Management's Report

Responsibility along the value chain — Suppliers

Responsibility along the value chain
Suppliers

Our objective is to secure competitive advantages for BASF through professional procurement structures. Our suppliers are an important element of our value chain. Together with them, we aim to create value and minimize risks.

Strategy

With our sustainability-oriented supply chain management, we contribute to risk management by clarifying our expectations and standards for our suppliers, and by supporting them in carrying out our specifications. We count on reliable supply relationships and want to make our suppliers’ contribution to sustainable development transparent. In order to achieve this, we set ourselves an ambitious goal: By 2020, we aim to evaluate the sustainability performance of 70% of the BASF Group’s relevant suppliers1 pursuant to our risk-based approach and develop action plans for any necessary improvements. The proportion of evaluated relevant suppliers was at 32% by the end of 2016. Furthermore, our Procurement competence center supports BASF’s business units in developing solutions to stand out from the competition in addressing customers’ market-specific requirements.

2020 Goal

<table>
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<th>Percentage of relevant suppliers evaluated for their sustainability performance</th>
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<td>70%</td>
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What we expect from our suppliers

- Global Supplier Code of Conduct
- Country-specific risk analysis forms basis of new supplier selection

Both new and existing suppliers are selected and evaluated not only on the basis of economic criteria, but also on environmental, social and corporate governance standards. Our Supplier Code of Conduct is founded on internationally recognized guidelines, such as the principles of the United Nations’ Global Compact, the International Labor Organization (ILO) conventions and the topic areas of the Responsible Care Initiative. The Code of Conduct covers compliance with human rights, labor and social standards, and antidiscrimination and anticorruption policies in addition to protecting the environment. The Code is available in 26 languages.

A country-based risk analysis forms the basis of our selection process for new suppliers. As a result of the country-related risks identified in South America and Asia, we queried around 2,100 suppliers in 2016 on their commitment to the values of our Supplier Code of Conduct. We moreover provided training to a total of 267 suppliers with an elevated sustainability risk, especially in Asia and South America, in 2016.

In addition, we instructed 292 procurement employees on sustainability-oriented supplier management. These are ways in which potential supply chain risks can be identified and minimized together with our suppliers.

Worldwide procurement

From our suppliers, we obtain raw materials, technical goods, and services – from technical to logistics and building facility services. BASF acquired raw materials, goods and services for our own production totaling approximately €34 billion in value from more than 70,000 suppliers around the world in 2016. Around 90% of this was locally sourced. With regard to our suppliers, there were no substantial changes in our value chain in 2016.

Evaluating our suppliers

- “Together for Sustainability” initiative aims to harmonize and standardize supplier assessments and audits
- 104 raw material supplier sites audited

BASF is a founding member of the Together for Sustainability (TfS) initiative of leading chemical companies for the global standardization of supplier evaluations and auditing. With the help of TfS, we promote sustainability in the supply chain. The initiative aims to develop and implement a global program for the responsible supply of goods and services and improve suppliers’ environmental and social standards. The evaluation process is simplified for both suppliers and TfS member companies by a globally uniform questionnaire. The initiative’s members conducted a total of 1,773 sustainability assessments and 241 audits in 2016. Membership has tripled since the initiative was founded; there were 19 members in 2016.

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1 We define relevant suppliers as those showing an elevated sustainability risk potential as identified by risk matrices and with respect to corresponding country risks. Our suppliers are evaluated based on risk due to the size and scale of our supplier portfolio.
We conducted a Supplier Day in Mumbai, India, in 2016 as part of the TfS initiative. TfS also provided training to suppliers at the annual China Petroleum and Chemical Industry Federation (CPCIF) Conference in Shanghai, China, in order to strengthen awareness for sustainability in the region.

Using TfS evaluations, we pursue a risk-oriented approach with clearly defined, BASF-specific follow-up processes. We drive these processes through a sustainability-oriented IT tool. Suppliers with an elevated sustainability risk are identified using risk matrices. Furthermore, our purchasers indicate the suppliers for whom they see a potentially elevated sustainability risk. We additionally check various information sources to see if any suppliers have been observed in connection with negative sustainability incidents. Based on these analyses, we audited a total of 104 raw material supplier sites on sustainability standards and had 551 sustainability assessments conducted by an external service provider in 2016.

If we identify potential for improvement, we support suppliers in developing measures to fulfill our standards. We conduct another review according to a defined timeframe based on the sustainability risk measured. If the weak points discovered were particularly severe and we are unable to confirm any improvement, we reserve the right to terminate the business relationship. This occurred in two cases in 2016. We use this approach to evaluate suppliers with an elevated sustainability risk at least every five years. The approach itself is reviewed every two years to identify possibilities for optimization.

Audit results

Our audits have revealed some deviations with respect to working hours and payment of the minimum wage, especially in China. Here, we have called for improvements on the part of our suppliers. None of our 2016 audits identified instances of child labor. For the suppliers we reviewed, persons under 18 were excluded from overtime and dangerous work; we found one case of unauthorized night work. We did not find any incidences of forced labor in 2016.

In August 2012, during an extended mining strike involving workers of the London-based platinum supplier Lonmin Plc in Marikana, South Africa, the conflict escalated and culminated in a violent confrontation between mine workers and armed South African police. Lonmin mine workers were among the fatalities. In June 2015, the Farlam Report commissioned by the South African government was released on the incidents.1 BASF undertook a thorough examination of the issues raised. We intensified our regular exchange with both Lonmin and with local stakeholders, such as leading industry and human rights representatives. Discussions included Lonmin’s measures for improving the living conditions of its workers.

At the end of 2015, BASF had an Environment, Social, Governance audit conducted at Lonmin by an internationally recognized audit firm, in accordance with enhanced TfS requirements. In the process, deficits were detected in areas such as the grievance process for workers and residents, as well as safety and security. Based on the results, BASF enhanced the questionnaire and expanded it with a view to industry-specific challenges in the mining sector. A follow-up audit conducted in January 2017 is currently being evaluated. We will use our sphere of influence within the platinum value chain to create awareness for industry-specific challenges and develop approaches for solutions together.

1 The Farlam Report found that the actions of the South African police forces and the striking miners were the primary cause of the violence. The Report also questioned whether Lonmin had used its best endeavors to prevent the incident.
Raw materials

Responsible resource management is an integral part of our strategy. It is applied within the company through our Verbund concept, our innovative products and the use of renewable raw materials. In the search for alternative raw materials, we employ solutions that contribute to sustainability.

Strategy

The Verbund system is an important component of our resource efficiency strategy: The by-products of one plant often serve as feedstock elsewhere, thus helping us to use raw materials more efficiently. In 2016, BASF purchased a total of around 30,000 different raw materials from more than 6,000 suppliers. Some of our most important raw materials are naphtha, natural gas, methanol, ammonia and benzene. In addition to fossil resources, we also employ renewable raw materials. We use these to manufacture products that either cannot be made with fossil resources, or only at significantly greater expense. Renewable raw materials also give us the opportunity to expand our raw material basis. Depending on the application, the better solution can be fossil or renewable raw materials; renewable raw materials are not per se sustainable, but can contribute to sustainability by, for example, reducing greenhouse gas emissions.

Renewable resources

■ Joint venture with Avantium
■ Numerous projects to improve sustainability along the value chain

In 2016, around 5.4% of the raw materials we purchased worldwide were from renewable resources. To make the use of these materials more competitive, we work on product innovations based on renewable raw materials as well as on enhancing production processes in reaction technology and preparation.

We also further established our “biomass balance” approach on the market in 2016. The goal here is to replace natural gas and naphtha at the beginning of the value chain with biogas and bio-naphtha from certified sustainable production. Should a customer select a biomass-balanced product, the proportion of renewable feedstock to be used is calculated based on the formulation. The calculation is certified by an independent third party (TÜV SÜD). Our Verbund production ensures that the properties and quality of all end products remain unchanged and that our customers can use them as usual. This method has already been applied for more than 40 BASF products – for example, for superabsorbents, dispersions, plastics such as polyamides and polyurethanes, and for intermediates available on the market as “drop-in products.” These can be used in place of previously employed products in the production process without having to change the process itself.

Together with Avantium, BASF established the Amsterdam-based Syrvinia C.V. joint venture in 2016 to produce and market furandicarboxylic acid (FDCA) from renewable resources. FDCA is a key chemical component of polyethylenefuranoate (PEF), which will also be marketed by the joint venture. PEF has a broad application profile and is especially suitable for producing certain food packaging materials, such as films and plastic bottles. Compared with conventional plastics, PEF demonstrates higher barrier properties for gases like carbon dioxide and oxygen, leading to a longer shelf life for packaged products. In addition, its higher degree of mechanical strength allows for thinner – and therefore lighter – packaging. We also offer our customers 1,4-butanediol (BDO) on a commercial scale using sugars as a renewable feedstock, based on a licensing agreement with the company Genomatica Inc., headquartered in San Diego, California. We use BDO to produce bio-based polytetrahydrofuran 1000 (PolyTHF® 1000), which primarily serves as a chemical component in thermoplastic polyurethane (TPU), an ingredient used to manufacture skis and roller skates, shoe soles, dashboard films in the automotive industry, and other products.

Palm oil, palm kernel oil, and their derivatives are some of our most important renewable raw materials. We want to ensure that the raw materials stem from sustainable, certified sources and actively support the Roundtable on Sustainable Palm Oil (RSPO). Based on the voluntary commitment to sustainably source palm oil products that we expanded in 2015, we increased our purchase of certified palm kernel oil by around 32,000 metric tons to 158,000 metric tons in 2016. In addition, our new BASF Palm Sourcing Policy addresses the requirements for protecting and preserving forests and peatland, along with the involvement of local communities in decision-making processes, and we began its implementation together with our suppliers in 2016.

We have intensified our dialog with partners along the value chain. In order to involve smallholder farmers and improve their living conditions, BASF and Henkel are working together with the development organization Solidaridad to provide training for around 5,500 farmers in Indonesia. BASF also advanced the RSPO certification of its sites for cosmetic ingredients. In 2016, 19 production sites worldwide were already RSPO certified. Our goal is to only source palm oil and palm kernel oil with RSPO certification, provided it is available on the market. This voluntary commitment has been expanded to include the most important intermediate products based
on palm oil and palm kernel oil up to 2025; these include fractions and primary oleochemical derivatives as well as edible oil esters.

We successfully completed our joint project with Cargill and the German governmental agency for international cooperation (Gesellschaft für Internationale Zusammenarbeit, or GIZ) on the sustainable production of coconut oil in the Philippines in 2015. Since then, small-holder farmers have been producing the world’s first Rainforest Alliance-certified dried coconut meat (copra), from which the oil is extracted. In a follow-up project, BASF is working together with Cargill, Proctor & Gamble and the GIZ to support the expansion of a certified and transparent supply chain for coconut oil in the Philippines and Indonesia. The project is being financed in part by the “develoPPP.de” program of the German Federal Ministry for Economic Cooperation and Development (BMZ). The project is also expected to result in improved income and living standards for around 3,600 small farmers.

BASF signed a contract in 2016 together with Arkema and Jayant Agro, along with the non-governmental organization Solidaridad, to promote sustainability in the castor oil supply chain. With the Sustainable Castor Initiative – Pragati, the project members want to improve the livelihood of castor oil farmers and their employees in India by helping them optimize their yield and reduce the impact on the environment. Furthermore, a sustainability code is being developed that will enable Indian farmers to offer the first certified sustainable castor oil on the global market. The project is initially scheduled to run for three years.

For more on the Biomass Balance Approach, see page 62
For more on palm (kernel) oil, see page 68
For more on our voluntary commitment to palm oil products, see basf.com/en/palm-dialog

Mineral raw materials

We procure a number of mineral raw materials, like precious metals, that we use to produce process and mobile emissions catalysts. In suspected cases, we track the origins of minerals – as defined in the Dodd-Frank Act – to see if they come from mines in conflict regions. We reserve the right to conduct an external audit and, if necessary, terminate our business relationship. The suppliers addressed have confirmed to us that they do not source minerals matching this definition of conflict minerals from the Democratic Republic of the Congo or its neighboring countries.

BASF is observing the current development of a European regulation on conflict minerals that creates obligations for importers and processors of mineral raw materials originating from conflict regions.
Environment, health, safety and security

Responsible Care Management System

We act responsibly as an integral part of society and have set out the framework for our voluntary commitments in our Responsible Care Management System. We never compromise on the safety and security of our employees, contractors and neighbors as well as our facilities, transportation and products, and the environment.

Strategy

- Worldwide safety initiatives foster awareness of workplace safety
- Ambitious goals for safety, security, health and environmental protection

BASF’s Responsible Care Management System comprises the global rules, standards and procedures for safety, security, health and environmental protection for the various stations along our value chain. Our regulations cover the transportation of raw materials, activities at our sites and warehouses, and distribution of our products as well as our customers’ application of the products. Specifications for implementing these measures are laid out in binding directives that are introduced in consultation with employee representatives. These describe the relevant responsibilities, requirements and assessment methods. At our sites, we cover energy and climate protection through, for example, our energy management.

We regularly conduct audits to monitor our performance and progress. We use the findings from these audits for continual improvement.

We set ourselves ambitious goals for safety, security, health and environmental protection. Our policies and requirements are constantly updated.

We assess the potential risks and weak points of all our activities – from research to production and logistics – and the effects of those on the safety and security of our employees, the environment or our surroundings. In our databases, we document accidents, near misses and safety-related incidents at our sites as well as along our transportation routes; appropriate measures are derived according to specific cause analyses. We foster awareness of workplace safety in every individual with our worldwide safety initiatives.

Audits

- 121 safety, security, health and environmental protection audits performed at 80 sites

Regular audits help ensure that standards are met for safety, security, health and environmental protection. We conduct audits at BASF sites and at companies in which BASF is a majority shareholder. We have defined our regulations for Responsible Care audits in a global Group requirement. During our audits, we create a safety and environmental profile that shows if we are properly addressing the existing hazard potential. If this is not the case, we agree on measures and conduct follow-up audits on their implementation.

Our internal audit system complies with the standards for external auditing procedures ISO 19011 and OHSAS 18001. Worldwide, 155 BASF production sites are certified in accordance with ISO 14001 (2015: 180)\(^1\). In the BASF Group in 2016, 121 environmental, safety and security audits were carried out at 80 sites, along with 37 short-notice audits on various topics at 33 sites. We audited 30 sites with respect to occupational medicine and health protection.

For more on Responsible Care, see basf.com/en/responsible-care

Costs and provisions for environmental protection in the BASF Group (million €)

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<thead>
<tr>
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<th>2016</th>
<th>2015</th>
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<tr>
<td>Operating costs for environmental protection</td>
<td>1,011</td>
<td>962</td>
</tr>
<tr>
<td>Investments in new and improved environmental protection plants and facilities(^2)</td>
<td>206</td>
<td>346</td>
</tr>
<tr>
<td>Provisions for environmental protection measures and remediation(^3)</td>
<td>588</td>
<td>538</td>
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\(^1\) Investments comprise end-of-pipe measures as well as integrated environmental protection measures.
\(^3\) Values shown refer to December 31 of the respective year.

For more on occupational safety and health protection, see page 98 onward

\(^1\) In addition to changes in the site portfolio, the decrease mainly resulted from the sites’ aim to be certified in accordance with ISO 50001 due to our energy efficiency goal.
Transportation and storage

Our regulations and measures for transportation and warehouse safety cover the delivery of raw materials, the storage and distribution of chemical products among BASF sites and customers, and the transportation of waste from our sites to the disposal facilities.

Strategy

In 2014, we had already nearly achieved the BASF Group goal of reducing the number of worldwide transportation accidents per 10,000 shipments by 70% from 2003 to 2020. Therefore, in our reporting on transportation incidents, we have focused since 2015 on dangerous goods spillages that significantly impacted the environment. We report on dangerous goods leaks of BASF products in excess of 200 kilograms on public transportation routes, provided BASF arranged the transport.

Transportation incidents

We recorded two incidents in 2016 with spillage of more than 200 kilograms of dangerous goods (2015: 2). None of these transportation incidents had a significant impact on the environment (2015: 0).

Accident prevention and emergency response

- Dangerous goods inspections expanded in contract management system
- Inspection program introduced for container barges

In order to ensure that our processes are even safer and create globally uniform standards, we introduced extended dangerous goods checks into our order management system in 2016.

We broadened the training opportunities for our employees and added new e-learning modules, such as the introduction of a multilingual training module in Europe on the road transportation of hazardous goods.

We stipulate worldwide requirements for our logistics service providers and assess them in terms of safety and quality. In 2016, we evaluated around 370 companies in all regions. Our experts use our own evaluation and monitoring tools as well as internationally approved schemes.

We added container barges to our existing inspection program in 2016. This includes not only evaluating the vessels themselves, but also the management systems of the shipping companies to review their safety standards.

We regularly evaluate the risks in transporting raw materials with high hazard potential using our global guideline. It is based on the guidelines of the European Chemical Industry Council, CEFIC.

Activities in external networks

We are actively involved in external networks, which quickly provide information and assistance in emergencies. These include the International Chemical Environmental (ICE) initiative and the German Transport Accident Information and Emergency Response System (TUIS), in which BASF plays a coordinating role. In 2016, we provided assistance to other companies in 176 cases worldwide. We apply the experience we have gathered to set up similar systems in other countries: For example, we intensified our activities in South America in 2016.

For more, see basf.com/distribution_safety and basf.com/emergency_response
Production

We never compromise on safety. For occupational and process safety as well as health and environmental protection and corporate security, we rely on comprehensive preventive measures as well as on the involvement of all employees and contractors. Our global safety and security concepts serve to protect our employees, contractors and neighbors as well as to prevent property damage and protect information and company assets. In this way, we help prevent injury, production outages and environmental damage.

Strategy

- Global safety standards
- Strengthening risk awareness

We have set ourselves ambitious goals for occupational and process safety as well as health protection. We stipulate globally mandatory standards for safety, security and health protection. A worldwide network of experts supports us in their implementation. Tried-and-true processes and solutions are documented and made globally available through networks and structured exchange. We regularly conduct audits on safety, security, health and environmental protection in order to monitor progress toward our goals. Risk-conscious working behavior is promoted for every individual through measures like systematic hazard assessments, specific qualification measures and global safety initiatives. Based on our corporate values, leaders serve as safety role models for our employees. Together, they contribute to the constant development of our safety culture.

Global safety initiative

- Process safety and information protection at Global Safety Days

With our global safety initiative begun in 2008, we have created the conditions necessary for the continuous development of a safety culture. Process safety and information protection were the main theme of our 2016 Global Safety Days, carried out in more than 860 activities at around 350 sites. Topics included product spillage prevention; reducing environmental, health and safety hazard potential; and proper conduct in handling sensitive information. More than 75,000 employees and contractors around the world took active part. This commitment and vigorous exchange make a major contribution to our safety culture. At the Ludwigshafen site, employees and contractors can obtain continuous further education on diverse safety and security topics at our training center. The training center was opened as part of our 2010 safety initiative; more than 19,000 participants received training there in 2016.

For more on the global safety initiative, see basf.com/global-safety-initiative

Occupational safety

- Employees and contractors worldwide instructed on safe behavior
- Fire at North Harbor in Ludwigshafen

We have made it our goal to reduce the worldwide lost-time injury rate per one million working hours to 0.5 at most by 2025. To this end, we promote risk-conscious behavior and safe working practices for every individual, particularly through regular communication, systematic risk assessments, specific qualification measures and our worldwide safety initiatives.

We recorded around 118,000 enrollments in occupational safety training courses worldwide in 2016. These seminars comprise not only legally stipulated instructions, but also courses on safe procedures to strengthen our employees’ risk-aware behavior and prevent work-related accidents.

2025 Goal

Reduction of worldwide lost-time injury rate per one million working hours

\[ \leq 0.5 \]

In 2016, 1.4 work-related accidents per one million working hours occurred at BASF sites worldwide (2015: 1.4), raising the rate of chemical-related accidents to 9% (2015: 8%). The rate of work-related accidents per one million working hours for contractors was at 1.5 in 2016 (2015: 1.4\(^1\)). Unfortunately, there were four incidents in 2016 with a total of seven fatalities (2015: two fatal work-related accidents). BASF is performing a comprehensive analysis of the incidents and using the findings to derive appropriate measures.

During maintenance work in Camaçari, Brazil, an employee of a crane company suffered fatal injuries when the crane he was operating tipped over. In May, an employee of an external company hired by BASF to perform maintenance work in Yeosu, South Korea, died from the effects of phosgene exposure. The cause of the accident was investigated by BASF and the relevant Korean authorities. In February 2017, the court responsible for the case ruled that the accident was attributable to carelessness on the part of individual employees.

\(^1\) The 2015 figure was adjusted to reflect a revised hour-counting method for contractors in Asia.
Although the court did not identify any technical or process defects, a small monetary penalty was nevertheless imposed on BASF. After the accident, BASF reviewed the safety measures and processes at all of its isocyanate production sites worldwide and once again clarified these to employees. An employee of a subcontractor succumbed to his injuries after falling through a roof opening in Kuan Yin, Taiwan, in July.

In October, three employees of the BASF fire department lost their lives in an accident at the North Harbor of the Ludwigshafen site, along with one barge crewman on a tanker moored in the harbor. BASF had contracted a specialist company for pipeline construction to perform scheduled preventive maintenance on an emptied and secured propylene line at the North Harbor. Several pipeline sections were to be replaced. A fire broke out during the work, leading to an explosion and ensuing fires in other pipelines. Six of the severely injured were discharged from the hospital in December; another was kept in the hospital for inpatient treatment. Light injuries were sustained by 22 people in the accident. The district attorney’s office of the city of Frankenthal is investigating the accident.

BASF is supporting assessors and authorities in their inspections and has also hired an independent expert to analyze the causes of the accident.

For more on the fire in Ludwigshafen, see basf.de/fire-northharbor

For more on occupational safety, see basf.com/occupational_safety

Lost-time injury rate per one million working hours

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<tr>
<td>Rate</td>
<td>3.3</td>
<td>1.9</td>
<td>1.7</td>
<td>1.4</td>
<td>1.5</td>
<td>1.4</td>
<td>1.4</td>
<td>0.5</td>
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Health protection

- Focus in 2016: heart attack and stroke prevention
- Global standards for occupational medicine and health protection

Our worldwide standards for occupational medicine and health protection are specified in a directive that is implemented by a global network of experts. Our global health management serves to promote and maintain the health and productivity of our employees. This was supported by numerous emergency drills and health promotion measures in 2016.

We measure our performance in health protection using the Health Performance Index (HPI). The HPI comprises five components: confirmed occupational diseases, medical emergency drills, first aid, preventive medicine and health promotion. Each component contributes a maximum of 0.2 to the total score. The highest possible score is 1.0. Our goal is to reach a value of more than 0.9 every year.

With an HPI of 0.96, we were once again able to fulfill the ambitious goal of exceeding 0.9 each year (2015: 0.97). Our 2016 global health campaign for employees centered on heart attack and stroke prevention. To obtain a self-evaluation of their heart’s age and their risk of heart attack and stroke, our employees filled out around 32,000 questionnaires worldwide. The offer included personal recommendations for individual risk factors and contact with a physician in the case of increased risk.

Our 2017 global health campaign will focus on the lungs and respiratory system. We raise employee awareness of these topics through offers tailored toward specific target groups. The BASF health checks form the foundation of our global health promotion program and are offered to employees at regular intervals.

For more on occupational medicine, health promotion campaigns and the HPI, see basf.com/health

Process safety

- Expanded initiative for reducing process safety incidents
- Enhanced training methods

We use the number of process safety incidents as a key performance indicator, following to a large extent the definition set by the European Chemical Industry Council (CEFIC). In 2016, we recorded 2.0 process safety incidents per one million working hours worldwide (2015: 2.1). We pursue continual improvement by investigating every incident in detail, analyzing root causes and using the findings to derive suitable measures. We set ourselves the goal of reducing process safety incidents to a rate of no more than 0.5 per one million working hours by 2025.

To this end, we continued our worldwide initiative focusing on plant maintenance, repair and operation. This initiative produced a catalog of successful practices for preventing process safety incidents that has been available in several languages to all production plants worldwide since 2016.
Our globally implemented management system for process safety provides the framework for the safe construction and operation of our plants as well as the protection of people and the environment. Our experts have developed a protection plan for every plant that considers the key aspects of safety, health and environmental protection – from conception to startup – and stipulates specific protection measures for each. We continued to review this management system in all regions in 2016.

In order to maintain the highest level of safety at our plants across their entire life cycle, we review the implementation of our protection plans in all facilities at regular intervals and depending on hazard potential. We use globally standardized software to track these safety assessments. One module of this program – already used in many of our plants – checks the timely implementation of stipulated measures, supporting our employees in production. We supplemented this in 2016 by updating a global recommendation for prioritizing safety measures.

To strengthen risk awareness, we enhanced our training methods, introduced global recommendations for training measures and instructed around 13,000 course participants.

Emergency response

- Regular review of emergency systems
- Global qualification program for emergency response teams

In order to ensure uniformly high standards around the world for safety, security, health and environmental protection, we continued to implement our requirements for emergency response planning and fire prevention in the BASF Group in 2016. We work, for example, with site-specific emergency response plans and actively involve situation-related partners and suppliers as well as cities, communities and neighboring companies.

We regularly check our emergency systems and drill procedures with employees, contractors and local authorities. Through 173 drills and simulations in 2016, we instructed participants in our emergency response measures. One topic, for example, revolved around collaboration between production facilities and the fire department.

Through our SPIDER Emergency Response and Information Center Verbund, our specialists from the site fire department, emergency medical team, site security, and environmental protection can work together quickly and reliably across different sites around Europe. Our central emergency response supports local emergency response units around the world and around the clock.

We have been using the KATWARN system at the Ludwigs-hafen site since 2015, an app-based warning system that serves as an additional information channel to quickly inform site employees and neighbors of dangerous situations. We are constantly improving its use.

We developed a global qualification program in 2016 to train our emergency response teams. All over the world, mentors from the BASF SE fire department support local emergency response instructors at the sites with their knowledge, contributing to safety.

Corporate security

- Worldwide network of information protection officers

We protect our employees, sites and company know-how against third-party interference, and establish the necessary framework worldwide with our uniform concepts. Audits enable us to check the implementation of these measures.

New online training courses are available to our employees to prepare them for travel. Business travelers, transferees, and employees in countries with elevated security risks are informed about appropriate protection measures and individually counseled where necessary. After any major incident, we now have the possibility of more quickly and accurately locating employees in the affected regions through a travel research system that was globally standardized in 2016.

Aspects of human rights related to site security, such as the right to liberty and security of person, are a component of the global qualification requirements of our security personnel. Respect for human rights is a mandatory element of any contract with service providers of the BASF Group who are active in this area. Our investment projects include performing comprehensive analyses of potential risks. In 2016, we standardized the use of security services at further European sites in order to increase effectiveness and efficiency.

Due to the increasing risks associated with the use of information technology, a global campaign for employees is drawing attention to how we can even better protect our company knowledge. For example, a global phishing simulation further strengthened our employees’ awareness of risks. Our worldwide network of information protection officers comprises more than 650 employees. They support the implementation of our uniform requirements and conduct seminars on secure behaviors. We provided information protection instruction to more than 27,000 participants in 2016. In addition, we published standardized Group-wide recommendations for the protection of information and knowledge.

For more on corporate security, see basf.com/corporate-security
Product stewardship

We review the safety of our products from research and development through production and all the way to our customers’ application. We work continuously to ensure that our products pose no risk to people or the environment when they are used responsibly and in the manner intended.

Strategy

- Global directives with uniformly high standards for product stewardship

We ensure uniformly high standards for product stewardship worldwide and our voluntary initiatives go beyond legal requirements. We monitor the compliance of our guidelines with regular audits.

We provide extensive information on our chemical sales products to our customers with safety data sheets in more than 40 languages. This is achieved with the help of a global database in which we maintain and evaluate continuously updated environmental, health and safety data for our substances and products. Our global emergency hotline network provides information around the clock. We train and support our customers in fulfilling their industry-specific or application-specific product requirements.

The Care Chemicals division, for example, is involved in the European Federation for Cosmetic Ingredients, EFfCI. Together with other producers of cosmetic ingredients, we discuss the best way to cover our customers’ demand for information. The aim is to enable them to ensure the safety of the cosmetic products they manufacture in accordance with current scientific knowledge. This includes knowledge that extends back along the value chain to the production processes of the chemical raw materials used.

The Intermediates division supports information exchange with customers who manufacture ingredients for personal end-user products. For example, BASF customers such as industrial producers of raw materials for consumer goods are specifically addressed and advised by BASF’s experts as soon as a change is observed in the risk assessment of materials used in the production process.

With our global risk assessment goal, we are supporting the implementation of initiatives such as the Global Product Strategy (GPS) of the International Council of Chemical Associations (ICCA). GPS is establishing worldwide standards and best practices to improve the safe management of chemical substances.

In addition, we are also involved in workshops and training seminars in developing countries and emerging markets. In 2016, for example, we conducted training sessions for chemical industry representatives on GPS in China, India and Kenya on safe chemical management. In order to facilitate public access to information, we are participating in the setup of an ICCA online portal that provides more than 4,600 GPS safety summaries.

Global goal

By 2020, we will conduct risk assessments for all substances and mixtures BASF sells worldwide in quantities of more than one metric ton per year. We already reached 75.4% of this goal in 2016 (2015: 67.8%). The risk associated with using a substance is determined by the combination of its hazardous properties and its potential exposure to people and the environment.

2020 Goal

Risk assessment of products that we sell in quantities of more than one metric ton per year

>99%

REACH and other legal requirements

- Third registration phase of REACH in progress

We are working continuously on registering substances produced in annual volumes between one and one hundred metric tons for the third phase of the E.U. chemicals regulation, REACH. We have already registered over 250 substances to this end. Moreover, our REACH activities are increasingly determined by E.U. authorities’ decisions on additional studies in connection with the evaluation of submitted dossiers. Independently of this, BASF is also obligated to continuously update the registration dossiers it has submitted. The number of updates has meanwhile exceeded the number of registrations, although over 90% of the updates are undertaken on our own initiative and not as a response to official inquiry.

We apply the experience we have gathered with REACH to fulfill new legal requirements around the world, such as in Korea, Taiwan and Turkey. In 2016, we submitted more than 8,000 preregistrations in Taiwan in order to secure our business activities there.

In an increasingly political agrochemical environment, we are facing a rise in both regulatory requirements and the number of additional studies required to obtain or extend approval for crop protection products.
Environmental and toxicological testing

Use of alternative and complementary methods for animal studies

Before launching products on the market, we subject them to a variety of environmental and toxicological testing. We apply state-of-the-art knowledge already in the research and development phase of our products. We only conduct animal studies when they are required by law and approved by respective authorities. Animal studies are at times stipulated by REACH and other national legislation outside the European Union in order to obtain more information on the properties and effects of chemical products.

We adhere to the specifications laid down by the German Animal Welfare Act as well as the requirements of the Association for Assessment and Accreditation of Laboratory Animal Care – the highest standard for laboratory animals in the world. We are continually developing and optimizing alternative and complementary methods, and we use them wherever it is possible and approved by the authorities. We use alternative and complementary methods in more than a third of our tests. Currently, 30 replacement and supplementary methods are being used in our labs and another 12 are in the development stage. BASF spent €3.0 million toward this purpose in 2016. One focus area of our research in 2016 and subsequent years is the development of alternative methods for testing the potential of substances that negatively affect organisms’ growth and development.

In 2016, our Experimental Toxicology and Ecotoxicology department began work together with a total of 39 partners on one of the largest European collaborative projects for alternative methods. The project, planned to run for six years, aims to develop alternative methods to the point that chemical risk assessments can be efficiently conducted largely without animal testing.

Management of new technologies

Continual safety research on nano- and biotechnology

Technologies such as nanotechnology or biotechnology offer solutions for key societal challenges – for example, in the areas of climate protection or health and nutrition.

Safe handling of nanomaterials is stipulated in our Nanotechnology Code of Conduct. We are constantly expanding our knowledge of nanomaterial safety. Over recent years, we have conducted more than 240 toxicological and ecotoxicological studies and participated in over 30 different projects related to the safety of nanomaterials. We published the results in over 100 scientific articles. One important finding is that toxicity is determined not by the size of the particles but by the intrinsic properties of the substance.

The European Chemicals Agency (ECHA) as well as the OECD and national authorities are currently developing regulatory concepts to test and assess nanomaterials. We contribute our expertise through various working groups, such as the Partner Expert Groups (PEGs) of the ECHA or the Business and Industry Advisory Group (BIAC) of the OECD. These regulatory concepts are all based on a new approach for the targeted investigation of nanomaterials. We developed them together with the European Centre for Ecotoxicology and Toxicology of Chemicals (ECETOC) and other experts and expanded them further using concrete examples in 2016.

An important prerequisite for the consistent application of regulatory specifications for nanomaterials is their clear identification. Together with partners, we have developed a tiered, efficient measurement method in various E.U. projects that is currently being validated for use in REACH.

Transparency is another issue. In our Nano dialog forum, we meet with environmental and consumer agencies to discuss questions on nanomaterial safety and transparency and develop joint recommendations for political representatives. We wrapped up another series of talks in BASF’s Nano dialog forum with a report and an event in Brussels in 2016.

BASF makes successful use of biotechnology. We produce a range of established products with the help of biotechnological methods. This provides us with a great wealth of experience in the safe use of biotechnological methods in research and development as well as in production. When employing biotechnology, we adhere to all standards and legal regulations. We are guided by the code of conduct set out by EuropaBio, the European biotechnology association that actively supports a science-based, transparent and predictable regulatory framework. The association addresses society’s ethical concerns, and promotes better mutual understanding of such issues through dialog.
Energy and climate protection

As an energy-intensive company, we are committed to energy efficiency and global climate protection. We want to reduce emissions along the value chain and utilize, for example, efficient technologies for generating steam and electricity, energy-efficient production processes, and comprehensive energy management. Our climate protection products make an important contribution toward helping our customers avoid emissions.

Strategy

We are committed to energy efficiency and global climate protection along the value chain

We want to reduce greenhouse gas emissions in our production and along the entire value chain. To this end, we have thoroughly analyzed the greenhouse gas emissions from our production in the past few years and implemented comprehensive reduction measures. This is how, for example, we have been able to reduce nitrous oxide emissions by more than 95% since 1997.

Comparisons with European emissions trading benchmarks show that our greenhouse gas-intensive chemical plants operate at above-average efficiency. To supply our production sites with energy, we rely on highly efficient combined heat and power plants with gas and steam turbines, and on the use of heat released by production processes. Around 50% of BASF Group emissions in 2016 resulted from steam and electricity generation in our power plants as well as in our energy suppliers’ power plants.

Our success also depends on the long-term security and competitiveness of our energy supplies. Furthermore, we are committed to energy management that helps us analyze and further improve the energy efficiency of our plants.

We offer our customers solutions that help prevent greenhouse gas emissions and improve energy and resource efficiency. Around half of our total annual research and development spending goes toward developing these products and optimizing our processes.

Our climate protection activities are based on comprehensive emissions controlling. We report on greenhouse gas emissions in accordance with the Greenhouse Gas Protocol Standard, as well as the sector-specific standard for the chemical industry. Since 2004, we have participated in the international non-profit organization CDP’s program for reporting on data relevant to climate protection. Reporting to CDP entails an annual analysis performed by our experts of the opportunities and risks that climate change poses for BASF. BASF achieved a score of A- in CDP’s rating for 2016, awarding it “Leadership” status. Companies on the “Leadership” level are distinguished by factors such as the completeness and transparency of their reporting. They also pursue comprehensive approaches in managing the opportunities and risks associated with climate change as well as emissions reduction strategies to achieve company-wide goals.

We advocate climate protection by supporting initiatives to this end. The G20 Summit will take place in Hamburg in July 2017, an annual meeting between leaders of state and government of the most influential industrialized countries and emerging markets. Companies from 20 countries – the Business 20 (B20) – are working on recommendations for these political leaders. BASF is leading the working group on energy, climate and resource efficiency. The group especially aims for a political environment that enables companies like BASF to make essential contributions to climate protection using their power of innovation.

For more on climate protection, see basf.com/climate_protection

<table>
<thead>
<tr>
<th>Year</th>
<th>Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002 Baseline</td>
<td>-34.6</td>
</tr>
<tr>
<td>2011</td>
<td>-33.4</td>
</tr>
<tr>
<td>2012</td>
<td>-34.1</td>
</tr>
<tr>
<td>2013</td>
<td>-33.9</td>
</tr>
<tr>
<td>2014</td>
<td>-34.6</td>
</tr>
<tr>
<td>2015</td>
<td>-40.0</td>
</tr>
<tr>
<td>2016</td>
<td>-37.2</td>
</tr>
<tr>
<td>2020 Goal</td>
<td>-40.0</td>
</tr>
</tbody>
</table>

1 The figure for 2011 was not adjusted to reflect the scope of consolidation pursuant to International Financial Reporting Standards 10 and 11. For more information on our data collection methods, see page 4.
2 The figures for the 2011 and 2012 business years were not adjusted to the currently applied factors for global warming potential. For more information on our data collection methods, see page 104.
### BASF Group’s greenhouse gas emissions according to the Greenhouse Gas Protocol

<table>
<thead>
<tr>
<th>BASF operations including Oil &amp; Gas</th>
<th>2002</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{CO}_2 ) (carbon dioxide)</td>
<td>14,634</td>
<td>16,496</td>
<td>16,215</td>
</tr>
<tr>
<td>( \text{N}_2\text{O} ) (nitrous oxide)</td>
<td>6,407</td>
<td>600</td>
<td>528</td>
</tr>
<tr>
<td>( \text{CH}_4 ) (methane)</td>
<td>244</td>
<td>88</td>
<td>45</td>
</tr>
<tr>
<td>HFC (hydrofluorocarbons)</td>
<td>61</td>
<td>119</td>
<td>87</td>
</tr>
<tr>
<td>( \text{SF}_6 ) (sulfur hexafluoride)</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Scope 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{CO}_2 )</td>
<td>5,243</td>
<td>3,795</td>
<td>3,884</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>26,589</td>
<td>21,099</td>
<td>20,759</td>
</tr>
</tbody>
</table>

#### Sale of energy to third parties (Scope 1)

| \( \text{CO}_2 \) | 347 | 1,071 | 1,161 |
| **Total**         | 26,936| 22,170| 21,920|

1. BASF reports separately on direct and indirect emissions from the purchase of energy. Scope 1 emissions encompass both direct emissions from production and generation of steam and electricity, as well as direct emissions from the generation of steam and electricity for sale. Scope 2 emissions comprise indirect emissions from the purchase of energy for BASF’s use.

2. Emissions of \( \text{N}_2\text{O}, \text{CH}_4, \text{HFC} \) und \( \text{SF}_6 \) have been translated into \( \text{CO}_2 \) emissions using the Global Warming Potential, or GWP, factor. GWP factors are based on the Intergovernmental Panel on Climate Change (IPCC) 1995 (2002 emissions) and IPCC 2007, errata table 2012 (2015 and 2016 emissions). HFC (hydrofluorocarbons) are calculated using the GWP factors of the individual components.

3. Location-based approach. Information on the calculation of market-based Scope 2 emissions can be found in the GRI and Global Compact Index; see basf.com/en/gri_gc.

4. Includes sale to BASF Group companies; as a result, emissions reported under Scope 2 can be reported again in some cases.

### Global goals

- Reduction of greenhouse gas emissions per metric ton of sales product
- Introduction of energy management systems in accordance with ISO 50001

We aim to reduce our greenhouse gas emissions per metric ton of sales product by 40% by 2020, compared with baseline 2002. In 2016, we achieved a reduction of 37.2% (2015: reduction of 34.6%). Since 1990, we have been able to lower our overall greenhouse gas emissions from BASF operations (excluding Oil & Gas) by 50.2% and even reduce specific emissions by 75.4%.

We set ourselves a new energy efficiency goal in 2015 covering both the chemicals and the oil and gas businesses. By 2020, we want to have introduced certified energy management systems (DIN EN ISO 50001) at all relevant production sites. Taken together, this represents 90% of BASF’s primary energy demand. This is one of the ways in which we intend to identify and carry out improvements in energy efficiency, reducing not only greenhouse gas emissions and saving valuable energy resources, but also increasing the BASF Group’s competitive ability.

**2020 Goal**

| Reduction of greenhouse gas emissions per metric ton of sales product Baseline 2002 BASF operations excl. Oil & Gas |
|---|---|---|
| \( \text{CO}_2 \) | 100% | -40% |

**Coverage of our primary energy demand through certified energy management systems at all relevant sites BASF operations incl. Oil & Gas**

| 90% |

In 2016, workshops were conducted in all regions to introduce our energy management systems. This is how, for example, an energy savings potential of over €1 million per year was identified during system implementation at three pilot plants at the largest South American site in Guaratinguetá, Brazil. It is already starting to be realized. All energy efficiency measures are recorded and analyzed in a global database and made available to Group sites as best practices. Currently, over 100 measures are being pursued to reduce energy consumption and increase competitive ability. External audits in accordance with ISO 50001 were already conducted at the first two Chinese sites in the Shanghai metropolitan region in 2016. At the moment, 31 sites are certified worldwide, representing 42.3% of our primary energy demand.

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*The selection of relevant sites is determined by the amount of primary energy used and local energy prices.*
We were able to further optimize the resource and energy consumption of our production in numerous projects around the world in 2016. New highly efficient combined heat and power plants started up at the German sites in Düsseldorf-Holthausen and Illertissen as well as at Pontecchio Marconi in Italy. Furthermore, process improvements at many additional sites have led to savings in steam and electricity.

We also rely on locally available energy sources for energy supply at our sites. Especially in the growing Asian market, we and our energy suppliers also utilize coal as an energy source since the more climate-friendly natural gas is not available in sufficient quantities at competitive prices.

We are exploring the use of renewable energies. These can only become a permanent part of our energy mix if they are competitive in terms of supply security and cost. Our research also contributes to increasing the efficiency of technologies for the use of renewable energy sources.

Gas and steam turbines in our combined heat and power plants enable us to fulfill around 70% of the electricity demand of the BASF Group. Compared with separate methods of generating steam and electricity, we saved 14.0 million MWh of fossil fuels and prevented 2.8 million metric tons of carbon emissions in 2016. The Verbund system is an important component of our energy efficiency strategy: Waste heat from one plant’s production process is used as energy in other plants. In this way, the Verbund saved us around 19.0 million MWh in 2016, which translates to 3.8 million metric tons less of CO₂ released to the environment. With combined power and steam generation as well as our continuously enhanced Energy Verbund, we were thus able to prevent a total of 6.6 million metric tons of carbon emissions in 2016.
Responsibility along the value chain — Environment, health, safety and security — Energy and climate protection

Reporting on greenhouse gas emissions along the entire value chain

Customers’ use of climate protection products sold in 2016 avoids 540 million metric tons of CO₂ equivalents

BASF has been publishing a comprehensive corporate carbon footprint since as early as 2008. This reports on all emissions along the value chain and shows the volume of emissions prevented through the use of our climate protection products. We plan our climate protection activities along the value chain based on our corporate carbon footprint.

Through various measures to reduce our raw material and energy requirements, the emission of greenhouse gases associated with producing the raw materials was decreased by a total of around 155,000 metric tons in 2016.

Our climate protection products help us offer solutions to our customers to avoid greenhouse gas emissions over their entire lifecycle as compared with reference products. According to the systematic sustainability analysis we conduct on our portfolio — using the Sustainable Solution Steering® method — such products are referred to as “Accelerator” solutions as using them contributes positively to climate protection and energy. One example is our Green Sense® Concrete technology for sustainable construction: The optimization of the concrete’s composition allows for reduced greenhouse gas emissions compared with conventional concrete production.

An analysis of 24 climate protection product groups revealed that customers’ use of products sold in 2016 helped to avoid 540 million metric tons of CO₂ equivalents. Every product makes an individual contribution in the value chain of customer solutions. Value chains are assessed in terms of BASF’s economic share of the respective customer solution. On average, 11% of the emissions avoided were attributable to BASF in 2016. The calculation of avoided greenhouse gas emissions was based on the chemical industry standard of the International Council of Chemical Associations (ICCA) and the World Business Council for Sustainable Development (WBCSD).

Prevention of greenhouse gas emissions through the use of BASF products (million metric tons of CO₂ equivalents)

<table>
<thead>
<tr>
<th>Emissions along the entire value chain</th>
<th>Without the use of BASF’s climate protection products</th>
<th>With the use of BASF’s climate protection products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without the use of BASF’s climate protection products</td>
<td>1,110</td>
<td>Emissions avoided</td>
</tr>
<tr>
<td>With the use of BASF’s climate protection products</td>
<td>570</td>
<td>540 million metric tons</td>
</tr>
</tbody>
</table>

Key indicators for energy and climate protection in BASF operations excluding Oil & Gas

<table>
<thead>
<tr>
<th>Category</th>
<th>Baseline 2002</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse gas emissions (million metric tons of CO₂ equivalents)</td>
<td>24.713</td>
<td>20.133</td>
<td>19.976</td>
</tr>
<tr>
<td>Specific greenhouse gas emissions (metric tons of CO₂ equivalents per ton of sales product)</td>
<td>0.897</td>
<td>0.587</td>
<td>0.564</td>
</tr>
<tr>
<td>Primary energy demand (million MWh)</td>
<td>55.759</td>
<td>57.262</td>
<td>57.423</td>
</tr>
<tr>
<td>Energy efficiency (kilograms of sales product per MWh)</td>
<td>494</td>
<td>599</td>
<td>617</td>
</tr>
</tbody>
</table>

1 The values for baseline 2002 were not adjusted to reflect the currently applied global warming potential factors.
2 Scope 1 and Scope 2 (location-based) according to the GHG Protocol Standard, excluding emissions from the generation of steam and electricity for sale to third parties; information on market-based Scope 2 emissions can be found in the GRI and Global Compact Index; see basf.com/en/gri_gc
3 Primary energy used in BASF’s plants as well as in the plants of our energy suppliers to cover energy demand for production processes

According to Greenhouse Gas Protocol, Scope 1, 2 and 3; categories within Scope 3 are shown in parentheses

For more on our emissions reporting, see basf.com/corporate_carbon_footprint
For more on the sustainability analysis of our product portfolio, see page 30 onward
Water is of fundamental importance in chemical production. It is used as a coolant, solvent and cleaning agent, as well as to make our products. We are committed to its responsible use along the entire value chain and especially in our production sites' water catchment areas. We have set ourselves a global goal for sustainable water management.

**Strategy**

- **Sustainable water management**

  We aim to use water as sparingly as possible and further reduce emissions to water. To do so, we have set out a Group directive with globally applicable standards.

  We are introducing sustainable water management at all relevant production sites. These include our major Verbund sites as well as the sites in water stress areas, or regions in which more than 60% of available water is used by industry, household and agriculture. We consider the quantitative, qualitative and social aspects of water use. We want to identify where we can improve at our sites, and use as little water as possible, especially in water stress areas.

  Together with the city of Guaratinguetá, Brazil, and the Fundação Espaço ECO®, we are engaged in the restoration of the local river basin at our site in Guaratinguetá, Brazil, which provides 90% of the local population’s water supply. These efforts aim to improve water quality and increase its availability.

  We offer our customers solutions that help purify water and use it more efficiently while minimizing pollution.

  In order to ensure transparency in our reporting on water, we once again took part in CDP reporting in 2016. According to CDP, an international nonprofit organization, BASF is a world leader in sustainable water management and was included for the first time in CDP’s Water A List. Of the 607 companies evaluated, only 24 of them received the top score of “A” – among them, BASF. CDP’s evaluation of sustainable water management includes how transparently companies report on their water management activities and what they do to reduce risks, such as water scarcity. CDP also assesses the extent to which product developments – even at the customers of the companies under evaluation – can contribute to sustainable water management.

  For more on the CDP water survey, see basf.com/en/cdp

**Global goal**

By 2025, we want to introduce sustainable water management at all sites in water stress areas and at our Verbund sites, covering 93% of BASF’s entire water abstraction. We achieved 42.6% of this goal in 2016.

Source: Pfister et al., 2009
We pursue our goal by applying the European Water Stewardship standard, which rests on four principles: sustainable water abstraction, maintaining good water quality, preserving conservation areas, and ensuring continuous improvement processes, including in cooperation with other users.

In 2016, around 23% of our production sites were located in water stress areas. Around 1% of BASF’s total water supply was abstracted from these sites.

### Water use

**Using water responsibly**

Our water usage totaled 1,649 million cubic meters in 2016. This demand was covered for the most part by surface water, such as rivers and lakes. At some sites, we use alternative sources such as treated municipal wastewater, brackish water or seawater, reducing our need for freshwater.

We predominantly use water for cooling purposes (85%), after which we recirculate it back to our supply sources. We recirculate as much water as possible in order to withdraw less. Our larger sites have recooling plants that allow water to be reused several times and which reduce the temperature of used cooling water before it is discharged back into a body of water.

The supply, treatment, transportation and recooling of water is associated with a considerable energy demand. We employ various means in our efforts to minimize this as much as possible. We are constantly working to optimize our energy consumption and the amount of water we use, and to adapt to the needs of our business and the environment.

### Emissions to water

**Further reduction of emissions**

A total of 1,644 million cubic meters of water were discharged from BASF production sites in 2016, including 184 million cubic meters of wastewater from production. Emissions of nitrogen to water amounted to 2,900 metric tons (2015: 3,000 metric tons). We were able to achieve this improvement by optimizing processes and exchanging products, for example. Around 15,900 metric tons of organic substances were emitted in wastewater (2015: 17,300 metric tons). Our waste water contained 23 metric tons of heavy metals (2015: 25 metric tons). Phosphorus emissions amounted to 310 metric tons (2015: 460 metric tons). Our wastewater is treated through different methods depending on the type and degree of contamination – including biological processes, oxidation, membrane technologies, precipitation or adsorption.

In order to avoid unanticipated emissions and the pollution of surface or groundwater, we create water protection strategies for our production sites. This is mandatory for all production plants as part of the Responsible Care initiative. The wastewater protection plans involve evaluating wastewater in terms of risk and drawing up suitable monitoring approaches. We use audits to check that these measures are being implemented and complied with.

For more, see basf.com/water

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**Water in the BASF Group 2016 (million cubic meters per year)**

**Abstraction / withdrawal**

<table>
<thead>
<tr>
<th>Source</th>
<th>Volume (million cubic meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface water / freshwater</td>
<td>1,360</td>
</tr>
<tr>
<td>Brackish water / seawater</td>
<td>200</td>
</tr>
<tr>
<td>Groundwater</td>
<td>66</td>
</tr>
<tr>
<td>Drinking water</td>
<td>21</td>
</tr>
<tr>
<td>Reusable wastewater from third parties</td>
<td>2</td>
</tr>
</tbody>
</table>

**Use**

<table>
<thead>
<tr>
<th>Use</th>
<th>Volume (million cubic meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>6,461</td>
</tr>
<tr>
<td>Cooling</td>
<td>6,214</td>
</tr>
<tr>
<td>Thereof recirculating</td>
<td>4,754</td>
</tr>
<tr>
<td>once-through</td>
<td>1,460</td>
</tr>
<tr>
<td>Production2</td>
<td>247</td>
</tr>
</tbody>
</table>

**Discharge**

<table>
<thead>
<tr>
<th>Source</th>
<th>Volume (million cubic meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface water / freshwater</td>
<td>1,428</td>
</tr>
<tr>
<td>Brackish water / seawater</td>
<td>187</td>
</tr>
<tr>
<td>Groundwater</td>
<td>11</td>
</tr>
<tr>
<td>External treatment plant</td>
<td>18</td>
</tr>
</tbody>
</table>

1 The difference between the volume of water drawn and the volume discharged is primarily attributable to evaporation losses during closed-circuit cooling.

2 Total from production processes, graywater, rinsing and cleaning in production.
Air and soil

We want to further reduce emissions to air from our production, prevent waste and protect the soil. We have set ourselves standards for doing so in global directives. If no recovery options are available for waste, we dispose of it in a proper and environmentally responsible manner.

Strategy

- Regular monitoring of emissions to air
- Professional disposal of hazardous waste
- Systematic management of contaminated sites

Regular monitoring of our emissions to air is a part of environmental management at BASF. Aside from greenhouse gases, we also measure emissions of other pollutants into the atmosphere. Our reporting does not take into account air pollutant emissions from oil and gas operations due to their substantial fluctuation during exploration phases.

Our Raw Material Verbund helps us prevent and reduce waste. We regularly carry out audits to inspect external waste disposal companies, ensuring that our hazardous waste in particular is properly disposed of. In this way, we also contribute to preventive soil protection and keep today’s waste from becoming tomorrow’s contamination.

When treatment is required for soil and groundwater contamination at active and former BASF sites, proper remediation measures are reviewed based on prevailing legal and current technical standards, and undertaken as necessary.

Emissions to air

- Further reduction of emissions


 Our product portfolio contains a variety of catalysts used in the automotive sector and in industry to reduce the emission of air pollutants.

**Emissions to air (metric tons)**

<table>
<thead>
<tr>
<th>Air pollutants from BASF operations excluding Oil &amp; Gas</th>
<th>2016</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO (carbon monoxide)</td>
<td>3,585</td>
<td>3,813</td>
</tr>
<tr>
<td>NO\textsubscript{X} (total nitrogen oxides)</td>
<td>11,143</td>
<td>11,058</td>
</tr>
<tr>
<td>NMVOC (nonmethane volatile organic compounds)</td>
<td>4,824</td>
<td>5,140</td>
</tr>
<tr>
<td>SO\textsubscript{X} (total sulfur oxides)</td>
<td>1,872</td>
<td>3,028</td>
</tr>
<tr>
<td>Dust</td>
<td>3,082</td>
<td>3,330</td>
</tr>
<tr>
<td>NH\textsubscript{3} (ammonia) and other inorganic substances</td>
<td>2,229</td>
<td>2,216</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>26,735</td>
<td>28,585</td>
</tr>
</tbody>
</table>
Waste management

- Total waste volume slightly above prior-year level

Waste prevention is our topmost goal. If waste is unavoidable, we review the options for recycling or energy recovery, using BASF’s existing Verbund structures for efficient waste management. Total waste volume amounted to 2.10 million metric tons in 2016 (+3.7%).

<table>
<thead>
<tr>
<th>Waste management in the BASF Group (million metric tons)</th>
<th>2016</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total waste generation&lt;sup&gt;1&lt;/sup&gt;</td>
<td>2.10</td>
<td>2.02</td>
</tr>
<tr>
<td>Thereof from oil and gas exploration</td>
<td>0.06</td>
<td>0.05</td>
</tr>
<tr>
<td>Waste recovered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recycled</td>
<td>0.26</td>
<td>0.27</td>
</tr>
<tr>
<td>Thermally recovered</td>
<td>0.51</td>
<td>0.41</td>
</tr>
<tr>
<td>Waste disposed of</td>
<td>1.33</td>
<td>1.34</td>
</tr>
<tr>
<td>Thereof in underground landfills</td>
<td>0.14</td>
<td>0.14</td>
</tr>
<tr>
<td>Thereof in surface landfills</td>
<td>0.47</td>
<td>0.48</td>
</tr>
<tr>
<td>Through incineration</td>
<td>0.72</td>
<td>0.72</td>
</tr>
<tr>
<td>Classification of waste for disposal&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonhazardous waste</td>
<td>0.46</td>
<td>0.44</td>
</tr>
<tr>
<td>Hazardous waste</td>
<td>0.87</td>
<td>0.90</td>
</tr>
<tr>
<td>Transported hazardous waste</td>
<td>0.23</td>
<td>0.27</td>
</tr>
</tbody>
</table>

<sup>1</sup> Comprises all production waste and hazardous waste from construction activities

<sup>2</sup> The classification of waste into hazardous and nonhazardous waste is performed according to local regulations.

Management of contaminated sites

- Systematic management of contaminated sites ensured

We develop remediation solutions that combine nature conservation, climate protection concerns, costs, and social responsibility. This means making customized decisions on a case-by-case basis, founded on the legal framework and current technological possibilities. We set out global standards for our approach to managing contaminated sites. A worldwide network of experts ensures their proper implementation.

We have been documenting relevant sites in a contaminated site database since 2013. Ongoing remediation work around the world continued on schedule and planning was concluded on future landfill remediation projects.