to Catawba Lands Conservancy (CLC) for supervision and care. The non-profit land trust puts together these kinds of donations like puzzle pieces in order to preserve the areas along the river from private or commercial use. CLC aims to preserve clean water, biodiversity and local farms as well as to provide public access. Along these lines, CLC also acts as lead agency on a decades-long project – the Carolina Thread Trail – which is expected to weave through 15 counties, joining scenic and historical sites into one picturesque trail.

More than 220 miles of the planned trail network are already established, such as the area near Long Creek, a tributary of the Catawba. Here, the path also runs through the U.S. National Whitewater Center, a lively water sport area where excursionists and top athletes alike race down the artificial whitewater courses in canoes and rafts. Or you can get to the river via a narrow access point where you can try out a canoe similar to what the Catawba Indians used to use for fishing, back during a time when the area was not as populated.

People on the river – this is the exact meaning of »Catawba« in the language of the original inhabitants. This word encompasses everyone: from the hikers and bikers on the »Thread Trail« to the shift workers in Mount Holly, Sam Perkins, the inspector in the green jacket, and Michael Teague, nature enthusiast and facilitator of sustainability. If more people understood the implications of our treatment of water sources, Perkins is convinced they would do more to protect it, because »your river depends on you as much as you depend on the river.« It is just the beginning and a flowing change for the better.

Social
RESPONSIBILITY



Clariant expressly supports UN Global Compact and the United Nations' Universal Declaration of Human Rights (UDHR), also known as the UN Human Rights Charter. The charter comprises general human rights principles, which serve as a joint ideal for all people and nations to ensure that each individual and all bodies of the company constantly strive to promote respect for corresponding rights and freedoms through education and training. National and international measures must thereby guarantee the formal as well as the actual recognition of, and compliance to, human rights. This applies to Clariant also. Accordingly, no complaints about adverse conditions were brought forward against Clariant in the year under review because of adverse effects of company concerns.



This responsibility forms an integral part of the company's philosophy. All Clariant employees are educated and trained to assume responsibility in line with their function, level of authority and qualifications. Clariant places great emphasis on upholding human rights within its sphere of influence. A number of internal regulations as well as Clariant's voluntary commitments in accordance with international charters are designed to safeguard these rights.

Clariant does not focus social engagement on individual showcase projects, but is actively committed to the common good in each and every location in which the Group operates. By structuring clear processes, the applied resources generate the biggest possible benefit for the recipient and Clariant itself with the right priorities. Guidelines help to clearly distinguish what charitable activities, investments in the community and commercial initiatives are. Clariant was involved in numerous projects in 2015, especially in the vicinity of the various production sites. In a very large number of cases, Clariant supports the education, training, and personal development of children and adolescents. In addition, the company also supports numerous activities in the areas of infrastructure, science, art and culture. And often these projects are not one-off events but part of long-term commitments.

Global social ENGAGEMENT

As an integral component of Clariant’s corporate philosophy and corporate social responsibility, the company cultivates and supports a range of pro-active Corporate Citizenship Activities around the globe, whose purpose is to strengthen the positive impact on all people connected with Clariant. The motivation and dedication of Clariant employees make these activities happen.





GLOBAL SOCIAL ENGAGEMENT

Discover more.
[reports.clariant.com/2015/sustainability-report/
social-engagement](https://reports.clariant.com/2015/sustainability-report/social-engagement)

Discover Value

SAFETY AT HOME



»For us, not only the natural properties of the material were important, but also the sustainable processing and environmentally compatible treatment.«

ANN KRISTIN AND NIKO SCHÄFER
Handeloh, Germany

Sustainable and safe building

Wood is becoming increasingly popular as a building material. The reasons for this include the positive product and performance characteristics of this natural material – without significant disadvantages. High stability, relatively low weight and a very positive ecological balance allow more and more houses to be made of wood and wood composites. In order to protect the wood building material against weathering and maintain the natural feel and integrity of the surfaces, the wood must be treated with suitable products. In addition, the risk of fires spreading can be reduced through the use of flame retardants.

How important are safety issues when it comes to your building project?

—
NIKO SCHÄFER Safety is a very important topic particularly with children, and it is something which we have considered during the planning and construction of our house. With proper treatment of the wood, we of course not only want to meet all of the fire safety requirements, but we also want to get the full potential of the positive properties of the wood building material. With the right method of construction and the proper treatment and processing of the wood, we want to meet the highest standards for fire, noise and weather protection.

What motivated you to use wood as a material for your new home?

—
ANN KRISTIN SCHÄFER Wood is a natural building material and has a number of positive properties that occur naturally: high stability and low weight. This provides benefits when conducting the structural analysis for a new building. Walls can be made thinner, allowing for a larger living space using the same floor area. In addition, wood provides a pleasant indoor climate, has good thermal insulation properties and is widely available to a sufficient degree at comparatively low prices.

So sustainability played an important role in the decision to build a wooden house?

—
NIKO SCHÄFER Exactly – because anyone who has children also thinks of the long-term future. For us, not only the natural properties of the material were important, but also the sustainable processing and environmentally compatible treatment. The natural character of the wood should be preserved. The products with which the wood is treated should be natural and solvent-free whenever possible. Only in this way is the very positive ecological balance of the wood maintained during construction as much as possible.

What challenges arose during the construction of a home made of wood?

—
ANN KRISTIN SCHÄFER As a natural building material, wood is subject to change over time. In order to maintain the natural character and feel of the wood for many years, it must be treated with the appropriate resources. In addition, a wooden house presents different requirements for insulation since it is not as impermeable as houses made of other materials. Films in the floors or in the roof can increase this impermeability. At the same time, this can serve to increase fire protection.

SAFETY AND DURABILITY IN THE BUILDING

Clariant offers innovative products that support the properties of wood as a building material: the flame retardant Exolit®, and Ceridust®, which is used as a wood coating made from renewable raw materials. Traditional flame retardants contain harmful chlorine and bromine compounds. Exolit®, however, is a highly effective protection against fire made from polyphosphates and is halogen-free, and therefore does not contain chlorine or bromine. The product has both a very good performance profile as well as an excellent environmental and health profile. For example, Exolit® has flame-resistant properties in its ability to foam. The protective layer then insulates from heat and blocks the supply of oxygen. In this manner, the spread of fire to sensitive building components and potential ignition sources is prevented or at least delayed. In the event of fire, there is significantly less smoke than from many other flame retardants, which allows more time to escape and to fight the fire.

Ceridust® helps protect wood from surface damage. Ceridust® is made from polysaccharides from renewable raw materials that do not compete with the food supply. As a bio-based additive, the product is an innovative solution for a wide range of wood coatings for effective protection of wood. Its suitability for water-based formulations can help manufacturers of coatings in the transition to environmentally compatible solutions. Combined with Hostavin® 3330, a water-based dispersion for UV protection of wood surfaces, a set of sustainable products is available for the wood treatment. The products Hostavin®, Ceridust® 8090 TP/9091 TP as well as a wide range of Exolit® solutions have been awarded the EcoTain® label due to their outstanding performance and sustainability profile.



Quality, performance and safety are of highest priority.

Societal benefits with high-quality products

Clariant does not want to create solely functional or solely high-quality products with its developments. Alongside quality and performance, Clariant wants to offer especially beneficial products, products that offer customers and especially consumers an above-average added value. Areas in which the Clariant products provide specific social benefits include medical and pharmaceutical packaging, mosquito nets with long-term effects, flame retardants or solutions for the food industry, which contribute to improving the quality and lifespan of food.

Protection against malaria infections

The World Health Organization (WHO) estimates that around 3.2 billion people, half of the world's population, are at risk of contracting malaria. Malaria is a widespread and often deadly disease triggered by mosquito-transferred single-celled parasites. It is most commonly found in developing countries. Around half a million people still die each year from the disease, but fortunately the number of new malaria infections and related deaths were reduced by 37% and 60%, respectively, between 2000 and 2015.

An important tool in the fight against malaria is mosquito nets. The WHO recommends nets treated with insecticides that kill mosquitoes on contact, known as insecticide-treated mosquito nets (ITNs). An even more effective type of net are those that last for several years: Long-lasting insecticidal nets (LLINs).

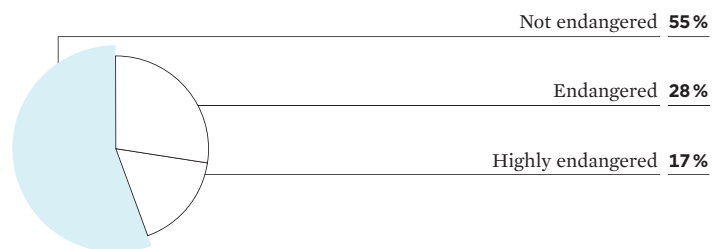
There are fewer than a dozen manufacturers worldwide that offer quality nets certified by the WHO. Clariant has developed a masterbatch technology for LLINs which is regarded as one of the best on the market with respect to bio-efficiency. One criterion used by the WHO is that the nets can be washed at least 20 times without losing their effectiveness, and Clariant's technology enables the nets to meet this requirement.

The masterbatches produced by Clariant are innovative because, in addition to its mechanical protective function, there is an insecticide incorporated into its fibers that kills mosquitoes on contact but is harmless to people. The fiber net has a storage function for the insecticide, making the nets effective for a guarantee of five years.

Through this innovative technology, Clariant is contributing to the global fight against malaria.

PROPORTION OF THE MALARIA-ENDANGERED PEOPLE IN THE WORLD POPULATION (2012)

World population in 2012: 7.2 billion people



Sources: World Health Organization, United Nations

Mold protection

Food spoilage during transportation over long distances is a serious problem. The United Nations Industrial Development Organization (UNIDO) estimates that up to 40 % of the food harvested worldwide each year is lost in transit. Containers used for transport of food and other goods are prone to condensation (so-called container rain) that promotes growth of mold and mildew, odor, changes in taste and texture. Cartons and packing materials are also affected by water, which may impair the sturdiness of the packaging and lead to cargo damage. The safe transportation of food is therefore a critical factor in the fight against global food loss.

To protect against moisture and spoilage during transport, Clariant has developed Container Dri® II, which offers reliable protection against moisture and water damage. The formation of condensation is effectively prevented. Rice or cereals no longer become rotten or moldy. Container Dri® II absorbs up to three times its own weight in water and stores it in a special gel that will not harm the health of consumers or the environment. With a significantly less humid environment, food can be kept for much longer while also decreasing costs and waste.

Container Dri® II from Clariant is completely non-toxic and the saturated dehumidification bags can be disposed of as normal industrial waste. The product offers a high level of safety and is extremely effective for all temperature and humidity ranges. Container Dri® II is already used in the shipping of American food aid for developing countries and dramatically reduces the amount of spoiled grain at the destination.

Healthcare and pharmaceutical packaging

Clariant Masterbatches provides numerous products for the medical and pharmaceutical field: from packaging to medical devices to laxatives. No standard products are delivered, but innovative and efficient solutions. In this manner, Clariant produces packaging that protects medicines and medical devices from any impact due to moisture or oxygen and are therefore essential for the purity and durability of the products. These materials are either directly integrated into the packaging material or added as an additional component such as in the closure stoppers of tablet tubes or in the form of separately enclosed capsules. Clariant is a world leader in this kind of active protective packaging for the pharmaceutical industry with around 32 % market share. Customer trust in the high quality of products plays a crucial role in the pharmaceutical industry.

The polymer product MEVOPUR® (page 69) is excellently adapted for both medical devices such as drug delivery pens, diagnostics, such as blood collection tubes, and bottles and closures used for packaging of pharmaceutical products. A special feature is the ability to supply MEVOPUR® in a variety of colors without undermining the product quality, regulatory requirements and functionality. Color is widely used in the Healthcare sector for identification of the device or drug type that helps protect against mix-ups, and thereby facilitates the work of medical staff and increases patient safety. Clariant has extensive knowledge of modification of polymers for functionality in medical devices and pharmaceutical packaging. This knowledge applied to the MEVOPUR® range offers possibilities to improve sustainability through the reduction of use of materials, reduce friction to improve ease of use of drug delivery devices, protect the polymer during sterilization, and reduce the use of solvent-based inks through laser marking.

Reporting Limits **AND REPORTING STRUCTURE**

Reporting Structure

The headquarters of Clariant AG are located at Rothausstrasse 61 in Muttenz, Switzerland. Clariant AG's business operations are conducted through its Group companies. Clariant AG is a holding company and directly or indirectly owns all Clariant Group companies worldwide. Clariant AG is a stock company under Swiss law with a very diverse shareholder structure. More details about the ownership and holding structure of Clariant AG can be found in Clariant's 2015 Annual Report on page 111. Important key figures about the Clariant Group such as sales, profit, balance structure, employees, research expenditure, etc. can be found in Clariant's Annual Report.

The Clariant Group

Clariant is a globally leading specialty chemicals company offering sustainable and innovative solutions to customers in a wide variety of markets. Meanwhile, Clariant's research and development is directed toward the key trends of our time. Among these are energy efficiency, renewable raw materials, efficient mobility and the maintenance of resources. The business activities of Clariant are divided into four business areas.

The Business Area **Care Chemicals** unites Industrial & Consumer Specialties (ICS) with the operations of New Business Development and the promising Biotechnology business. This Business Area supports customers in improving product characteristics of personal care products or crop protection solutions, for example. Clariant offers with GlucoPure innovative home care products that are to a high extent based on renewable raw materials without compromising on performance (page 35).



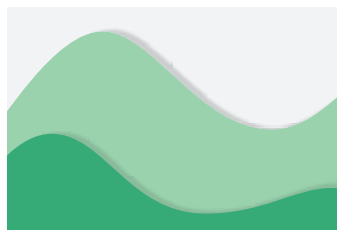
Further information on
the Business Area
Care Chemicals in
Annual Report 2015
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The Business Area **Catalysis** offers a broad portfolio of catalysts which allow the use of alternative raw materials such as natural gas, coal and biomass. 90 % of all chemical processes require catalysts. EnviCat® helps reduce harmful nitrous oxide emissions (page 29).



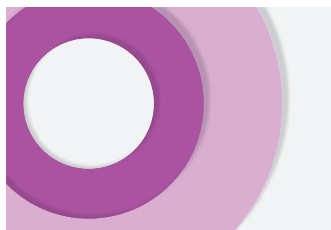
Further information on
the Business Area
Catalysis in Annual Report
2015
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The Business Area **Natural Resources** comprises Oil & Mining Services and Functional Minerals. Oil & Mining Services supports customers on step change innovative solutions that ensures that oil and mining companies alike can produce more efficiently, economically and sustainably. Functional Minerals offers products and solutions for industrial manufacturing and purification processes, as in the refining of edible oils and metal casting. Clariant helps to drastically reduce emissions in foundries with LE Technology (page 80).



Further information on
the Business Area
Natural Resources in
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The Business Area **Plastics & Coatings** comprises the Business Units Additives, Masterbatches and Pigments. This Business Area develops products for customers in diverse industries – from the packaging industry to the electrical and electronics industry to the paint and coatings industry. A typical application example of this Business Area are Easy Dispersible (ED) pigments that are used for example in road markings (page 67).



Further information on
the Business Area
Plastics & Coatings in
Annual Report 2015
→ page 86

The Clariant Group is active in a multitude of countries with production and operating facilities or representations. For a relevant overview, see Clariant's 2015 Annual Report on pages 209 ff. Clariant markets and sells its products worldwide. In the past years, Clariant has increased the geographical diversification of its business and reached a significant sales growth in the emerging countries (also see the Clariant 2015 Annual Report on page 53). There were no essential changes in Clariant's Group structure or Business Areas in the 2015 year under review.

The Clariant online report covers all material indicators according to the GRI Guidelines (reports.clariant.com/2015/sustainability-report/gri). The topics/indicators we have identified as material to report on can be found on page 28; all points listed therein will be considered either in the printed report and/or in the online report. The materiality of the relevant aspects is presented in the chapter entitled Sustainability Strategy. Topics within the G4 profile that have little or no relevance to Clariant or its stakeholders are mentioned, but not discussed in detail. This Clariant Sustainability Report encompasses all Group companies and plants (provided Clariant owns more than half of the shares), as well as all relevant business and subject areas. An overview of the most important Clariant AG Group companies can be found on pages 209 ff. of the 2015 Clariant Annual Report. No restrictions are made unless specifically identified. The representation of the sustainability areas and activities in this report cover all major issues for Clariant. There were no essential changes or corrections in 2015 compared

to prior Clariant Sustainability Reports. This report was prepared with the utmost care following an in-depth evaluation. This is so that Clariant can present a balanced picture of its sustainability efforts.

The reporting period of this Sustainability Report comprises 1 January through 31 December 2015 and is therefore identical to the financial year of Clariant. Clariant's Sustainability Report is currently published on an annual basis within the first four months following the reporting year. The last sustainability information published on Clariant in printed form was made available in March 2015 as part of the 2014 Sustainability Report.

Questions about this report should be addressed to: Group Communications, Daniel Kaufmann, Tel.+ 41 61 469 54 79, and Investor Relations, Anja Pomrehn, Tel.+ 41 61 469 67 45. Inquiries via e-mail to sustainability@clariant.com. Website www.clariant.com. Orders for this report may be placed on the Clariant website: www.clariant.com or sent in writing to the following address: Clariant International AG, Investor Relations, Rothausstrasse 61, 4132 Muttenz, Switzerland. An external assurance has been conducted for this Report by PricewaterhouseCoopers (page 113).

GRI

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¹ external assurance of report content (see page 113)

² no external assurance of report content

AR = Annual Report

■ UN Global Compact

● For details see the Online Sustainability Report <http://reports.clariant.com/2015/sustainability-report/gri>

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DIMENSION		UNGC/GRI	PAGE
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¹ external assurance of report content (see page 113)

² no external assurance of report content

AR = Annual Report

■ UN Global Compact

● For details see the Online Sustainability Report <http://reports.clariant.com/2015/sustainability-report/gri>

Independent Assurance Report on the Clariant Sustainability Reporting 2015

To the Board of Directors of Clariant AG, MuttENZ

We have been engaged to perform assurance procedures to provide limited assurance on sustainability indicators in relation to the sustainability reporting of Clariant AG and the consolidated subsidiaries («Clariant») for the year ended 31 December 2015.

Scope and Subject matter

Our limited assurance engagement focused on the following data and information disclosed in the Sustainability Report:

- a) The quantitative 2015 sustainability indicators (Environmental key indicators on F2, Raw material procurement according to regions on p. 51, Supplier sustainability assessments on p. 50 – 51, Accident numbers on p. 62, Process safety event rate on p. 65, Hours of training on p. 65 and Social key indicators on F7) disclosed in the Sustainability Report 2015 of Clariant; and
- b) The management and reporting processes to collect and aggregate the data as well as the control environment in relation to the data aggregation of these data.

Criteria

The reporting criteria used by Clariant are described in the internal reporting guidelines and define those procedures, by which the sustainability indicators are internally gathered, collated and aggregated. The internal guidelines are based on the G4 Sustainability Reporting Guidelines issued by the Global Reporting Initiative (GRI).

The accuracy and completeness of sustainability indicators are subject to inherent limitations given their nature and methods for determining, calculating and estimating such data. Our assurance report should therefore be read in connection with Clariant's internal guidelines, definitions and procedures on sustainability reporting. Further, the greenhouse gas quantification is subject to inherent uncertainty because of incomplete scientific knowledge used to determine emissions factors and the values needed to combine emissions of different gases.

Responsibilities and Methodology

The Board of Directors of Clariant is responsible for both the subject matter and the criteria as well as for selection, preparation and presentation of the information in accordance with the criteria. Our responsibility is to form an independent conclusion, based on our limited assurance procedures, on whether anything has come to our attention to indicate that the sustainability indicators are not stated, in all material respects, in accordance with the reporting criteria.

We planned and performed our procedures in accordance with the International Standard on Assurance Engagements (ISAE) 3000 (revised) «Assurance engagements other than audits or reviews of historical financial information» and with ISAE 3410 «Assurance Engagements on Greenhouse Gas Statements». These standards require that we plan and perform the assurance engagement to obtain limited assurance on the identified sustainability indicators.

A limited assurance engagement is substantially less in scope than a reasonable assurance engagement in relation to both the risk assessment procedures, including an understanding of internal control, and the procedures performed in response to the assessed risks. Consequently, the nature, timing and extent of procedures for gathering sufficient appropriate evidence are deliberately limited

relative to a reasonable assurance engagement and therefore less assurance is obtained with a limited assurance engagement than for a reasonable assurance engagement.

Independence and quality controls

We have complied with the independence and other ethical requirements of the Code of Ethics for Professional Accountants issued by the International Ethics Standards Board for Accountants, which is founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behavior.

Our firm applies International Standard on Quality Control 1 and accordingly maintains a comprehensive system of quality control including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

Summary of work performed

Our limited assurance procedures included, but were not limited to the following work:

- Reviewing the application of Clariant's internal guidelines
- Interviewing personnel responsible for the collection and reporting of the sustainability indicators at Clariant sites in the U.S.
- Performing tests on a sample basis of evidence supporting the sustainability indicators as outlined in the scope and subject matter section concerning completeness, accuracy, adequacy and consistency
- Inspecting the relevant documentation on a sample basis
- Reviewing and assessing the management reporting processes for sustainability reporting and consolidation and their related controls

We have not carried out any work on data other than outlined in the scope and subject matter section as defined above. We believe that the evidence we have obtained is sufficient and appropriate to provide a basis for our assurance conclusions.

Limited Assurance Conclusion

Based on the procedures we performed, nothing has come to our attention that causes us to believe that

- a) The quantitative 2015 sustainability indicators of Clariant as described in the scope and subject matter section are not prepared and disclosed in all material respects in accordance Clariant's internal guidelines and procedures and the underlying GRI G4 Sustainability Reporting Guidelines; and
- b) The management and reporting processes to collect and aggregate the data as well as the control environment in relation to the data aggregation are not functioning as designed.

Basel, 18 March 2016

PricewaterhouseCoopers AG



Dr. Marc Schmidli



Raphael Rutishauser

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Note About Forward-Looking Statements

This report contains forward-looking statements based on current assumptions and projections made by management. Such statements are subject to known and unknown risks, uncertainties and other factors which may cause the actual results and performance of Clariant International Ltd to differ from those expressed in, implied or projected by the forward-looking information and statements. The information published in this report is provided by Clariant International Ltd and corresponds to the status as of the date of publication of this report.

Disclaimer

Clariant International Ltd publishes Sustainability Reports in English and in German. The English version is legally binding.

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climate neutral

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»The Together for Sustainability initiative allows us to leverage an industry-wide approach and state-of-the-art capabilities – significantly enhancing the sustainability evaluation of our suppliers while saving cost, time, and resources.«

NORBERT MERKLEIN

Head of Group Procurement Services



Integrated Sustainable
Business

»With locations around the world, we can offer personalized expertise and are in a prime position to react quickly and meet customer needs.«

DERYA OZER

Technical Marketing Manager EMEA

SUSTAINABLE PRODUCT PORTFOLIO

> 80

products received the EcoTain® label at the end of 2015

76 %

of the portfolio meet Clariant's intended sustainability standard

EMPLOYEES

140 000

hours of training attended by employees in 2015

0.17

LTAR at all-time-low

»The CompTox Suite marks
a milestone in the assessment
of chemical substances.«

RÜDIGER WALZ

Head of Product Stewardship

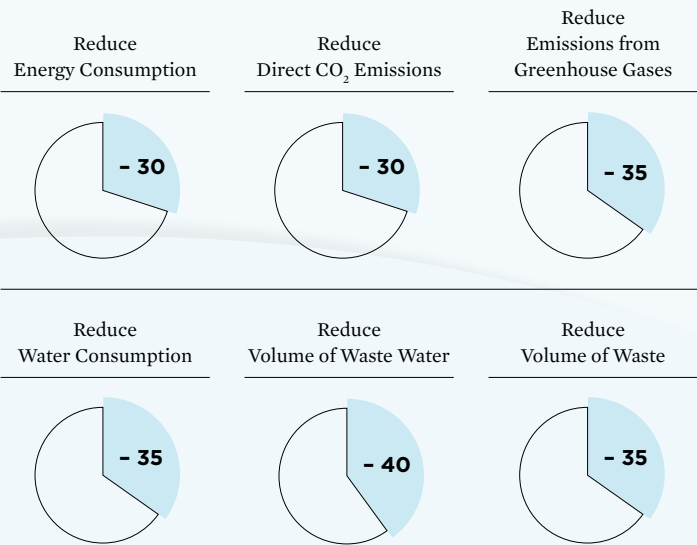


Performance
Advantages



Safe Use, Transparency
and Information

ENVIRONMENTAL TARGETS 2025 in % (per t produced goods)

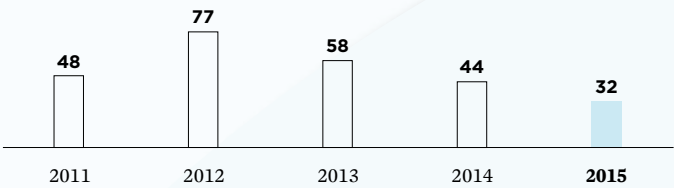


Social

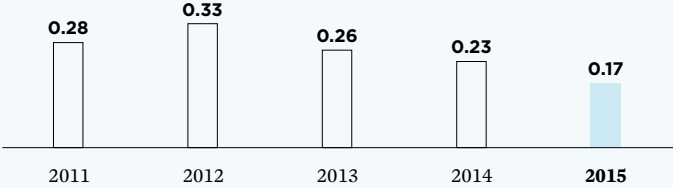
KEY INDICATORS

LOST TIME ACCIDENTS

Occupational accidents with at least one day's work lost



OCCUPATIONAL ACCIDENTS IN RELATION TO OUTPUT LTAR¹



¹ LTAR = Lost Time Accident Rate (the ratio of the number of occupational accidents where at least one day's work was lost to every 200 000 hours of work)

EMPLOYEES BY REGION IN 2015



KEY FIGURES

	2015	2014
Employees (FTE)	17 213	17 003
Personnel expenses (in CHF m)	1 345	1 458
Training hours	140 000	90 000
Age structure (%)		
< 30	14.5	13
30 – 50	61.1	63.4
> 50	24.4	23.6

EMPLOYEES BY CATEGORY AND GENDER IN 2015

Employee Category	Gender	FTE	in %
Management (Level 1 – 5)		817	4.7
	Female	104	0.6
	Male	713	4.1
Employees (Non-ML)		8 986	52.2
	Female	3 047	17.7
	Male	5 939	34.5
Worker		7 410	43.1
	Female	604	3.5
	Male	6 806	39.5
Total		17 213	100

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