

Consolidated Environmental Statement 2019

Bayer Bergkamen site

To improve readability, and in the spirit of treating everyone equally, gender-neutral language is used throughout this brochure.

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#### Dear reader,

At the heart of our actions lie two major social challenges – providing healthcare and securing food supplies for the world's growing population. We firmly believe that we can only achieve these objectives if innovation and sustainability go hand in hand. For Bayer, sustainability therefore also means shaping the future and, as part of our corporate strategy, this is firmly integrated into our day-to-day workflows.

The success of innovative approaches rests on their ability to generate benefits for our customers, our employees and society. In particular, this means protecting the environment and the health of all those employed at the Bergkamen site in addition to acting responsibly toward nature. To do justice to the full scope of this claim, Bayer developed a concept some years ago for its site in Bergkamen that sets out clear rules for exercising corporate responsibility along the entire value chain of the products manufactured here.

This extends from the procurement, processing and use of raw materials and energy to the storage and shipment of finished products. Every single step is governed by the requirements of our systematic environmental management system. In this way, we pursue a style of corporate governance that centers on collaboration and dialog in favor of protecting the environment and integrates everyone involved – including external partners. The safety of employees and our neighbors in the area surrounding the site has top priority in this respect.



Adopting an economical approach to resources and energy constitutes another key focus. You can find detailed explanations and examples of Bayer's commitment to these issues inside this brochure. We regularly commission independent institutions and external auditors to scrutinize our efforts to combine innovation with environmental considerations.

We document our achievements by publishing this Environmental Statement. At the same time, we under-

take to further improve safety, environmental protection and sustainability. Management staff have a particular duty in this respect – and meet their responsibility by continuously developing the safety programs and environmental initiatives organized at the Bergkamen site.

The considerable progress our company has made over the past 150+ years strengthens our resolve to continue with our strategy. Given this long history, there is in any event no place for short-term thinking and actions. Bayer therefore remains committed to restricting the development of products and services to those that enhance lives of people across the globe and take environmental considerations into account. All of this corresponds entirely to our mission "Bayer: Science For A Better Life."

Dr. Timo Flessner Head of Supply Center Bergkamen

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### The Bayer Bergkamen site

#### Location

Bergkamen is home to Bayer AG's largest site for manufacturing active pharmaceutical ingredients. Around 1,600 employees work here, manufacturing ultrapure active ingredients and intermediates for further processing at the company and also for third parties. The works premises cover just under 110 hectares and are located in the north-eastern part of Germany's Ruhr region, between the cities of Dortmund and Hamm. Active ingredients have been manufactured here for over 50 years.



A good two thirds of the over 100-hectare site has been developed. The remaining area is available for expanding existing installations and building new ones.

In 1959, Schering AG purchased Chemische Werke Bergkamen to expand its production beyond the narrow confines of West Berlin, which was an exclave of West Germany at the time. The production of active pharmaceutical ingredients started on April 2, 1962 – two-and-a-half years after the foundation stone was laid. This marked the start of an industrial company that is now firmly established in the region as its largest employer. It is part of Supply Center Bergkamen, one of the world's largest and most state-of-the-art production sites for hormones and contrast media, which has been part of Bayer AG since 2006.

In Bergkamen, Bayer currently operates four chemical production plants, a microbiological production/ processing facility, as well as a microbiological Technical Service Center in which new processes are prepared for use in production and established processes are enhanced – including with genetically modified organisms. According to § 7 of Germany's Genetic Engineering Safety Ordinance (GenTSV), the relevant premises are classified as safety level S1 (no risk). Besides the chemical production facilities and the microbiology operations, there are various supply and disposal facilities, in particular the power plant, afterburner, hazardous waste incinerator, distillation facility and the process water and central wastewater treatment plants. These facilities are also available to LANXESS Organometallics GmbH and Huntsman Advanced Materials Deutschland GmbH, other companies based at the works premises.

#### Products with active ingredients "Made in Bergkamen"

Numerous preparations from Bayer contain active pharmaceutical ingredients (API) produced in Bergkamen. In total, the active ingredients for products manufactured by Bayer in Bergkamen generated global sales far in excess of EUR four billion in 2018.

Active substance	Medicinal product
Drospirenone	Yasmin <sup>®</sup> (contraception)
Levonorgestrel	Mirena® (contraception)
Cyproterone acetate	Diane <sup>®</sup> (contraception)
Estradiol valerate/ dienogest	Qlaira® (contraception)
lopromide	Ultravist <sup>®</sup> (contrast medium)
Gadobutrol	Gadovist <sup>®</sup> (contrast medium)
Gadolinium oxide/DTPA	Magnevist <sup>®</sup> (contrast medium)



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#### **Diagnostic imaging**

Hailed as a sensational breakthrough when it was discovered in 1895, X-ray technology has now developed into a highly specialized field of medicine – diagnostic imaging. The ability to detect a disease with high precision in its early stages paves the way for successful treatment. Facilitating targeted treatment is key to curing patients.

Among the wide variety of diagnostic options that exist, imaging methods are particularly important. Contrast media produce higher-quality images of structures and functions. They enable tissues and organs to be viewed in their natural surroundings inside the human body. As a market leader in this segment, Bayer has always been at the forefront of diagnostic imaging. Milestones in the company's history include the launch of one of the first X-ray contrast media in 1930 and the world's first contrast medium for magnetic resonance imaging in 1988. The most important preparations for the site are Ultravist<sup>®</sup>, Magnevist<sup>®</sup> and Gadovist<sup>®</sup>.



#### Contrast medium active ingredients for diagnostic imaging processes

lopromide	Gadobutrol	Gadolinium oxide/DTPA
Ultravist®	Gadovist®	Magnevist®

Fig. 1: Bayer is a world market leader for contrast media.

The company produces the relevant active ingredients at its site in Bergkamen.

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#### Women's healthcare

With close to 100 years of experience, Bayer is a world leader in the field of women's healthcare. It focuses on three areas – contraception, menopause management and gynecological treatments.

Progynon, the first hormone preparation for treating menopausal symptoms, was launched on the market back in 1928, while Anovlar® heralded in the era of the contraceptive pill in 1961. One of our most important areas of specialization at present is developing oral contraceptives such as Qlaira®, YAZ®, Diane® and Yasmin®. In the field of hormone therapy, drugs such as Climara® and Climen® are used to treat menopausal symptoms. The active ingredients in all these products are steroid hormones such as ethinyl estradiol, levonorgestrel, gestodene, dienogest and drospirenone. Bayer produces all these active ingredients in Bergkamen.



#### Contraception/hormone replacement therapy

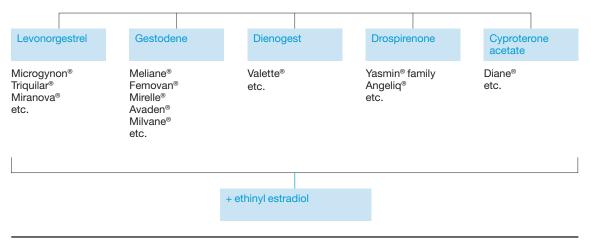


Fig. 2: The Bergkamen site supplies hormones for a large number of contraceptives.

#### **Product stewardship**

As a manufacturer of active pharmaceutical ingredients, we feel especially committed to humankind and the environment, over and above the scope of legal requirements. In addition to innovation, growth and cost-efficiency, sustainability is therefore an equally important part of our corporate goals.

For close to 25 years now, the issue of pharmaceuticals in the environment has occupied scientists and the general public alike. Concerns regarding the effects of pharmaceutical substances have led to numerous studies being conducted at national and international level. Bayer started providing the responsible authorities with environmental risk assessments of pharmaceuticals for human use at an early stage. Active ingredients that have already been launched on the market are also assessed on an ongoing basis.

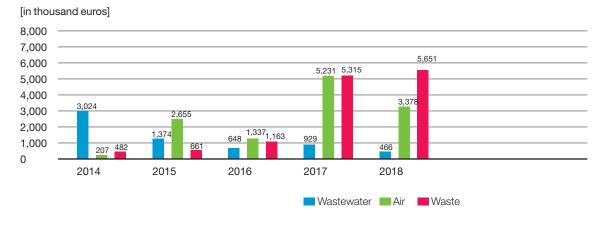
Bayer has set itself the goal of analyzing potential environmental risks of active pharmaceutical ingredients even more closely so as to produce a more differentiated evaluation. To this end, we are systematically expanding the database of environmental properties – for example, with tests on pharmaceuticals' ecotoxicity, spreading patterns and degradation behavior. In connection with the approval process for human and veterinary pharmaceuticals in Europe and the United States, an environmental risk assessment is also conducted for all new active ingredients. Active pharmaceutical ingredients can enter the environment through human or animal excreta, through improper disposal or during production. Surface waters are particularly relevant here. Our compliance with wastewater thresholds is reviewed by supervisory authorities and external auditors, as well as by internal experts who conduct on-site audits at regular intervals. To further reduce or completely avoid traces of pharmaceuticals entering the environment, we take our own measures in production operations.

Beyond this, Bayer participates in various research projects to develop further reduction measures. For example, it acts as a coordinator in the European "Intelligence-led Assessment of Pharmaceuticals in the Environment" project, which looks for new ways to improve how environmental risks are assessed.

In recent years, Bergkamen has made substantial investments in optimum technological solutions for treating waste air and wastewater. One example is the modernization of our wastewater treatment plant, with a particular focus on the retention of active hormone ingredients and iodized X-ray contrast media.

Ultrafiltration is setting new standards. The plant, which was taken into operation in 2004, is able to retain all biomass from biological wastewater treatment.





#### Environmental protection investments

Fig. 3: Environmental protection investments by purpose in the period 2014 to 2018.

Despite numerous studies on the presence of active ingredients from hormone production in the aquatic environment, it has not yet been possible to produce a conclusive assessment of the impact on aqueous ecosystems. As early as 1998, we therefore resolved in Bergkamen to collect all wastewater from ethinyl estradiol production separately and incinerate it. This rules out any emission of artificial hormone components from these operations.

Wastewater is also generated during the manufacture of X-ray contrast media. As diagnostic agents, the iodized contrast media that may still be contained in this water in trace form are biologically inert because of the way in which they work. Despite the fact that they have been shown to be ecotoxicologically safe, we assess the wastewater from each iopromide stage separately as a precaution. In recent years, we have also developed processes to significantly reduce the discharge of iopromide stages into the wastewater treatment plant while also enabling the iodine they contain to be recycled. In addition to this, we have installed a plant specifically to recover organically bound iodine from the wastewater.

#### **Production processes**

There are virtually no overlaps between the manufacture of hormones and contrast media. Handling large volumes of X-ray contrast media safely is a key aspect of operations. As much iodine as possible needs to be incorporated into the contrast medium molecule so as to optimize the contrast for the doctor performing the examination.

The situation for hormones is completely different. These active ingredients are produced in comparatively small quantities, in an extremely complex process with up to 19 different synthesis stages. The close networking of microbiological and chemical production is vital, because key intermediate stages during the long process of creating the finished active ingredient involve microorganisms such as bacteria, fungi and yeasts. Depending on the active ingredient to be manufactured and the quantity required, reactors, centrifuges, dryers and other equipment are combined to create various production lines. Several such lines are normally operated in parallel. In some cases, their outputs vary significantly according to the batch size, run time and yield of the individual synthesis stages.

The duration of a campaign – i.e. the period during which a product is manufactured – is equally variable. It can take anything from a few days to several months. The individual plant components need to be cleaned before a new campaign starts. The scope and intensity of this procedure depend on the international requirements of pharmaceutical legislation. In recent years, a number of plants have been taken into operation where production is no longer in campaigns but more or less continuous.

At most active ingredient facilities, the production flow runs from top to bottom to make use of gravity. The upper floors are used for chemical reactions and product processing, while isolation, drying and filling operations are located on the lower floors. This means the entire production process, including packing, takes place in a largely closed system.

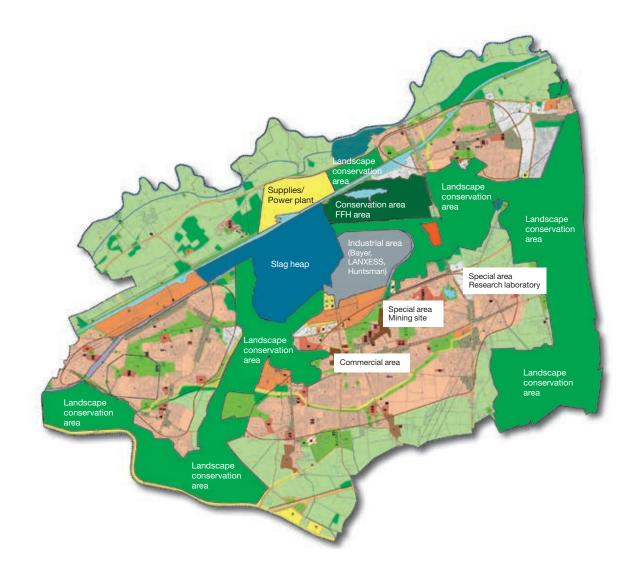
#### **Planning and licensing legislation**

The works premises are surrounded by areas with different classifications – the Beversee conservation area to the north, a landscape conservation area and two settlements to the east, a commercial and residential area to the south, and a landscape conservation area and a slag heap designated as a local recreational area to the west.

The site is designated as an industrial area in the town of Bergkamen's land utilization plan. The companies LANXESS Organometallics GmbH and Huntsman Advanced Materials Deutschland GmbH account for 15 of the 67 hectares that have been developed.



Automated plants with cutting-edge process control systems help minimize waste volumes by ensuring an efficient production process – from the very first batch to filling of the finished active ingredient.



#### Implementing Article 13 of the Seveso III Directive (settlement monitoring)

The Seveso III Directive takes its name from a town in northern Italy where a serious industrial accident occurred in 1976. Its aim is to prevent such incidents and limit their consequences. To this end, Article 13 stipulates that areas with large quantities of hazardous substances must be located a reasonable distance away from any schools, kindergartens, major transportation routes, etc. that require particular protection.

The Seveso III Directive and the equivalent German legislation – the "Störfallverordnung" (StörfallV = Major Incidents Ordinance) – apply equally to Bayer AG, LANXESS Organometallics GmbH and Huntsman Advanced Materials Deutschland GmbH. With the approval of Arnsberg District Authority, the companies and the town of Bergkamen have reached an agreement for implementing the Directive for the purpose of ensuring their safe coexistence, as envisaged therein. The Directive not only safeguards existing buildings and current construction projects, but also offers legal security for future plans without affecting the high level of safety and protection for employees and the local community. The agreement between the companies involved and the municipality thus forms the basis for urban development in the immediate vicinity of the works and the development of the chemical site.

# Environmental policy and other aspects of the management system

Encouraging sustainable development is an integral part of Bayer's corporate policy. We consider economy, ecology and corporate social responsibility to be equally important in all our activities. By voluntarily taking part in the chemical industry's Responsible Care initiative and pursuing a sustainable development policy, we aim to achieve continuous improvements in the fields of healthcare, safety and the environment.

#### For the Bergkamen site, this means:

- Continuously improving environmental protection and occupational safety.
- > Using energy efficiently. By optimizing our energy-related performance, we are helping reduce environmental pollution.
- > Seeing occupational health & safety and environmental protection as a management task. Our management staff encourage employees to demonstrate a personal sense of responsibility toward the environment and make them more aware of possible environmental pollution and safety risks.
- > Ensuring strict compliance with laws, ordinances, our voluntary undertakings and guidelines.
- > Preventing accidents, guarding against occupational diseases and designing workplaces in line with ergonomic principles.
- > Going beyond technical and economic requirements to work toward ensuring the physical and social well-being of our employees by applying occupational health management principles when designing workplaces.

> Endeavoring to optimize safety when planning, procuring, installing and operating our plants, and to improve their energy-related performance.



 Taking environmental protection and occupational safety require-

ments into account when assessing and selecting service providers, suppliers, freight companies and other partners. In this regard, we prefer to acquire and use products and services that are energy-efficient.

- > Engaging in open dialog with staff, neighbors and the public so as to improve mutual understanding and strengthen trust in our responsible actions.
- > Ensuring the availability of information and all resources needed to achieve our strategic and operational objectives.
- Reviewing this policy on a regular basis and updating it where necessary.

Following the change of leadership at the Bergkamen site in 2017/18, the new management team has also undertaken to uphold this policy.



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#### **Organizational measures**

As a global company, Bayer has set itself high standards for achieving its objectives and regularly checks they are being complied with. All relevant requirements resulting from the quality, safety and environmental standards are described in a management system that takes into account international standards such as the EMAS regulation and

DIN EN ISO 14001 (both for environmental protection), OHSAS 18001 (for occupational safety) and DIN EN ISO 50001 (for energy).

The management system focuses in particular on the clear assignment of responsibilities. Member of the Board of Management Dr. Hartmut Klusik is responsible for environmental protection, health and safety.

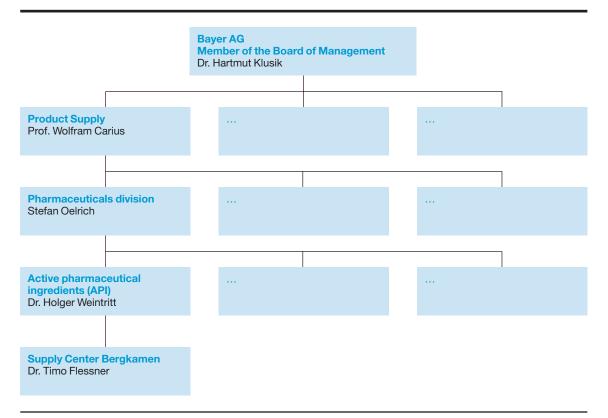


Fig. 4: Quality, safety and environmental protection are an integral part of management tasks and therefore apply equally to all levels in the management hierarchy.



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At Supply Center Bergkamen, site manager Dr. Timo Flessner is responsible for the application and practical implementation of the management system.

	Supply Center Bergka Dr. Timo Flessner	amen			
<b>Production</b> Dr. Maik Röck			i <b>te Engineeri</b> Carlos Hedler	ng & Technology	 
Quality Unit Dr. Iris Escher			<b>Supply Chain</b> I Dr. Thomas Kai	Management mpmeyer	
Business Support Supply Cen Dr. Hans Berlage	iter		<b>perational E</b> pr. Karl-Heinz N		
Health, Safety & Environment Thomas in der Weide	(HSE)		<b>Press &amp; Public</b> Nartin Pape	Relations	

Fig. 5: The function managers report directly to the site manager – including on all issues relating to the management system.

#### Officers

Supply Center Bergkamen appoints officers for aspects such as water pollution control, air pollution control, waste, incidents, biological safety, transportation of hazardous goods, fire safety, radiation protection and environmental/energy management. Wherever necessary, it notifies the responsible authorities accordingly. These officers advise decision-makers and employees on all issues that are of relevance for safety and environmental protection, monitor compliance with existing requirements under public law for building and operating plants, and notify the relevant people in the event of changes to legislation. They are involved in the planning of projects that affect their area of responsibility at a sufficiently early stage to enable their input to be factored into the decisions that need to be taken.

# Internal safety, environmental protection and energy audits

The officers for the various specialist areas regularly perform joint safety and environmental protection audits. Audits are a systematic and documented method for checking compliance with internal and statutory safety and environmental protection requirements, and also for identifying weaknesses and potential for improvement. These audits cover all areas that are relevant to safety and environmental protection:

- > Production and technical operations
- > Laboratories
- > Storage
- > Energy and water supplies
- > Waste management
- > Waste air and wastewater purification plants

#### **Material flow management**

At the Bergkamen site, the material flow and disposal management system determines what happens to residual materials and wastewater:

- > Recycling/reuse
- > Incineration (internal or external)
- > Landfill
- Local wastewater pre-treatment before being discharged into the central wastewater treatment plant
- > Direct discharge into the wastewater treatment plant<sup>1</sup>.

#### **Continuous improvement**

The regular evaluation of HSE (health, safety and environment) data identifies trends early on, which enables corrections to be made promptly. This evaluation ensures compliance with laws, ordinances, technical regulations and company directives. It also supports the continuous improvement process.

#### **Context analysis**

An annually updated context analysis determines the overarching topics and developments relevant to Supply Center Bergkamen and its management system. The extent to which environmental changes could affect the organization (e.g. as a result of climate change or over-usage of natural resources) is also assessed during this process.

The context analysis also considers various stakeholders who are directly or indirectly affected by the company's activities or who could influence such activities. The relevance of topics and stakeholders is rated on a scale from 0 to 3 (0 = irrelevant, 1 = low, 2 = medium, 3 = high).

At present, the context analysis addresses 14 stakeholders and 17 topics overall, recording the opportunities and risks for each topic and stakeholder, deriving appropriate measures and citing any binding obligations.

Stakeholder/topic	Authorities (incl. Arnsberg District Authority, Bergkamen Planning Department, etc.)
Expectations/requirements/influence	Approved and compliant operations, Compliance with all ancillary provisions and public law requirements relevant to Supply Center Bergkamen
Opportunities/risks	Opportunities: Good connections to authorities, positive collaboration; faster approval procedures Risks: Delays in approval procedures, regulatory offense proceedings, etc.
Measures	Measures (opportunities): Inviting authorities and involving them in certain matters; scoping in relation to the approval procedure; regular meetings with authorities Measures (risks): Internal environmental audits, approval management and discussions, tracking and evaluating regulations, official representation
Binding obligations	Statutory obligations, e.g. 17th & 13th Federal Immission Control Ordinance (BImSchV); ancillary provisions of approval bodies

#### Excerpt from the context analysis

#### Dialog

Objective dialog in a spirit of trust with staff, customers and the public about environmental issues is very important to us. Consequently, it is also one of the basic principles anchored in our environmental policy. We ensure such dialog takes place at Supply Center Bergkamen with practical initiatives such as:

- > Open days,
- > Bayer Safety Day,
- > Brochures such as this Environmental Statement,
- > Annual neighborhood dialog with local residents,

- > Information for neighbors of the Bergkamen site in accordance with the Major Incidents Ordinance (StörfallV),
- > Regular exchange of ideas with political and administrative representatives and officials from the responsible supervisory authorities,
- > Internal training and advanced training events on HSE issues,
- > News ticker on the intranet,
- > BGK direkt in-house newspaper,
- > Project-specific info sheets about measures at the site,
- > Safety data sheets and product information for customers.



the latest news about Supply Center Bergkamen since August 2009.

### Environmental impact

# Determining and assessing environmental aspects

We interpret environmental impact as all changes to the environment resulting from our activities. To minimize this impact, we need to identify all activities that are of relevance to the environment and assess the associated consequences.

Environmental aspects are assessed using a matrix that considers the following criteria:

- > Potential for damaging the environment
- > Environmental impact (local, regional, global)
- > Degree of frequency
- Environmental, official and internal regulations
- Significance to stakeholders and employees

Criteria are rated on a scale from 1 to 3 according to their extent or frequency (1 = low, 2 = medium, 3 = high). The points are then added up and the environmental aspect is classified as major or minor according to a predefined scale. The environmental aspects identified as being major (direct and indirect) are set out in the following sections.

In addition to this method of assessment, Bayer requires ecological assessments to be performed for all new investment projects exceeding EUR ten million, examining the impact on humans and the environment of both the production processes at the site (process assessment) and the products associated with the investment project (product assessment). The process assessment includes resource consumption, the emissions situation and an assessment of feedstock, intermediates and end products to establish their risk potential and ascertain whether sufficient data is available. Depending on the potential threat and the local circumstances, assessments of the risks to humans and/or the environment may need to be performed for some materials with hazardous (eco)toxicological properties.

Such ecological assessments were carried out, for example, for the expansion of X-ray contrast medium production in 2011 and the optimization of the distillation facility in 2017.

A change management process also exists for "everyday business", i.e. for minor changes to plants and processes. This ensures the environmental officer is involved in all projects. A checklist process is followed to assess all environmental aspects and, if necessary, measures are determined to avoid or minimize the associated risks. Site officers for tasks such as air and water pollution control are also involved in this process.

#### Overview of environmental KPIs from 2014 to 2018 [t/T = metric tons]

	Unit	2014	2015	2016	2017	2018
Production volumes	t	11,656	12,331	12,712	12,322	12,649
Energy usage						
Energy usage, total	TY	1,165	1,162	1,097	1,138	1,093
related to production volume	TY/t	0.099	0.094	0.086	0.092	0.086
from renewable energies	TY	39.6	36.2	54.2	48.1	66.1
Share of renewable energies as a percentage of total energy usage	%	3.4	3.1	4.9	4.2	6.0
Energy used from waste	TY	269.4	264.6	317.1	349.8	228.3
Natural gas used	TY	861.4	909.4	689.4	797.5	800.8
Energy used, liquid fuels	TY	7.8	3.7	75.1	14.0	39.0
Energy gained from waste heat	TY	10.3	9.4	7.9	6.3	16.2
Steam energy transferred to third parties	TY	117.7	127.5	144.1	133.3	116.8
Electricity from external sources	TY	133.6	102.9	151.4	103.4	125.3
In-house electricity generation	TY	175.9	194.4	148.6	186.6	167.0
Electricity consumption, total	TY	309.4	297.3	299.9	290.0	292.3
related to production volume	TY/t	0.027	0.024	0.024	0.024	0.023
share of renewable energies as a percentage	%	12.8	12.2	18.1	16.6	22.6
Waste						
Waste, total	t	42,549	43,351	45,145	49,157	50,180
Production waste, hazardous	t	36,361	37,496	39,397	41,040	40,358
related to production volume	t/t	3.1	3.0	3.1	3.3	3.2
Production waste, non-hazardous	t	1,048	1,082	1,146	2,043	2,161
related to production volume	t/t	0.09	0.09	0.09	0.17	0.17
Rubble, non-hazardous	t	1,898	2,821	2,109	3,920	5,316
Rubble, hazardous	t	34.0	82.7	56.4	170.9	249.4
Waste from wastewater treatment, hazardous	t	3,207	1,869	2,437	1,983	2,096
related to production volume	t/t	0.28	0.15	0.19	0.16	0.17
Biodiversity (land usage)						
Total surface area	ha	110	110	110	110	110
Developed & sealed areas as a percentage	%	40.9	40.9	40.9	40.9	40.9

	Unit	2014	2015	2016	2017	2018
Material efficiency						
Solvent usage	t	39,599	39,051	40,673	39,253	42,190
related to production volume	t/t	3.39	3.17	3.20	3.19	3.34
Recycling volume, solvents	t	22,876	22,616	21,035	23,510	20,931
Recycling quota, solvents	%	57.8	57.9	51.7	59.9	49.6
Emissions						
Carbon dioxide	t	65,291	71,810	66,946	73,664	70,908
related to production volume	t/t	5.6	5.8	5.3	6.0	5.6
Nitrogen oxides	t	61.1	62.8	61.6	70.2	65.1
related to production volume	kg/t	5.2	5.1	4.8	5.7	5.1
Carbon monoxide	t	10.5	15.0	13.6	8.0	1.7
related to production volume	kg/t	0.9	1.2	1.1	0.7	0.1
Organic substances (VOC)	t	28.4	25.6	30.7	30.7	14.6
related to production volume	kg/t	2.4	2.1	2.4	2.5	1.2
Sulfur dioxide	t	1.02	1.03	4.15	1.02	1.63
related to production volume	kg/t	0.09	0.08	0.33	0.08	0.13
Methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride <sup>2</sup>	t	0	0	0	0	0
Water/wastewater						
Total water consumption	m <sup>3</sup> x 1,000	1,317	1,265	1,296	1,363	1,381
related to production volume	m³/t	113	103	102	111	109
Wastewater volume	m <sup>3</sup> x 1,000	1,255	1,244	1,264	1,327	1,249
Nitrogen discharge	t	24.7	37.4	39.1	42.5	38.7
related to production volume	kg/t	2.12	3.03	3.07	3.45	3.06
TOC discharge	t	27.0	34.0	37.0	41.2	41.5
related to production volume	kg/t	2.32	2.76	2.91	3.34	3.28
Phosphorus discharge	t	1.07	1.05	1.22	1.19	0.99
related to production volume	kg/t	0.092	0.085	0.096	0.097	0.078
Discharge of heavy metals	t	0.18	0.17	0.19	0.19	0.19
related to production volume	g/t	15.44	13.46	14.55	15.38	14.97

#### **Direct environmental impact**

Direct environmental impact is subject to operational control and can therefore be influenced. Examples include:

- > Emissions of substances into the air,
- > Other emissions (e.g. odors, noises, vibrations, light, heat and radiation),
- > Wastewater,
- > Waste,
- > Energy consumption,
- > Consumption of resources (raw materials, water).

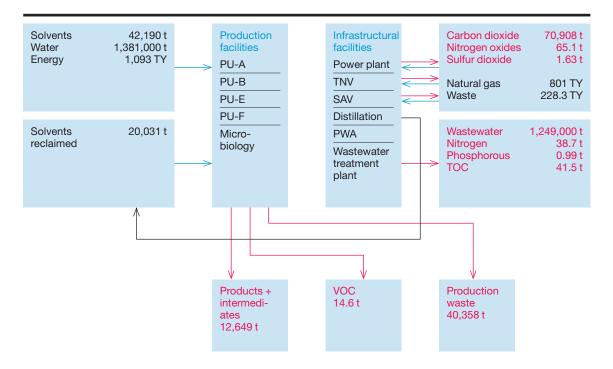


Fig. 6: Simplified overview of incoming and outgoing material flows in 2018 [t = metric tons; TNV = thermal afterburner; SAV = hazardous waste incinerator; PWA = process water treatment plant].

One of the distillation facility's main tasks is separating substance mixtures so that the individual substances can be recycled.



Water, solvents and gases reach the production processes via closed pipeline systems. Waste air from equipment is collected and incinerated at the power plant or in the thermal afterburner. Scrubbers and similar plants are used to clean some waste air streams. This applies in particular to waste air containing hydrogen, which cannot be combined with other waste air streams for safety reasons.

Depending on the level of contamination, process water is routed to a special treatment plant (PWA) or the process wastewater network. As a general rule, process water containing volatile chlorinated hydrocarbons, strong-smelling substances or substances that are hard to break down goes to the PWA.

Water circulating in a closed circuit is the main energy carrier for cooling. The steam used for heating is also available in the works network in a closed system.

The distillation facility processes contaminated solvents. The purified distillates are subsequently returned to the production process. If recycling is not possible due to material-related or economic criteria, solvents are incinerated – as far as possible utilizing the energy they contain – or disposed of.



#### **Production volumes**

The environmental impact of the Bergkamen site depends, among other things, on the volume of intermediates and end products manufactured, which rose by approximately eight percent from 11,656 metric tons in 2014 to 12,649 in 2018. A further rise in volume is anticipated in the coming years, as the production capacity of the X-ray contrast media facility is due to be increased.

Despite efforts to work as economically as possible, an increase in resource consumption and emissions cannot always be prevented when production expands. Consequently, where expedient, the following figures indicate both absolute values and the relative changes in these parameters related to the production volume.

#### **Production volume**

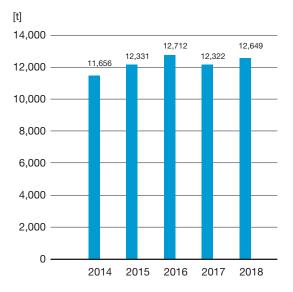


Fig. 7: The volumes of intermediates and end products rose slightly between 2014 and 2018 [t = metric ton].

Safety comes first during production operations, too. All plants undergo regular maintenance and are inspected by external auditors.

#### Water consumption

Previously, the Bergkamen site obtained all the water it needed from the Datteln-Hamm Canal and the public grid. After the "Rainwater retention" project was successfully completed in 2013, it became possible to reduce the amount of water extracted from the canal and partially replace it with rainwater. The site was therefore able to use 137,000 m<sup>3</sup> of this as cooling water, among other things, for the first time in 2014.

In 2018, water consumption amounted to approximately 1.38 million m<sup>3</sup>. Water is mainly used:

- > As a solvent, extracting agent and reagent,
- > For product precipitation/purification,
- > For waste air scrubbing,
- > For cleaning plants and buildings,
- > For cooling,
- > For steam generation.

Water consumption depends on the range of products produced in a particular year and the associated water requirements for manufacturing and cleaning. Efforts are continuously being made to reduce water requirements by conducting a variety of process optimizations (for example, replacing wet scrubbers and water ring pumps with fabric filters and dry-running pumps). It is important to bear in mind in this respect that, due to quality requirements in pharmaceutical legislation, not all technically feasible measures to reduce water consumption can be implemented.

From 2014 to 2018, the relative water consumption amounted to between 102 and 113 m<sup>3</sup> per metric ton of intermediates and end products. The rise in drinking water consumption over the past two years can be attributed to a change in the way the cooling towers are operated (interconnection), as installing new, more energy-efficient pumps required a cooling tower to be disconnected from the network. As the systems vary in terms of conductivity, however, this connection resulted in increased blowdown and a greater demand for drinking water.

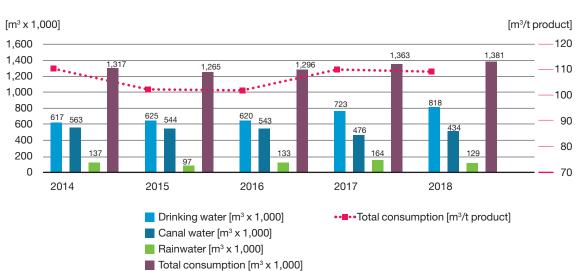
Furthermore, in 2018 a reverse osmosis plant for producing fully desalinated water was brought into operation, which also led to a greater demand for drinking water.

In 2017, Germany had a per capita water

consumption of approximately 45 m<sup>3</sup>. On

#### this basis, the Bergkamen site's water conwet sumption is roughly equivalent to that of a city with 31,000 inhabitants.

By way of comparison:



#### Water consumption

Fig. 8: Consumption of drinking, canal and rainwater between 2014 and 2018.

#### **Wastewater**

The total amount of wastewater produced at the Bergkamen site in 2018 – including the production facilities, power plant, hazardous waste incinerator and distillation facility – amounted to approximately 1.25 million m<sup>3</sup>. This includes precipitation from open operating areas, which is also disposed of with the process wastewater and not via the rain wastewater system, as a preventive measure to rule out contamination of rainwater in the event of a leak.

All process and fecal wastewater is purified at the central wastewater treatment plant. Wastewater from production facilities that is contaminated with solvents passes through an additional preliminary purification stage. It undergoes initial processing to ensure subsequent biological purification poses no problems.

Rainwater from uncontaminated, sealed areas is collected separately and discharged via a receiving water. It is tested for organic substances on an on-going basis and, in the event of any contamination, is immediately routed to one of the three emergency collecting tanks. These tanks have a combined capacity of 21,500 m<sup>3</sup> – a volume that is sufficient to hold all wastewater generated at the Bergkamen site for several days.

#### Wastewater volume

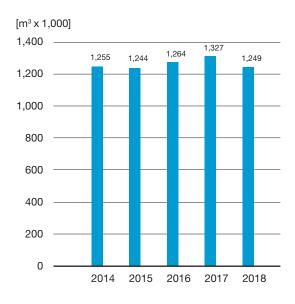
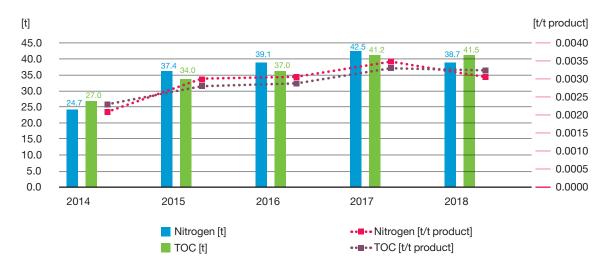


Fig. 9: Change in the amount of wastewater generated.

Due to the wide variety of active ingredients produced, the wastewater composition is not homogeneous but constantly fluctuates.

The increase in the loads of nitrogen and TOC<sup>3</sup> from 2014 to 2018 can be particularly attributed to the rise in production volumes. In addition, the product portfolio also has a major impact on the loads of nitrogen and TOC. Above all, the microbiology can significantly influence these parameters.

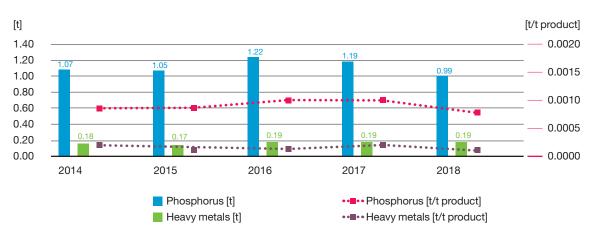
<sup>3</sup>TOC is a sum parameter in water and wastewater analyses. It indicates the water's level of contamination with organic substances.



#### Nitrogen and organic material (TOC) in the wastewater

Fig. 10: Nitrogen and organic material (TOC) loads in wastewater.

The graph below shows the discharge of phosphorus and heavy metals into the wastewater. The heavy metals discharged are mainly nickel, copper and zinc, which remain at a consistently low level. The discharge of phosphorus is influenced by a product of microbiology, in which the microorganisms used are nourished with a solution containing phosphate.



#### Phosphorus and heavy metals in the wastewater

Fig. 11: Phosphorus and heavy metal loads in wastewater. The heavy metals in question are zinc, nickel and copper [t = metric tons].

#### **Process water treatment plant (PWA)**

The PWA separates solvents, strong-smelling substances and substances that are hard to break down so as to reduce AOX/TOC loads. Provided it is technically feasible and economically viable to do so, the separated substances are treated to enable them to be reused in production. Substances that cannot be reused are recycled or disposed of at the site's own incineration plants and external facilities.

#### Central wastewater treatment plant (ZABA)

Due to the renaturation of the River Seseke, a former receiving water, and its tributaries, since 2004 the site's wastewater has no longer been discharged into the Lippe network's wastewater treatment plant but directly into the River Lippe. This required the wastewater to be purified at the ZABA, which meant adding a nitrification and denitrification stage (PAA stage) and also introducing membrane technology to eliminate slurry. The modernized wastewater treatment plant started operating in 2004.

When the membrane stage was taken into operation, each line was fitted with nine cartridges. The cartridges installed at the time each had a filtering surface area of 440 m<sup>2</sup>, providing a total membrane surface area of 15,840 m<sup>2</sup>. As capacity utilization levels at the production facilities rose, the membrane stage was gradually expanded to twelve cartridges per line in a slightly different design. The total area available for wastewater purification has thus now increased to 21,960 m<sup>2</sup>.

The combination of the process water treatment plant (PWA) and the central wastewater treatment plant (ZABA) enables us to achieve TOC degradation rates that for years have remained consistently high at above 98 percent. Moreover, our production facilities also adopt measures to keep the pollution of the wastewater with organic substances as low as possible, such as the X-ray contrast media facility's thermolysis plant. At this plant, wash and mother liquors are steam-heated to an approximate temperature of 160 °C to transform organically bound iodine into iodide that can be fed into the downstream process of iodine recovery. As a result, nearly all iodine (>96 percent) is removed from the process water as iodide, with the TOC contamination of the process wastewater significantly reduced at the same time.

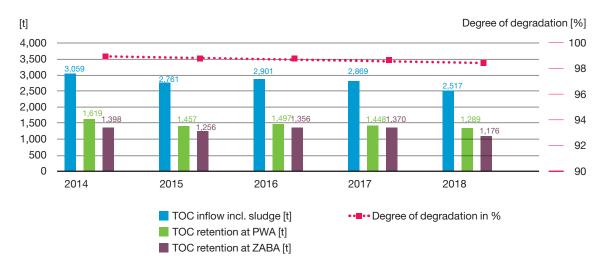
Different measures are taken to prevent unwanted odors, including the use of largely closed wastewater treatment plants, a three-step scrubber for treating waste air emitted by the wastewater treatment plant, and a system to suppress odors located at the point of transfer from the canal network to the wastewater treatment plant.

Ultrafine micro-membranes ensure maximum purity in wastewater treatment.





Motivated staff and flawless plants – success factors for safe and environmentally friendly production.



TOC degradation at the PWA and wastewater treatment plant

Fig. 12: TOC degradation at the process water and wastewater treatment plants [t = metric tons].

# Waste air (solvent balance, organic substances)

In addition to air emissions resulting from incineration processes at the power plant and in the hazardous waste incinerator, emissions of volatile organic substances from the active ingredient facilities are also environmentally relevant. These VOC<sup>4</sup> emissions are generated from the use of various solvents that are an essential part of active ingredient production.

### Solvents used in 2018

Solvents	metric tons
1,2-dichloroethane	10,338
Alcohol, absolute	6,935
Acetone	4,774
Ethyl acetate	3,557
Methanol	3,463
Methylene chloride	3,195
Tetrahydrofuran	2,354
Other	7,574
Total volume	42,190

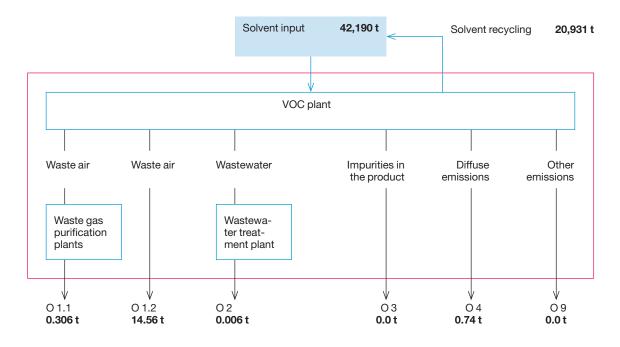
The solvents are located in closed plants from which the waste air is collected centrally and sent for incineration. This means that emissions are restricted to a small number of processes that can only be performed in open systems, including cleaning and taking samples. The requirements relating to such plants are described in the 31st BImSchV (Federal Immission Control Ordinance). An external state-approved laboratory monitors our production plants' compliance with VOC emission limits. All emissions are assessed and documented in an emissions register.

Figure 13 shows the solvent balance required by law. It includes all conceivable emission paths for volatile organic substances (waste air, wastewater, diffuse emissions, etc.). In 2018, 15.6 of the total of 42,190 metric tons of solvents used were released into the atmosphere. This is equivalent to 0.04 percent. By way of comparison, the statutory limit is five percent.

The main emission paths for volatile organic compounds is through the ambient air dissipated via emissions sources in active ingredient plants, e.g. through doors, windows and flanges. This air can contain organic substances and diffuse emissions. The other emission paths, via wastewater or minor residue emissions via the waste air produced by waste gas purification plants, are of lesser importance.



An improvement suggested by chemists Kai Jonas Pohl (left) and André Hesener has significantly reduced solvent consumption when cleaning small parts.



**Emissions determined for 2018** 

O 1.1 = Emissions in the treated waste gases collected

01.2 = Emissions in the untreated waste gases collected

02 Amount of organic solvents in the wastewater, taking into account wastewater treatment =

Amount of organic solvents remaining in the end product as an impurity or residue Diffuse emissions, e.g. via doors, windows, flanges О3 =

04 =

09 = Organic solvents released in some other way

#### Limit as per 31st BlmSchV:

O 1.1 + O 1.2 + O 2 + O 3 + O 4 + O 9 < 5% of solvent volume used

0.306 t + 14.56 t + 0.006 t + 0.0 t + 0.74 t + 0.0 t = 15.6 tcorresponding to approx. 0.04 percent of the total volume of 42,190 t of solvents used

Fig. 13: Emissions were determined using the "direct method" [t = metric tons].

# Waste air (emissions resulting from incineration processes)

During incineration processes, flue gases are produced, which contain, among other things, inorganic components such as nitrogen oxides (NOx) or gaseous chlorine compounds (e.g. hydrogen chloride). Major sources of air emissions resulting from incineration processes are the power plant, the thermal afterburner and the hazardous waste incinerator.

With a view to continuously monitoring these parameters, the power plant and the hazardous waste incinerator are connected to Arnsberg District Authority's remote emissions monitoring system. Once it has been reviewed by the authority, the annual emissions data for the power plant and the hazardous waste incinerator is published online. As stipulated in the notification of approval, the thermal afterburner is regularly monitored by an external measuring body.

Converting the power plant's gas turbine to low nitrogen oxide (NOx) burners in 2008 reduced nitrogen oxide emissions in subsequent years from around 140 metric tons a year to just under half of

Air emissions excluding carbon dioxide in metric tons [t]

that. Depending on the gas turbine's run times, nitrogen oxide emissions have since remained relatively stable at between 60 and 70 metric tons a year.

A pledge was made in the 2013 Environmental Statement to reduce VOC emissions after these emissions also rose between 2010 and 2012 due to increased production. To this end, an emissions reduction program was launched and the facilities in all plants were optimized with regard to emissions, inspecting all processes – from taking samples to loading the dryers – for any emissions-relevant weaknesses, and identifying measures to reduce them.

The hard work has paid off. In 2018, VOC emissions were measured at 14.6 metric tons – the lowest figure to date. As an objective for the years ahead, despite the anticipated increase in production, we have set out to permanently cap our VOC emissions at 15 metric tons a year (see the Objectives section).

Year	Nitrogen oxides	Carbon monoxide	Organic substances	Sulfur dioxide	Dust
	NOx	со	VOC	SO2	
2014	61.1	10.5	28.4	1.02	0.377
2015	62.8	15.0	25.6	1.03	0.337
2016	61.6	13.6	30.7	4.15	0.809
2017	70.2	8.0	30.75	1.02	0.701
2018	65.1	1.7	14.6	1.63	0.637

Fig. 14: Following the introduction of a site-wide emissions reduction program, Bergkamen succeeded in significantly reducing VOC emissions.

### <sup>5</sup> In 2017, no measurements of emissions were taken at the sources of ambient air, as the measuring institute commissioned with this abruptly ceased providing this service. The emissions value taken in 2016 was therefore used as a substitute value for 2017.

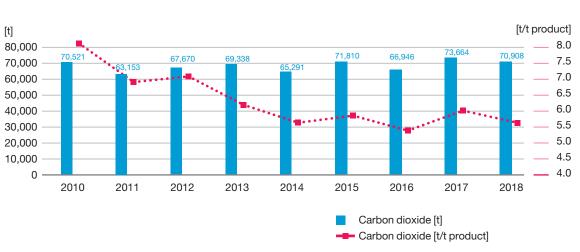
#### **Carbon dioxide emissions**

To us, sustainability means safeguarding our future viability and, as part of corporate strategy, it is integrated into our day-to-day workflows. We underline Bayer's mission as a company that acts sustainably through our commitment to the U.N. Global Compact and the Responsible Care<sup>™</sup> initiative and our active global involvement in leading initiatives such as the World Business Council for Sustainable Development (WBCSD).

Supply Center Bergkamen has supported the Bayer Climate Program in many different ways over the years. For example, Production Unit F and microbiology production operations have both undergone a "Climate Check", which involved Bayer experts evaluating the total energy consumption of the facilities, including all installations such as heat exchangers and drives, and examining technical aspects of buildings – from lighting and air conditioning to ventilation and insulation. Another focal point was optimizing the plants' operating parameters and variables. The experts interviewed plant operators on site to obtain additional indications on how energy could be used more efficiently. This led to various measures being launched, such as the conversion of plants to use natural gas rather than heating oil and the optimization of incineration processes. Over an extended period, it was thus possible to successfully reduce the relative carbon dioxide emissions from more than eight metric tons for each metric ton of product (2010) to the current value of five to six metric tons for each metric ton of product (2014 to 2018).

#### By way of comparison:

The total carbon dioxide emissions in Germany throughout 2017 amounted to around 800 million metric tons.



#### Carbon dioxide emissions

Fig. 15: Carbon dioxide emissions [t = metric ton]

#### **Product dust**

Double dust filters are integrated into waste air systems wherever product dust is generated. The differential pressure of these filters is monitored to make sure they are working properly and they are checked each time prior to the production plants being used. This ensures that the limit of 0.05 mg/ m<sup>3</sup> specified in "TA Luft"<sup>6</sup> is not only met, but the actual level is some way below this limit.

#### Waste

Waste classified as hazardous is generated when manufacturing active ingredients for pharmaceuti-

#### Process step

cals. A waste incineration plant was built back in 1977 to ensure the safe disposal of these substances. It has been upgraded several times since then, primarily due to stricter legal requirements but also to stop elementary iodine being released during the incineration of waste containing this substance.

Liquid waste has been incinerated in a special boiler at the site's own power plant since 2001, which helps replace fossil fuels. This practice has significantly altered the structure of waste disposal in favor of thermal recycling. It is important to bear in mind that waste volumes can vary greatly due to changing production campaigns. The following process steps have the potential to generate waste:

Waste
-------

1100000 0100	Matte
Phase separation	Organic and aqueous phases
Filtration	Used filter material, filtered-out solids
Centrifugation	Mother and wash liquors, rinsing liquids
Drying	Condensates
Distillation	Distillation bottoms
Cleaning	Cleaning solvents

Figure 16 shows how much hazardous production waste was generated at the Bergkamen site from 2010 to 2018. Over the past five years, the absolute amount of waste has slightly increased.

Since 2010, the site has succeeded in reducing the relative amount of waste from more than 4.2 to now just 3.2 metric tons for each metric ton of product. The relative amount of waste generated depends on the type and volume of the active ingredients being

manufactured. During the manufacture of active ingredients for contrast media, for example, around one metric ton of waste is created for each metric ton of product. For the same production volume of steroid hormones, in contrast, around 50 metric tons of waste are generated. There are plans to expand contrast media capacity over the coming years - and thus reduce the relative amount of waste produced even further.

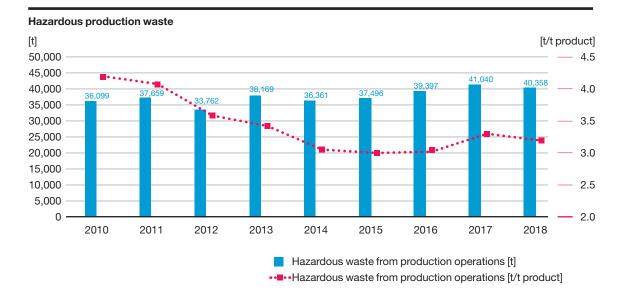


Fig. 16: Amounts of hazardous waste generated in production operations [t = metric ton].

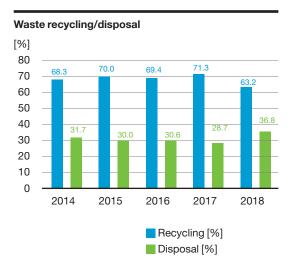
#### Waste avoidance and recycling measures

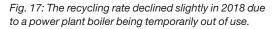
Our strategy is to avoid or recycle waste. The "material flow management" function works on gearing all production processes toward this requirement. The main objectives include:

- > Increasing yields and reducing waste volumes,
- > Avoiding off-specification batches,
- > Minimizing cleaning measures.

One special feature at the Bergkamen site is iodine recycling. Upgrading the waste incineration plant with flue gas scrubbing in 1997 enabled quantitative binding of the iodine released when incinerating waste containing this substance. In addition to solid and liquid waste from X-ray contrast media production, finished goods that are returned are also recycled. The iodide solution obtained in this way is sold to external customers, which results in complete material recycling of the iodine. GMP<sup>7</sup> regulations do not permit direct use of the iodine recovered for the site's own production operations. This process made it possible to recover and recycle around 251 metric tons of iodine in 2018.

The recycling rate for 2014 to 2017 was around 70 percent. In 2018, however, this figure dropped to 63.2 percent, which can be attributed to a longer downtime of one of the power plant's boilers. Residue solvents, which cannot be recovered by way of distillation, can be recycled in this boiler because it features combined heat and power generation technology.

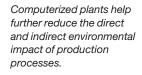




The Bergkamen site has a long-standing tradition of recovering solvents in pharmaceutical production. The process takes place at the distillation facility, which supplies production operations with adequate amounts of the appropriate quality of solvents required for manufacturing pharmaceuticals. The key tasks involved in distillation include:

- Recovering solvents in line with economic and ecological principles,
- Manufacturing raw materials not available on the market (e.g. fatty acid anhydrides),
- > Using distillation columns with a bladder volume of 4 to 70 m<sup>3</sup> in batch operation and various interconnection options for continuous operation,
- > Phase separations,
- Rectification processes in pressure ranges from high vacuum to normal pressure,
- Processes involving azeotropic and extractive distillation.

From 2014 to 2018, the recycling quota for solvents was between 50 and 60 percent. Due to the construction of a new distillation facility, this figure is set to rise further over the coming years.





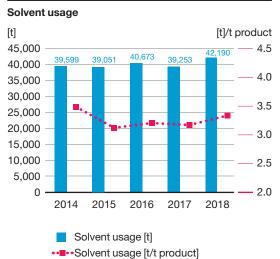


Fig. 18: The relative use of solvents has barely changed over the past five years [t = metric ton].

#### Soil

As a general rule for building projects, soil samples are taken and tested for contaminants by an external auditor to identify soil contamination and rectify the situation as quickly as possible. If contamination is detected, the necessary remediation measures are initiated immediately.

The Bergkamen site has several dozen groundwater measuring points at different depths that have been set up for monitoring purposes – in particular at the plot's outer boundaries, but also on the works premises. External auditors regularly take water samples at these measuring points for subsequent analysis and assessment. Contamination requiring remediation measures has been detected at two of them. In both cases, the groundwater is now routed via purification plants that bind the contaminants – to activated carbon, for example.



The remediation wells create artificial groundwater pits into which potentially contaminated groundwater flows. This rules out any uncontrolled outflow into the surrounding area. Due in no small part to this measure, there has to date been no evidence of any impact on the groundwater beyond the site's boundaries.

The implementation of the Industrial Emissions Directive (IED) imposed new requirements on the Bergkamen site regarding approval procedures and plant operation. For example, when an IED plant is shut down, the site must be returned to its previous condition if the operation of the plant has led to substantial contamination of the soil or groundwater. When constructing a new IED plant or making substantial changes to an existing one, a baseline report for soil and groundwater must be presented and submitted as part of the approval procedure. The soil analyses carried out to date have not indicated any critical contamination of the soil.



Major investments in recent years have continuously improved the efficiency of the power plant. The photo shows the interior of the turbine hall.

#### Energy

The power plant at the Bergkamen site is equipped with five steam generators and a gas turbine that cover all the steam requirements and a significant proportion of its electricity requirements. The plant has a capacity of 100 metric tons of steam and nine megawatts of electricity. The additional electricity required is bought in.

Solvents and waste gases containing solvents from the production facilities are used as fuel in addition to natural gas and heating oil. This practice helps prevent emissions from organic solvents and reduce the need for fossil fuels.

With a view to further reducing its energy consumption, in 2015 the Bergkamen site introduced an energy management system to ISO 50001 and secured certification by an external auditor. In the future, this will enable us to better identify potential energy savings and thus channel our investment activities more effectively. The new system, which is aimed at seamlessly tracking all energy flows rather than just individual measures, will ensure the site is successful in this regard. This comprehensive approach is nurturing organizational change and led to a team of 18 energy officers and one energy manager being instated at Supply Center Bergkamen in 2016.

Their task is to help implement and improve the energy management system. In the long term, they are also to strengthen the site's sustainable development policy and devise energy-saving measures. Specific projects have already been put into place.

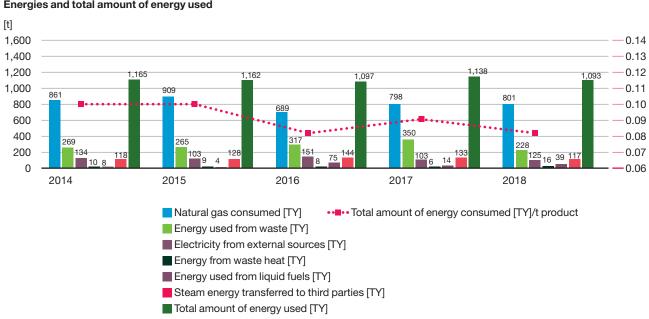
By acquiring new cooling water pumps alone, Bayer has saved around two million kilowatt hours in Bergkamen since 2017. Further savings (see Objectives for 2019 and beyond) are expected to be made by continuing the program to replace old motors with high-efficiency models and by increasingly using LED lighting.

#### **Energy usage**

The most important energy sources are natural gas, waste containing energy such as contaminated solvents from on-site production, metal alkyl residues from the plants operated by LANXESS Organometallics GmbH and external electricity.

Less relevant energy sources are liquid fuels (EL heating oil, diesel) and waste heat.

To calculate the total energy usage, it is necessary to deduct the energy transferred to external companies in the form of steam from these values.



#### Fig. 19: In the period from 2014 to 2018, the relative amount of total energy used fell by around 14 percent.



By submitting suggestions for improvement, staff at the site contribute toward reducing energy consumption and improving energy efficiency - such as here at the hazardous waste incinerator.

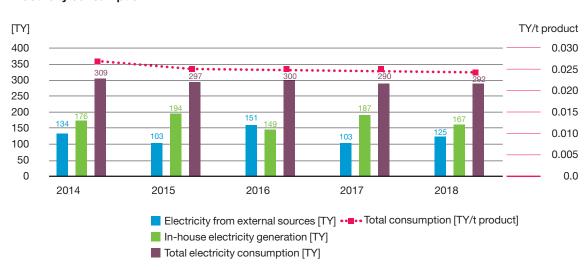
#### Energies and total amount of energy used

#### **Electricity consumption**

In the period from 2014 to 2018, relative electricity consumption was successfully reduced by around 13 percent. Various projects carried out in recent years contributed to this achievement. For instance, only high-efficiency models of motors are considered for acquisition and more LED lighting is being used. Depending on the turbine's run time in the particular year, the proportion of electricity generated in-house was between 50 and 65 percent. In 2018, renewable energy sources accounted for a total of 22.6 percent of the overall amount of electricity consumed.

#### By way of comparison:

In 2018, the Bergkamen site's electricity requirements totaled 292 TY (81,117,000 kWh). That is equivalent to the annual consumption of approximately 16,230 four-person households (on average, such households consume approximately 5,000 kWh each year).



**Electricity consumption** 

Fig. 20: In the period from 2014 to 2018, relative electricity consumption fell by around 13 percent.

#### Indirect environmental impact

Transporting goods of all kinds to and from Supply Center Bergkamen consumes energy and generates harmful emissions. The same applies to business trips and employees' journeys to and from work. A point is made of optimizing capacity utilization for the relevant modes of transport and avoiding empty runs so as to minimize these emissions.

Bayer is also working further to reduce its CO<sub>2</sub> emissions generated by the Group's global fleet of over 25,000 vehicles. The aim of the Sustainable Fleet Initiative is to reduce average CO<sub>2</sub> emissions to 110 g/km for new vehicles registered in 2020. In 2018, greater efforts were made in this direction by conducting e-mobility pilot projects, among other things.

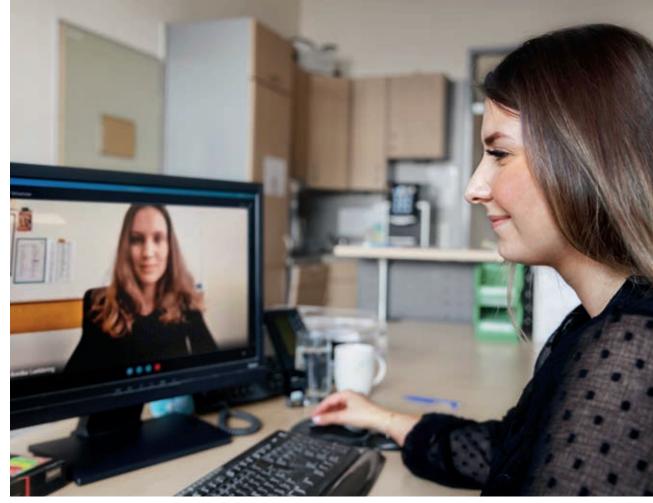
The Bergkamen site supports this initiative. As early as May 2018, the plant safety staff replaced a diesel vehicle with an electric car. Encouraged by the positive experience with this new StreetScooter, Energy Supply decided to acquire two more electric vehicles, which do not produce any emissions and make far less noise than their predecessors. In the area of communication, Bayer is increasingly using energy-efficient workstation solutions with integrated voice and video functions. Such IT solutions reduce the number of business trips necessary and thus emission levels. The Bergkamen site also features a state-of-the-art video conference room.

Producing essential raw materials, consumables and supplies and the relevant packaging materials has an impact on the environment, which varies according to the technological standard of suppliers. It is an elementary factor in Bayer's value chain that suppliers and external partners respect and adhere to sustainability standards. Besides economic standards, we therefore also apply environmental, social and corporate governance (ESG) standards when choosing our suppliers. These standards are defined in Bayer's Supplier Code of Conduct, which is based on the principles of the U.N. Global Compact and Bayer's Human Rights Position. The Code forms the fundamental basis for our collaboration. It is legally binding and integrated into electronic ordering systems and contracts throughout the Group.

The Bergkamen site has procured several electric vans over the past few years.







Skype conferences benefit the environment by eliminating the need for business trips.

Online supplier assessments and on-site audits are conducted to monitor how suppliers are performing in terms of sustainability. An external service provider with the status of leading supplier of webbased platforms for such tasks carries out the assessments, which are based on a modular online questionnaire, coupled with accompanying verification documents and meticulous screening. By 2020, we aim to assess every supplier with a significant procurement volume (> EUR 1 million p.a.) that is regarded as potentially risk-laden. In addition to this, suppliers are inspected at their premises by external, independent auditors. The inspection criteria cover both our Code and sector-specific requirements that we have jointly laid out in the Together for Sustainability (TfS) industry initiative and the Pharmaceutical Supply Chain Initiative (PSCI). These initiatives are designed to help standardize the sustainability requirements for suppliers in the chemical and pharmaceutical industries. Bayer reserves the right to terminate a supplier relationship if especially critical sustainability weaknesses have been identified during an online assessment or an on-site audit and no improvement is observed during a follow-up evaluation.

#### Bayer supplier assessments and audits

	2017	2018
Sustainability assessments <sup>8</sup> via the online platform	622	715
Sustainability audits <sup>9</sup> by external auditors	57	79
Sustainability/HSE <sup>10</sup> audits by Bayer auditors	115	130

8 Initial and repeat assessments of suppliers initiated by Bayer.

<sup>9</sup> Initial and follow-up audits of suppliers initiated by Bayer.

10 Health, Safety & Environment.

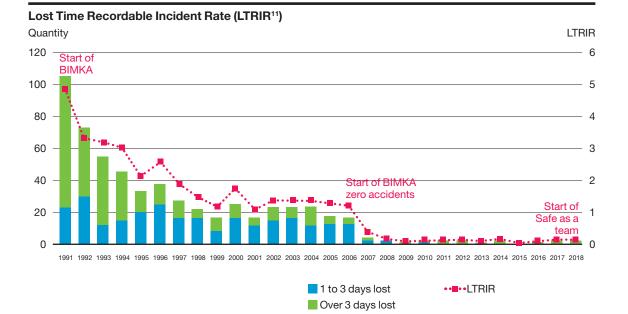


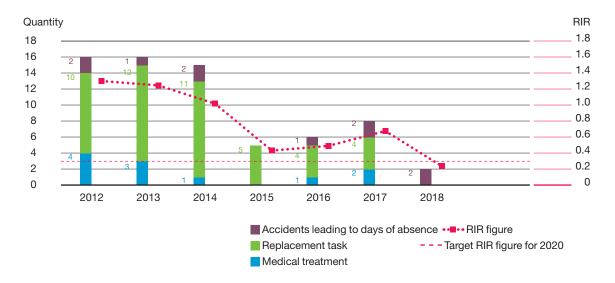
Fig. 21: Reduction in number of accidents achieved by occupational safety programs.

#### **Occupational safety and accidents**

As an integral part of our management system, occupational safety was first audited in line with OHSAS 18001 requirements in 2006. The certification body confirmed in the process that a health and safety management system exists and is applied. The successful outcome of the audit also proved that the requirements of OHSAS 18001:2007 are being met. For the year 2020, we are planning to convert the certification of our occupational safety management system to ISO 45001, the new international standard for state-of-the-art occupational safety.

In the early 1990s, Supply Center Bergkamen initiated an important process for improving occupational safety with its BIMKA (observe, inform, motivate, monitor, evaluate) occupational safety program. As a result, accident statistics from that decade show a considerable drop in incidents. Nonetheless, a comparison with figures from other sites belonging to the Bayer Group revealed there is yet more scope for improvement. Building on the BIMKA program, since 2008 the Bergkamen site has been conducting the Groupwide "Managing safety!" accident prevention initiative with an additional module – the "BIMKA zero accidents" occupational safety program, which was put in place with the help of an external consultant.

This new occupational safety program has led to a further drop in accident rates. For the first time in 2015, there wasn't a single accident leading to days of absence in Bergkamen – that's a LTRIR of zero! Spring 2016 marked the launch of the new "Safe as a team" occupational safety program. The core elements, which are designed to further reduce the already low accident rate, include increasingly interlocking different safety systems and considering and ranking both appropriate and improper behaviors. The aim of this new occupational safety program is to lower the RIR rate to 0.32 by 2020.



#### Accidents leading to days of absence, replacement tasks and medical treatment (RIR<sup>12</sup>)

Fig. 22: From 2020 onward, the target is to keep the RIR permanently at  $\leq$  0.32.

Bayer previously used the LTRIR rate, which records all work-related accidents leading to days of absence, to assess accidents. In the future, the RIR rate will serve as the new reference parameter. This rate also takes into account medical treatment and replacement positions. In its integrated annual report, Bayer pledged to lower its RIR rate to 0.32 by 2020. As this target also applies to the Bergkamen site, further occupational safety activities are required to reliably achieve it long-term.

At the start of 2014, the Behavioral Safety initiative was adopted by the Bayer Safety Council headed by the Chairman of the Board of Management. The initiative focuses on the human factor and the safety-conscious behavior of employees. Behavioral safety involves identifying and preventing unsafe working practices and appropriately reinforcing and consolidating safe working methods at all levels. This approach is by no means limited to the production plants but is also intended to cover areas of work such as research & development, marketing & sales and administration.

Supply Center Bergkamen implemented this initiative under the heading "Safe as a team" in 2016. Initially, employees were trained as coaches and then acted as ambassadors for their fellow co-workers. With the aim of the new occupational safety program being to reinforce positive behavior, occupational safety experts work with other staff members on site to analyze the rules that exist and where they are already being effectively put into practice. As a result, staff are more alert to correct behavior and take a more conscious approach to safety issues.

<sup>12</sup> The RIR (Recordable Incident Rate), in addition to the number of work-related accidents leading to days of absence, also records the number of cases in which medical treatment was given and tasks were replaced, and is based on 200,000 working hours.



Safety through dialog – supervisors and staff regularly discuss ways of optimizing occupational safety and preventing accidents.

#### **Bayer Safety Day**

The Group-wide Bayer Safety Day is held once a year with the aim of making staff more aware of occupational health and safety issues. The event includes a variety of occupational health and safety activities. Recent focal points have been as follows:

2016: Safe as a team – safety-conscious behavior in the workplace 2017: Pay attention! 2018: Move safely!

#### **Occupational health management**

Health is the most precious commodity of all. Consequently, protecting employees against accidents and diseases is and always will be a key objective. As early as 1996, Bayer began its occupational health management scheme in Bergkamen, which covers a wide range of activities for protecting people while they are at work and for ensuring their tasks, the way work is organized and working conditions are conducive to good health. Occupational health management should also provide guidance on conduct – above all by management staff – that promotes health, safety and well-being. The focus is on the following objectives:

- > Guarding against health impairments,
- > Encouraging staff to adopt a healthy and active lifestyle,
- > Creating a healthy working environment,
- > Boosting motivation and job satisfaction.

To this end, it is necessary to alert all staff members to health issues, increase their health awareness and take measures to adapt to changed working conditions. Our conviction that people are the most important resource a company has serves as our guiding principle.

Staff are involved through health groups. Lasting several days, these workshops run by external specialists address health concerns on site, which they use as the basis for developing measures to improve the situation.

In 2014, the role of health officer was created to act as the link between staff and their supervisors. Their main role is to provide information, organize activities and motivate others in their area of responsibility with regard to health issues. At the same time, they are there to support staff and supervisors. In total, 17 health officers have been appointed at Supply Center Bergkamen, with due care to ensure each area/function has at least one health officer at its disposal. To coordinate the work of health officers, encourage them to network and pool health-related issues across multiple areas of responsibility, the site management has appointed two health coordinators. Their role involves:

- > Taking on board health-related issues from health officers,
- Presenting these issues to the plant management and the Occupational Health Management committees,
- > Supporting the on-site work performed by the health officers.

The health center also opened its doors in 2014. For the first time in its history, this provided the Bergkamen site with an established port of call for health issues. Besides a large training room with a sound system and various pieces of sports equipment, the center houses a massage room and a seminar room for the theoretical element of health training courses. From 2014 to 2018, many of the existing occupational health management activities were continued and refined. Examples are as follows:

- > Rehabilitation sports (with a doctor's prescription)
- > Self-defense for all
- > Preventive back and joint training (fascia training)
- > Fitness boxing
- > Running and walking meetups
- > Aqua-Vital and fitness training
- > "Five" compact courses (back and joint circuit)

Other health promotion measures include:

- > Vaccinations
- > Advanced health checks
- > Back gymnastics
- > Help to stop smoking
- > Medical massages
- > Medical podiatry



The company's sports association continuously adapts and develops its offerings – such as the recently founded mountaineering department for walking and climbing enthusiasts.

#### **Benefits of preventive medicine**

In addition to the usual checks by the works doctor, the occupational health management system also offers staff thorough preventive health screening with advanced health checks.

Based on the works agreement for lifetime working and demographic change, the Works Council and company management have agreed to introduce this new form of health promotion, which involves a preventive health screening and an intensive consultation. The screening, which goes way beyond the offerings of statutory health insurance providers, is free of charge, takes place during working hours and is carried out by in-house medical staff. All employees receive a written invitation to attend a personal health check. A blood sample is taken one or more days before the appointment. For the check, the employee pedals a bike and subsequently has an in-depth discussion with the doctor. During the consultation, which lasts about an hour, staff are given the results of their blood tests and find out more about good and bad cholesterol and their personal risk of a stroke or heart attack. Based on all the findings, the doctor and employee look for indications as to where action is needed, what needs to be done as quickly as possible, which measures require more time, and what is going well.



Supply Center Bergkamen offers its staff a free health check, including a detailed medical consultation.

## Objectives and programs

#### Evaluation of objectives and programs from the 2016 Environmental Statement

Objectives/programs/measures Occupational health and safety	Implemented by	Comments		
<ul> <li>LTRIR rate &lt; 0.17 (number of accidents leading to days of absence), RIR rate &lt; 0.32 (number of recordable accidents)</li> <li>Implementing Bayer's Behavior Based Safety occupational safety initiative</li> <li>Conducting a plant-wide survey on occupational safety.</li> <li>Consequently deriving measures, launching new tools and training courses.</li> <li>Launching activities at the start of 2017.</li> </ul>	2020 Occupational safety survey conducted in April/May 2016	Survey has been conducted and evaluated.		
LTRIR rate < 0.17 (number of accidents leading to days of absence), RIR rate < 0.32 (number of recordable accidents)	2020 Start of 2016	Safety specialist has been trained as a coach.		
<ul> <li>LTRIR rate &lt; 0.17 (number of accidents leading to days of absence), RIR rate &lt; 0.32 (number of recordable accidents)</li> <li>Implementing Bayer's Behavior Based Safety occupational safety initiative</li> <li>Training for safety officers and supervisors in the different functions (see above).</li> </ul>	2020 End of 2016	Training courses held in first half of 2017.		
<ul> <li>Reducing the absence rate to below 5.75 percent</li> <li>Conducting health promotion activities</li> <li>Continuing to offer free preventive screenings (health checks) to all staff.</li> </ul>	2018	Ongoing health checks.		
<ul> <li>Reducing the absence rate to below 5.75 percent</li> <li>Conducting health promotion activities</li> <li>Setting up a training circuit for fitness, running and walking.</li> </ul>	2018 2016 • 2018 •	Setting up a running and walking route (approx. two km in length, partially as a woodchip track). Instead of a fitness circuit with multiple exercise stations (outdoor equipment), a Five equipment circuit was permanently installed at the health center.		
<ul> <li>Reducing the absence rate to below 5.75 percent</li> <li>Conducting health promotion activities</li> <li>Conducting a Health Day for all staff.</li> </ul>	2018 Meeting on June 16, 2016	Health Day was carried out as planned.		
<ul> <li>Reducing the absence rate to below 5.75 percent</li> <li>Conducting health promotion activities</li> <li>Annual "Live more mindfully" campaign from April 1, 2016 to December 31, 2016.</li> </ul>	2018 Annual campaign in 2016	Annual campaign was carried out as planned.		

• = Objective fully achieved

= Objective not yet fully achieved

Project discontinued

Reducing exposure to hazardous substances at the workplace	Ongoing objective	
Adopting targeted individual measures to reduce		A glovebox was installed in the project
<ul> <li>exposure to hazardous substances</li> <li>Setting up two gloveboxes in B008 (microbiology), dispensing with IBC handling.</li> </ul>	Mid-2018	A glovebox was installed in the project that performs the functions of both planned gloveboxes. This measure has been implemented.
Reducing exposure to hazardous substances at the workplace	Ongoing objective	
Adopting targeted individual measures to reduce	,	
exposure to hazardous substances	Mid-2018	$\rightarrow$ Implementation to be carried out in
<ul> <li>Using additional extraction systems (microbiology) to improve how big bags are emptied.</li> </ul>	•	2019.
Reducing exposure to hazardous substances at the workplace	Ongoing objective	
Adopting targeted individual measures to reduce	objective	
exposure to hazardous substances	Mid-2018	This measure has been implemented.
<ul> <li>Setting up a glovebox with PTS, including sampling for suspensions.</li> </ul>	•	
Reducing exposure to hazardous substances at the	Ongoing	
<ul> <li>• Adopting targeted individual measures to reduce</li> </ul>	objective	
exposure to hazardous substances	By end of	→ On target
> Reviewing development of TIP synthesis free of	2020	
ethylene chloride (PU-F).	•	
Reducing exposure to hazardous substances at the	Ongoing	
<ul> <li>• Adopting targeted individual measures to reduce</li> </ul>	objective	
exposure to hazardous substances	2016 🔹	Samplers have been installed.
<ul> <li>Installing closed samplers at stirred reactors (PU-E).</li> </ul>		
Objectives/programs/measures		
Environment/energy		
Reducing relative energy consumption by five percent by 2020	2020	Reference year 2014
Conducting energy-saving projects	_	Plan:
Constructing a more energy-efficient distillation plant to replace the old plant.	See comments	<ul> <li>Application for approval submitted in 2015.</li> </ul>

percent by 2020	2020	Reference year 2014
Conducting energy-saving projects		Plan:
> Constructing a more energy-efficient distillation plant to replace the old plant.	See comments for timetable	<ul> <li>&gt; Application for approval submitted in 2015.</li> <li>&gt; Approval granted in 2016.</li> <li>&gt; Construction began in 2016.</li> <li>&gt; Commissioned in 2017.</li> <li>Delay:</li> <li>&gt; Application for approval first submitted in 2016.</li> <li>&gt; Approval first granted in 2017.</li> <li>&gt; Commissioned in 2019.</li> </ul>
Reducing relative energy consumption by five percent by 2020 • Conducting energy-saving projects	2020	Reference year 2014
<ul> <li>Exchanging the water pumps in the B018, B201, C205 cooling towers – potential annual savings of approx. 2,350,000 kWh.</li> </ul>	End of 2016 •	Water pumps in the B018 and B201 cooling towers were exchanged in 2016; for C205, the swap was made at the start of 2017.

Reducing relative energy consumption by five percent by 2020	2020	Reference year 2014	
<ul> <li>Conducting energy-saving projects</li> <li>Continuing the program to replace old motors with high-efficiency models. Annual exchange of approx.</li> <li>1,500 – 1,700 kW operating power. Potential savings of approx. 200,000 kWh p.a. once all motors have been changed.</li> </ul>	Ongoing •	The motor exchange is an ongoing project. At the start of 2019, 28.9 percent were achieving the maximum possible drive power. $\rightarrow$ On target	
Reducing relative energy consumption by five percent by 2020	2020	Reference year 2014	
<ul> <li>Conducting energy-saving projects</li> <li>&gt; Replacing old insulation for the 90 °C &amp; 160 °C steam heat exchangers, pumps and pipes in the energy transfer environment in PU-E.</li> </ul>	2016	Project implemented as planned.	
Reducing relative energy consumption by five percent by 2020	2020	Reference year 2014	
<ul> <li>Conducting energy-saving projects</li> <li>Exchanging the 2 °C refrigeration compressors in PU-A         <ul> <li>potential annual savings of approx. 190,000 kWh.</li> </ul> </li> </ul>	2016	Project implemented as planned.	
Reducing relative energy consumption by five percent by 2020	2020	Reference year 2014	
<ul> <li>Conducting energy-saving projects</li> <li>Inspecting steam traps throughout the entire works.</li> </ul>	Ongoing	→ On target	
<ul> <li>Environment/air pollution control</li> <li>Further reducing VOC emissions (&lt; 25 metric tons p.a.).</li> <li>Continuing the program to reduce VOC emissions</li> <li>Exchanging old centrifuges in PU-E for new highly gas-tight devices.</li> </ul>	2020 Start of 2018	The new centrifuges are all in operation. Project implemented.	
<ul> <li>Further reducing VOC emissions (&lt; 25 metric tons p.a.).</li> <li>Continuing the program to reduce VOC emissions</li> </ul>	2020		
Installing an automated hose cleaning system in PU-E with an automatic cleaning program including inertization, testing for tightness, emptying and rinsing.	End of 2016	The automated hose cleaning system was put into operation in 2016.	
Objectives/programs/measures Environment/wastewater			
<ul> <li>Reducing the contaminant loads introduced into the wastewater</li> <li>Adopting targeted individual measures</li> <li>Installing a system for reducing COD and recovering iodine from the PU-F wastewater streams. The expected reduction in iodine load is approx. 20 metric tons p.a.</li> </ul>	Ongoing objective End of 2016	Objective from the previous 2013 Environmental Statement updated. Improved recovery of iodine by optimizing the peroxide dosage. However, the planned measures to reduce the discharge of iodide – and thus technically also the COD discharge – by lowering the surplus of peroxide	

Reducing the contaminant loads introduced into the wastewater

- Adopting targeted individual measures
- Introducing decentralized online analytics to obtain information for optimizing preliminary treatment at the central wastewater treatment plant (ZABA).

Ongoing objective

•

At the pre-planning stage, it was established that the information gained from decentralized online analytics was not sufficient to derive measures for optimizing preliminary treatment at the ZABA. As an alternative, the entire preliminary treatment process is to undergo optimization. This project is to be integrated into the environmental objectives as soon as further details become available.

#### Objectives/programs/measures

Environment/resource conservation

<ul> <li>Resource-friendly production</li> <li>Adopting targeted individual measures</li> <li>Installing a fourth recovery module in the ethanol recovery plant: Increasing the proportion of ethanol recovered in PU-F.</li> </ul>	Ongoing objective End of 2016	Increasing the proportion of ethanol recovered by one third compared to the current expansion phase.
	•	Project implemented.
<ul> <li>Resource-friendly production</li> <li>Adopting targeted individual measures</li> <li>&gt; Project for cleaning major plant components in the CIP (cleaning in place) process in PU-A.</li> </ul>	Ongoing objective 2016 to 2018	Reducing the cleaning cycles and demand for solvents. Energy requirements decrease at the same time, e.g. during boiling in stirrers and when operating feed pumps or equipment motors.
	•	Project implemented.
<ul> <li>Resource-friendly production</li> <li>Adopting targeted individual measures</li> <li>&gt; Project to optimize the cleaning of equipment in PU-B by means of automation.</li> </ul>	Ongoing objective 2016 to 2018	Reducing cleaning cycles, lowering demand for solvents, improving occupational safety by avoiding manual tasks.
	•	Project implemented.

#### Environmental, occupational safety and energy objectives for 2019 and beyond

#### **Objectives/programs/measures**

Environment/air pollution control

<ul> <li>Avoiding complaints from neighbors, particularly about odors</li> <li>Adopting measures to improve odor situation</li> <li>Installing two more activated carbon adsorbers in the wastewater treatment plant.</li> </ul>	Ongoing objective 2019	The installation of two more adsorbers is expected to increase throughput at the wastewater treatment plant. This means the water that accumulates in the emergency collecting tanks during heavy rainfall can be processed more quickly and the build-up of odors can be prevented.
<ul> <li>Avoiding complaints from neighbors, particularly about noise</li> <li>Adopting measures to improve noise situation</li> <li>Installing soundproofing equipment at the induced-draft fan for boiler 2/chimney B313.</li> </ul>	Ongoing objective 2019	The installation of soundproofing equipment at the induced-draft fan is expected to prevent noise spreading via the 120-meter-high chimney.
<ul> <li>Further reducing VOC emissions (permanently</li> <li>15 metric tons p.a.)</li> <li>Continuing the program to reduce VOC emissions</li> </ul>	2021	
<ul> <li>Installing a new cleaning system for small parts in PU-E and using a new cleaning agent.</li> </ul>	2019	The new "Imsol R" cleaning agent, a dibasic ester, has a very low vapor pressure. As a result, its VOC emissions are much lower than those for the previously used acetone cleaning agent. Provided everything goes well, the concept will be rolled out for all production operations.

#### Objectives/programs/measures Environment/energy

Reducing relative energy consumption by five percent by 2020 • <b>Conducting energy-saving projects</b> > Replacing lighting (energy-efficient LED technology) in	2020	Reference year 2014 (0.099 TY/t)
A001, B002, B245, B249, B311 and C119.	2021	
Reducing relative energy consumption by five percent by 2020 • Conducting energy-saving projects	2020	Reference year 2014 (0.099 TY/t)
<ul> <li>Replacing and optimizing lighting in PU-A, including with LED technology.</li> </ul>	2020	Due to issues relating to explosion protection, it was not previously possible to install LED lighting in the production environment. Now LED lighting is available that meets the relevant requirements.
Reducing relative energy consumption by five percent by 2020	2020	Reference year 2014 (0.099 TY/t)
<ul> <li>Conducting energy-saving projects</li> <li>Continuing the site-wide program to replace old motors with high-efficiency models. Annual exchange of approx. 1,500 – 1,700 kW operating power. Potential savings of approx. 200,000 kWh p.a. once all motors have been changed. Updating target set in the 2016 Environmental Statement.</li> </ul>	Ongoing	The exchanging of motors is an ongoing project. At the start of 2019, 28.9 percent were achieving the maximum possible drive power.

Reducing relative energy consumption by five percent by 2020 • Conducting energy-saving projects	2020	Reference year 2014 (0.099 TY/t)
<ul> <li>Replacing the two older waste gas ventilators in TNV C147 with new, more energy-efficient, frequency- controlled models.</li> </ul>	By 2020	
Reducing relative energy consumption by five percent by 2020 • Conducting energy-saving projects	2020	Reference year 2014 (0.099 TY/t)
<ul> <li>Renovating pipe bridges: Improving insulation to re- duce heat losses. For 2019, this affects approx. 250 m of pipes along the 300 line / power plant.</li> </ul>	2019	
Reducing relative energy consumption by five percent by 2020 • Conducting energy-saving projects	2020	Reference year 2014 (0.099 TY/t)
<ul> <li>Conducting energy-saving projects</li> <li>Constructing a new, more energy-efficient distillation plant to replace the old plant.</li> <li>Updating target set in the 2016 Environmental Statement.</li> </ul>	2019	Among other things, optimizing the condensation temperature controls at the column head by adding a secondary cooling system, and replacing a stirrer with outer surface heating with a state- of-the-art falling film evaporator that heats more effectively. An additional thin-film evaporator improves the recovery of 1,2-dichloroethane.
<ul> <li>Reducing relative energy consumption by five percent by 2020</li> <li>Conducting energy-saving projects</li> <li>Replacing the compound refrigeration system at the power plant with a new, more energy-efficient system, while also swapping the R404A refrigerant for R449A.</li> </ul>	2020	Reference year 2014 (0.099 TY/t) The new R449A refrigerant has a significantly lower global warming potential (GWP = 1397) than R404A (GWP = 3922).
Reducing relative energy consumption by five percent by 2020 • Conducting energy-saving projects	2020	Reference year 2014 (0.099 TY/t)
<ul> <li>Conducting energy-saving projects</li> <li>Exchanging two compressors used in microbiology for new, more energy-efficient equipment. Potential annual savings of approx. 550,000 kWh following exchange.</li> </ul>	First compressor switched in 2019	
	Second compressor switched in 2020	
Reducing relative energy consumption by five percent by 2020 • Conducting energy-saving projects	2020	Reference year 2014 (0.099 TY/t)
<ul> <li>Inspecting steam traps throughout the entire works.</li> <li>Updating target set in the 2016 Environmental Statement.</li> </ul>	Ongoing	

Objectives/programs/measures Occupational health and safety		
<ul> <li>LTRIR rate &lt; 0.17 (number of accidents leading to days of absence), RIR rate &lt; 0.32 (number of recordable accidents)</li> <li>Implementing Bayer's Behavior Based Safety occupational safety initiative (Safe as a team) at the</li> </ul>	2020	
<ul> <li>Bergkamen site</li> <li>Maximum of four RIR accidents at site in 2019.</li> </ul>	End of 2019	Works objective for 2019
LTRIR rate < 0.17 (number of accidents leading to days of absence), RIR rate < 0.32 (number of recordable accidents)	2020	
<ul> <li>Implementing Bayer's Behavior Based Safety occupational safety initiative (Safe as a team) at the Bergkamen site</li> <li>Conducting final workshops to establish safe habits for two functions that have yet to undergo training.</li> </ul>	2019	
<ul> <li>Reducing number of accidents at external companies</li> <li>Initiating activities for reducing accidents at external companies</li> </ul>	2020	
<ul> <li>Conducting an External Company Day in 2019.</li> <li>More inspection patrols and better occupational safety at major construction sites.</li> <li>Maximum of six external company accidents leading to days of absence in 2019.</li> </ul>	2019	
<ul> <li>Reducing the absence rate to below 5.75 percent</li> <li>Conducting health promotion activities</li> </ul>	2020	
> Conducting a Health Day for all staff.	2020	
Reducing the absence rate to below 5.75 percent  Conducting health promotion activities	2020	
> "Five" study in the health center.	2019	Medical history review and measuring mobility with an external trainer, carried out over six weeks before repeating the test.
<ul> <li>Reducing exposure to hazardous substances at the workplace</li> <li>Adopting targeted individual measures to reduce exposure to hazardous substances</li> </ul>	Ongoing objective	
<ul> <li>Reviewing development of TIP synthesis free of ethylene chloride (PU-F).</li> <li>Updating target set in the 2016 Environmental Statement.</li> </ul>	End of 2020	
<ul> <li>Reducing employees' exposure to hazardous substances at the workplace</li> <li>Adopting targeted individual measures to reduce exposure to hazardous substances</li> </ul>	Ongoing objective	
<ul> <li>Installing a sieving system for active ingredients as a closed operation in PU-A.</li> </ul>	2020	Closed operation reduces the amount of dust emitted during sieving processes.

## Validation

## Gültigkeitserklärung

Erklärung des Umweltgutachters zu den Begutachtungs- und Validierungstätigkeiten

Der Umweltgutachter Dipl.-Ing. Henning von Knobelsdorff Mozartstraße 44 53115 Bonn

hat das Umweltmanagement-System, die Umweltleistungen, die Umweltbetriebsprüfung, ihre Ergebnisse und die konsolidierte Umwelterklärung der

## Bayer AG Supply Center Bergkamen Ernst-Schering-Straße 14 D-59192 Bergkamen

Registriernummer: DE-118-00016

NACE-Code 21.1 "Herstellung von pharmazeutischen Grundstoffen" & 21.2 "Herstellung von pharmazeutischen Spezialitäten u. sonstigen pharmazeutischen Erzeugnissen" auf Übereinstimmung mit der Verordnung (EU) 2017/1505 i.V.m. VO (EG) 1221/2009 des Europäischen Parlaments und des Rates vom 25. November 2009 über die freiwillige Beteiligung

von Organisationen an einem Gemeinschaftssystem für das Umweltmanagement und die Umweltbetriebsprüfung (EMAS III) geprüft und die vorliegende Umwelterklärung für gültig erklärt. Mit der Unterzeichnung dieser Erklärung wird bestätigt, dass

 die Begutachtung und Validierung in voller Übereinstimmung mit den Anforderungen der Verordnung (EU) 2017/1505 i.V.m. VO (EG) 1221/2009 durchgeführt wurden,
 das Ergebnis der Begutachtung und Validierung bestätigt, dass keine Belege für die

Nichteinhaltung der geltenden Umweltvorschriften vorliegen,

 die Daten und Angaben der konsolidierten Umwelterklärung des o.b. Standortes mit 1600 Mitarbeitern im begutachteten Bereich, ein verlässliches, glaubhaftes und wahrheitsgetreues Bild sämtlicher Tätigkeiten des Standortes innerhalb des in der Umwelterklärung angegebenen Bereiches geben.

Die nächste konsolidierte Umwelterklärung wird der Registrierstelle spätestens bis 25. Mai 2022 vorgelegt. In der Zwischenzeit werden vom Unternehmen jährlich durch den Umweltgutachter für gültig erklärte Aktualisierungen der Öffentlichkeit zugänglich gemacht.

Diese Erklärung kann nicht mit einer EMAS-Registrierung gleichgesetzt werden. Die EMAS-Registrierung kann nur durch eine zuständige Stelle gemäß der Verordnung (EG) Nr. 1221/2009 erfolgen. Diese Erklärung darf nicht als eigenständige Grundlage für die Unterrichtung der Öffentlichkeit verwendet werden.

Bergkamen, den 10. April 2019

06-

Henning von Knobelsdorff Umweltgutachter DE-V-0090

Environmental auditor's validation

	Certifi	cates				Zertifikat
	<b>Zertifi</b> Prüfungsnorm Zertifikat-Registrier-Nr.	ISO 14001:2015			Umwel	Der Itgutachter Henning von Knobelsdorff bescheinigt hiermit, dass die <b>Bayer AG</b> Niederlassung Bergkamen Ernst-Schering-Straße 14 D - 59192 Bergkamen
	Unternehmen: <b>Bayer AG</b> Ernst-Schering-Str. 14 59192 Bergkamen Deutschland			für die Tätigkeiten Herstellung von pharmazeutischen Grundstoffen, Herstellung von pharmazeutischen Spezialitäten und sonstigen pharmazeutischen Erzeugnissen ein Energiemanagementsystem in Übereinstimmung mit dem Standard		
Gurunuşeç	Geltungsbereich:	Herstellung von pharmazeutischen Grundstoffen, Herstellung pharmazeutischen Spezialitäten und sonstigen pharmazeutisc Erzeugnissen Durch ein Audit wurde der Nachweis erbracht, dass die Forderungen der ISO 14001:2015 erfüllt sind.		armazeutischen		DIN EN ISO 50001:2011 eingeführt hat und anwendet. Das Zertifikat ist gültig bis zum 25. April 2020. Das Managementsystem wird jährlich überprüft. Zertifikat-Nummer 270417 Bayer_BEK EM 00 Bonn, den 27. April 2017
Zung und Verwendung bedarf der vorherigen Zur	Gültigkeit:	Dieses Zertifikat ist gültig vom 31.0 Erstzertifizierung 2001			S OHSAS 18001:2007	
ken. Eine Nut		04.07.2018		Prüfungsnorm Zertifikat-Regis		01 113 060019
TUV, TUEV und TUV sind eingetragene Marken	www.tuv.com	Constanting States		Unternehmen:		Bayer AG Ernst-Schering-Str. 14 59192 Bergkamen Deutschland
Top: Environ Top righ	mental management s nt: management system			Geltungsbereid	ch:	Herstellung von pharmazeutischen Grundstoffen, Herstellung von pharmazeutischen Spezialitäten und sonstigen pharmazeutischen Erzeugnissen
			ndurg bedaff der vorherigen Zustimmung.	Gültigkeit:		Durch ein Audit wurde der Nachweis erbracht, dass die Forderungen der BS OHSAS 18001:2007 erfüllt sind. Dieses Zertifikat ist gültig vom 31.07.2018 bis 30.07.2021. Erstzertifizierung 2006

04.07.2018

DAkks

11-01-05



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## Glossary

#### Active pharmaceutical ingredient (API)

Substance used to make a pharmaceutical. The purpose of such substances is to influence the pharmacological effectiveness or some other direct effect in the diagnosis, curing, alleviation, treatment or prevention of an illness or disease.

#### Adsorbable organic halogen compounds (AOX)

Sum parameter in water analyses, abbreviation for "adsorbable organic halogen compounds in water" (in organic chemistry, X represents the halogens fluorine, chlorine, bromine and iodine).

**BIMKA zero accidents** (observe, inform, motivate, monitor, evaluate)

Occupational safety program with further development of tools specifically for investigating accidents, assessing risks and giving instructions.

#### Federal Immission Control Act (BImSchG)

Occupational safety program with further development of tools for activities such as accident investigation, risk assessment and instruction.

## Federal Immission Control Ordinance (BImSchV)

A series of ordinances have been issued to provide concrete specifications relating to the Federal Immission Control Act. These include limit values for noise and emissions along with further plant operating requirements. The 31st BImSchV specifies limits for emissions of volatile organic compounds when using organic solvents in specific plants and the 17th BImSchV relates to the incineration and co-incineration of waste.

#### **Climate Check**

The Group uses this tool developed by Bayer to analyze production processes worldwide – including raw materials, logistics and energy – to determine their climate compatibility.

#### Eco Management and Audit Scheme (EMAS)

European ordinance relating to the voluntary participation of organizations in a community system for environmental management and environmental auditing.

#### Emissions

Disruptive factors – such as contaminants and irritants in gaseous, liquid or solid form, noise, vibrations, light, heat and nuclear radiation – released from a plant or technical process into the environment.

#### FFH area

Protected area as defined by the Habitats (FFH) Directive adopted by the European Union in 1992 which, in conjunction with the Birds Directive, serves to preserve biodiversity.

## Genetic Engineering Safety Ordinance (GenTSV)

The Genetic Engineering Safety Ordinance is a non-legislative regulation relating to genetic engineering legislation and regulates safety requirements pertaining to genetic engineering work at genetic engineering plants and the release of genetically modified organisms.

#### ISO 14001

International environmental protection management standard

#### ISO 50001

International energy management standard

#### lodine

Chemical element belonging to the group of halogens. The name is derived from the ancient Greek word "ioeides" meaning "violet colored". Vapors released during heating are characteristically violet in color. Aromatic iodine compounds are used as X-ray contrast media in diagnostic applications.

#### Solvent

A solvent is a substance that can dissolve gases, other liquids or solids without causing chemical reactions between the dissolved and dissolving substances. As a result, the individual substances in the solution can be recovered on completion of the production process using physical processes such as distillation or adsorption.

#### LTRIR

To meet international standards, the previous parameter for occupational accidents – the million working hours rate (MAQ) – has been replaced by the LTRIR (lost time reportable incident rate), which is based on 200,000 working hours and includes occupational diseases.

#### Occupational Health and Safety Assessment Series (OHSAS 18001)

International occupational safety management standard

#### **OHSAS 18001**

International occupational safety management standard

#### **Operational Excellence**

Procedure to improve processes

#### **Responsible Care**

Global voluntary initiative of the chemical industry to achieve continuous improvements in the areas of environment, health and safety, independently of legal requirements, and regularly document the progress made.

#### X-ray contrast media

Designation for substances exhibiting stronger or weaker adsorption of radiation than the surrounding body tissue during medical radiography.

#### Hazardous waste incinerator (SAV)

The SAV is used for the thermal treatment of hazardous waste that cannot be incinerated with domestic waste due to its nature or volume.

#### Standard operating procedure (SOP)

An approved written procedural description containing instructions for performing tasks that do not apply to a specific product or material but are of a more general nature (for example, operation of plants, maintenance, general cleaning, cleaning of premises, environmental monitoring, sample taking, inspection, etc.). Some standard operating procedures can complement product-specific master or batch documentation.

#### Total Organic Carbon (TOC)

Total amount of organically bound carbon in water, determined by converting the carbon to carbon dioxide.

#### Validation

Verification of the environmental management system by an independent external auditor who checks whether the information in the Environmental Statement is correct and the environmental management system complies with EMAS requirements.

#### Volatile Organic Compounds (VOC)

Generic term for volatile organic substances that contribute to air pollution, including hydrocarbons, alcohols, ketones, esters, ethers and chlorinated hydrocarbons.

#### ZABA

Central wastewater treatment plant

#### Certification

Certification is the name given to a process that is used to confirm compliance with specific standards for products, services and the relevant manufacturing processes, including commercial relations. For the purposes of this document, it means checking whether the company has a quality and/or environmental management system that complies with the relevant standard (e.g. DIN EN ISO 14001). *Corporate news 2016/2017/2018* 

## Water networks undergo thorough inspection

The water networks at the Supply Center Bergkamen have started to age. The pipes for both drinking and production water date back to when the site was first founded and – although they have often been upgraded – are over 70 years old. This provides adequate grounds for closely scrutinizing their performance. The potential impact of this inspection, which is taking place from March 9 to 11, has not escaped the notice of staff.

"The plant fire department and fire insurance underwriters are not the only ones who want to know whether there's enough extinguishing water on hand if a fire breaks out," Benedikt Wilhelm, Head of Utility Supply, says. The production facilities, too, rely on there being a certain amount of water available, which is why Wilhelm and his team are keen to find out: Are certain sections leaking and in need of renovation? Are fittings or slides in the pipeline system damaged or are lime deposits causing restrictions in the diameters of the pipes? An analysis conducted with the aid of an external service provider is supposed to clarify the situation. Over three days, a very large volume of water will be drained from selected points in the networks. Numerous measuring devices installed in the pipes will record the losses in pressure, storing the data on the computer for evaluation purposes. Having been "fed" with this data, the program will then determine the exact condition of the pipe networks.

Given that the water will flow faster, rust particles deposited in the pipes will most probably come away. Across the entire plant, water from the taps could turn brown. To avoid exactly that, the project team has decided, as a precautionary measure, to continue thoroughly rinsing the pipes after the water has been drained. All the same, this will not rule out the chance of rust impurities. "It's nothing serious, really. You just need to let the water run until it turns clear again," says Wilhelm, asking for staff to be understanding of potential short-term impairments.

## Looking back on the deflagration in Production Unit A <u>Take care when handling solvents</u>

Let us rewind almost four weeks, when deflagration at a HPLC system in Production Unit A triggered a fire that caused injury to a staff member. The repercussions of this incident have since been largely remedied – both for the staff member in question, who will soon be able to return to work, and for operations. It is therefore time to briefly assess what happened.

"I am delighted to hear that the injured member of staff is back on his feet again," says plant manager Dr. Ingo Ortmann, relieved at the progressive recovery. Dr. Ortmann already sought assurance about his co-worker's state of health on the same night the incident occurred, and has subsequently kept in close contact with him.

It is largely thanks to chemical technician Thomas Pape, who was working with the aforementioned staff member on the HPLC system, that more severe consequences were avoided. Dr. Ortmann: "Thomas Pape followed protocol for such situations to the letter. He conducted himself in exemplary fashion in every respect." The immediately launched investigation of the events, conducted by external experts, has yet to reveal any leads as to what caused the spontaneous ignition. The system was operated in line with official requirements, the TÜV tests were carried out as planned and confirmed the equipment was in flawless condition, and the earthing points set up to prevent static charge were in working order.

The safety assessment revealed that a mix of solvents had been forced into an open container during the venting of the HPLC columns, which caused flammable vapors to form. "To prevent this incident from recurring, we have decided to modify the system to enable a closed mode of operation in the future," Head of HSE Thomas in der Weide has announced.

## Inspection patrols are set to avoid errors when laying hoses Watch out for bending radii!

A potential danger arises for humans and the environment whenever substances leak, no matter how much or where. It is therefore vital sustained efforts are made to tackle the underlying causes – including the failure to observe permissible bending radii when laying hoses. Time and again, such inadvertence leads to damage with undesirable consequences. It is hoped that production inspection patrols will raise awareness of this issue and encourage staff to exercise greater caution.

In-depth investigations of what causes substances to leak at Supply Center Bergkamen have revealed that leakages and product discharges can often be traced back to misconduct. Material errors or other technical reasons, meanwhile, are comparatively rare. "We can often control whether unwanted substances are released or not," confirms Thomas in der Weide, Head of Health, Safety and Environment. In a bid to make this correlation even clearer, supervisors are conducting regular inspection patrols at the production facilities. Besides examining whether hoses have been laid correctly and verifying compliance with bending radii limits, they also examine whether a leakage test has been conducted and that the prescribed minimum overlap has been observed at the screw connections.

Martin Kage (left) and Ralf Wienbrandt, both from Production Unit A, show how it's done. It is essential to adhere to the permissible bending radii when laying hoses.



## Cable damage brings many facilities and systems temporarily to a halt Minor damage with a major impact

Fortunately, it doesn't happen often that production facilities all need to be shut down unexpectedly. Yet on April 15, this positively rare scenario did indeed occur. At around 2 p.m., owing to a sudden voltage sag, all systems went into safe mode – exactly as they should in such situations.

This was due to a damaged earth cable in the 6 kV plant power network in Production Unit E's supply area. Besides a great deal of uproar, the cable damage caused a substantial amount of extra work – especially for Energy Supply staff responsible for the power supply, utility supply and current supply.

The short sag in voltage disabled the majority of the drives used in production operations and supply systems. "Our task was to swiftly stabilize the supply of electricity," Michael Ackfeld, Head of Current Supply, says. Once that was achieved and the supply of critical media such as extinguishing water and nitrogen was also stabilized, the plants received an on-screen notification via the Safety & Security Control Center.

Bit by bit, the staff from Power Supply and Utility Supply then brought the media and power plants back into operation. Early in the evening, the plant staff were informed that the energy supply had been stabilized and were able to set about restarting the individual production processes. "Although this was an exceptional event, everyone involved behaved very professionally and quickly gained control of the unusual situation," says Dr. Klaus Vissmann, Head of Infrastructure & Utilities. At present, the Current Supply team is examining how to fix the cable damage. 58

## Engineering Services is raising awareness of proper conduct on stairs Consciously opting for the safer alternative

Stairs are a safety risk – and the danger is significantly higher when people are carrying loads. Incident statistics at Bayer and accidents outside of work both substantiate this. In light of two recent stair-related incidents, Dr. Sebastian Schmidt, Head of Engineering Services, decided it was time he and his function were given training on proper conduct on stairways.

"The way we behave at work often mirrors how we behave at home," says Schmidt, explaining why he is keen to raise awareness about the subject. His aspiration couldn't be more timely. In Germany alone, more than 1,000 people die every year as a result of falling down stairs. With his efforts, he is also supporting the new Group-wide "Safe as a team" occupational safety program, which centers, among other things, on observing and evaluating behavior.

In a training session, participants determined which in-house publications about climbing stairs already existed, what the house rules say about the topic and what employees know about it. Safety officer Klaus-Dieter Kunkel-Nickel also conducted behavior-related discussions on health and safety in the workplace (VGAs) with staff to reduce the risk of accidents. The third part of the training saw everyone practice the right way to behave on stairs, including how to safely transport heavy and bulky items.

The training highlighted that there is always a safe alternative when climbing stairs – and that sometimes it is necessary to ditch old habits to let what you have learned set in for good.



The right way - always carry loads in pairs.

## Disposal facilities – 500,000 euros invested in better air Successfully fighting odors

Years ago, a special form of wastewater piping was installed at the Supply Center Bergkamen premises to minimize odor emissions. Since then, the majority of process wastewater has been channeled to the wastewater treatment plant through a closed pipeline system above the ground. As not only time was taking a toll on the system, the site has decided to invest a great deal of money into renovating it.

The laws of physics had particularly blighted the pipelines that stretch from the process water treatment plant (PWA) to the wastewater treatment plant. "The work premises lie on a natural incline," Dr. Helmut Bennemann, Head of Disposal Facilities, explains. As a result, negative pressure can build up in sealed systems such as wastewater pipes and ultimately render them inoperable.

Originally, the wastewater pipes were made up of two components – one inner chemical-resistant and one outer pressure-resistant pipe. "The inner polyethylene pipe was only loosely connected to the outer one," says Bennemann, explaining the structure. The negative pressure drew the inner pipe inward, causing cracks to form. But there's no longer any risk of that happening. "We have built everything from the same mold and with thicker walls to create a pipeline that can resist both negative and positive pres-



sure." It's also been reinforced with special arches that act like a spring. If the black wastewater pipe expands in the sunlight, it can therefore yield without the risk of distortion, which would cause undesirable inner tension. The wastewater pipeline is only routed underground for the final section, from the microbiology facility to the wastewater treatment plant. Supply Center Bergkamen uses rainwater for operational purposes

## Saving water on a large scale

Everyone likes to celebrate achievements – especially if they took a great deal of effort. Last November, as part of a global study involving more than 600 other large corporations, Bayer was assessed in terms of its water management and ranked among the top 24. This gratifying result is in part thanks to the efforts of Supply Center Bergkamen.

SC Bergkamen consumes 1.3 million cubic meters of water every year – that equates to a town of just under 30,000 residents. Given these dimensions, it is important for the site to handle the valuable resource water responsibly. The fact that only around 50 percent of the water needed has to be of drinking quality makes things easier. The other half – the production water – has a lower standard of quality to meet.

Rather than obtaining it from local utility companies, the site therefore sources its production water from the Datteln-Hamm Canal and collected rainwater. The water first has to be processed before it can be used for operational purposes. It is then kept as extra water in the cooling towers, for the incineration plant scrubbers, or used in combination with lime to neutralize wastewater. Additionally, it is fed into one of the site's two extinguishing water networks.

By commissioning the collecting tank (pictured) in 2012, the site paved the way for using substantial amounts of rainwater for operational purposes. "Nowadays, we use around 140,000 cubic meters of rainwater every year. This eco-friendly source covers more than 20 percent of our entire demand for production Exemplary water management – SC Bergkamen collects rainwater to use for operational purposes.

water," Dr. Helmut Bennemann, Head of Disposal Facilities, points out.

There are even plans to optimize the replacement of canal water with rainwater in the future by installing a smarter pump circuit, for example. The site hopes the planned measures will not only lower costs – there is a "water extraction fee" for using canal water – but also ensure water is handled even more responsibly.

## Staff and plants are taking precautions for the cold season It's time to prepare for winter

A hefty night frost served Supply Center Bergkamen staff with their first cycling ban after mist froze on the ground at various parts of the site.

"The best way to safeguard against accidents is to be cautious and adapt your conduct to the weather conditions. Any accident is one too many – including in winter," says Thomas in der Weide, Head of Health, Safety and Environment. Plant safety staff and the fire department help prevent incidents in good time, constantly observing the weather and issuing updates about winter-related hazards.

Surfaces not completely cleared of ice and snow that could put road users at risk should be reported to the fire department by calling 3777.



Signs at certain points indicate where cycling is prohibited.

State-of-the-art technology provides an optimum overview of wastewater treatment An artificial eye in the settling tank



Joachim Langner examines camera images to monitor foaming.

Wastewater treatment is an extremely sensitive issue – not least because of the internal and statutory requirements that the site must meet. To avoid disruptions to operations, problems such as foaming need to be dealt with post-haste. In this particular case, state-of-the-art technology has recently started offering assistance, with an industrial camera monitoring the settling tank and raising the alarm in good time.

A short while back, the Innovation Technology Team (ITT) launched a pilot project at the Bergkamen wastewater treatment plant to monitor foaming using an industrial camera. "We installed additional LED lighting in the closed settling tank to ensure we could get optimum images despite the high humidity and darkness," Dr. Helmut Bennemann, Head of Disposal Facilities, explains. The camera streams the images straight to employees' workstations, meaning they don't have to carry out as many inspection patrols in a day.

Previously, a sensor was used at the plant to monitor foaming. "But that didn't always give a reliable, prompt enough warning. Now and then, adhesion occurred. Or the foam formed far away from the sensor," say Jens Weinreich and Joachim Langner, outlining the old

### Suggested improvement for saving energy in cooling towers Less pressure is better

Supposedly minor details sometimes have an unimaginable effect. Thomas Baumeister, who works as a foreman for Utility Supply at the power plant, has learned that lesson already. He realized that the pressure in the B018 cooling tower's pipeline system was higher than required and the pumps were therefore consuming an unnecessarily excessive amount of energy. When he then submitted his suggested improvement to the Ideas Forum, he couldn't have guessed that his solution was part of something bigger.

"I love hearing from attentive co-workers like Thomas Baumeister," says Dr. Klaus Vissmann, Head of Infrastructure & Utilities, adding: "In this case, his observations and calculations have enabled the company to save quite a bit." Baumeister had noticed that the pressure in a cooling tower's pipeline system was six bar – far higher than necessary.

His realization led him to calculate that 20 percent less pressure would be entirely sufficient in day-to-day operations. "That's a substantial reduction and makes a real difference," says Baumeister. The trained fitter's proposal triggered a chain reaction, as what he had devised for one cooling tower could be applied directly to the two others at the Bergkamen site. A project team from Infrastructure & Utilities therefore set about devising a new concept and finally came up with a plan to equip all cooling towers with the same pumps. "Not only are we now saving energy from having lowered the pressure; we are also simplifying how we procure replacement parts and conduct maintenance because all cooling towers have identical pumps," Baumeister explains. It's great when staff come up with exciting ideas for improvements. It's even better when their brainwave has such a far-reaching, positive impact on the site.



(From left) Marco Lenkenhoff, Dr. Karl-Heinz Neff and Dr. Klaus Vissmann congratulate Thomas Baumeister (second from left) on his suggestion and the bonus he received as a result.

technology's weaknesses. Thanks to the state-of-the-art industrial camera, it is now much easier to identify issues early on and quickly alert staff.

It still has to be determined, however, at what point in time an automatic alert needs to be issued to enable employees to respond to the foaming and initiate countermeasures in good time. In the long term, the plant hopes to evaluate the foaming data and discover – and put a stop to – the underlying causes.



Tracking down energy losses – gradual inspection of all pipe bridges Putting pipe bridges to the test

Running across almost the entire premises, pipe bridges are a dominant feature of the Bergkamen site. Led by Hendrik Rolf, a civil engineer at Infrastructure & Utilities, a project group is now conducting a detailed inspection of the structures. Some bridges and pipes just need a lick of paint, others require all-round renovation.

Connecting different buildings and plants on the works premises, the pipe system has adapted as the site has evolved over time. The oldest elements have been in place for over 40 years. Now the project group is scrutinizing the system from top to bottom. Where is energy being lost? Where do the corrosion and grid protection components need to be replaced? "The work has already been completed on the B line," Rolf explains. At present, the group is examining the 300 line, at the section that stretches from Building B244 to the central solids warehouse. Other subsections along the 300 line are to follow each year. Besides ensuring pipes and pipe bridges continue to fulfill requirements, another key focus is to determine where energy losses – and consequently costs – can be reduced.



## Suggested improvement for reducing gas consumption Smarter waste incineration



(From left) Ozan Bedran Alp, Gerhard Krause, Sebastian Reimann and Peter Unger received an attractive bonus for their achievement from Head of DF Dr. Helmut Bennemann (left), commission member Thomas Pfister (second from right) and Dr. Karl-Heinz Neff (right), who heads up the Bergkamen Ideas Forum.

If they hadn't done so already, many householders realize natural gas doesn't come for free when they look at their annual energy bill. For large-scale users such as Bayer that consume a great deal more, the figures are particularly impressive. It's therefore all the more encouraging when smart ideas help to considerably lower the demand for gas, which is precisely what five co-workers from Disposal Facilities (DF) managed to do with a convincing suggestion for improvement. Waste incineration sounds simple enough. In reality, however, it's a sophisticated process that calls for different parameters to be very carefully observed and coordinated. Failure to do so means the incineration process will run into problems, such as the requisite temperature not being reached or the injection nozzle becoming blocked. It goes without saying that this would be disastrous with regard to the waste gas values that by law must be complied with.

The changing composition of the liquid waste mixtures, which are usually delivered for hazardous waste incineration in a mobile tank, presents an additional difficulty. To satisfy official requirements at all times, the operators had played it safe until now, switching the incineration to a gas burner during the daily filling of the mobile tank.

But that step recently became superfluous after Ozan Bedran Alp, Gerhard Krause, Sebastian Reimann, Dean Schröder and Peter Unger discovered that using smart process controls and integrating an additional mobile tank to better mix the liquid waste could significantly reduce the use of the gas burner. This measure secures the facility an annual saving of almost EUR 60,000!

Supply Center Bergkamen passes EMAS audit Last week, no fewer than three management systems were put through their paces. The independent auditor's findings are as clear as day – no objections were raised. With regard to energy, the environment and occupational safety, the Bergkamen site meets the demands of the Eco Management and Audit Scheme (EMAS – also known as the EU eco audit), which exceed legal requirements.

## Three certificates in one

This excellent outcome goes to show that those in charge certainly got their priorities right in the past. "The functions involved tackled the right issues and took appropriate measures," highlights Dr. Michael Lohrengel from HSE. They kick-started activities to promote the responsible use of resources and reduce energy consumption, for example, and took precautions to ensure safety in plant operations.

To create the ideal conditions for achieving these aims, the Bayer Bergkamen site voluntarily undergoes a periodic EMAS audit. Having passed once again and obtained the associated certification, the site has also proven the effectiveness of its management systems. "But the detailed final report we will shortly receive also contains suggestions for how we can raise the high standard we have already achieved even further," Lohrengel points out. As continuously improving operational management systems also forms part of the EMAS requirements, the site plans to carefully work through these points between now and the next audit.

The Bergkamen site has already developed a range of environmental, occupational safety and energy objectives on its own initiative. It has set goals to further reduce emissions and recover more solvents, for example. In addition, it has agreed to lower its relative energy consumption by five percent by 2020 and offer even more health promotion activities. Energy Supply is taking part in the "Safe as a team" occupational safety program

# Working together to improve safety

The "Safe as a team" program has been running at Supply Center Bergkamen for the past year or so and Energy Supply has been taking part since last November. Staff from the function are delighted with the initial results. In light of the positive developments, they are already looking to the future and wondering what they can improve next.

The occupational safety program is about pointing out hazardous conduct and – even more importantly – acknowledging safe behavior. "We don't lecture people, but rather give friendly advice or praise," explains Thomas in der Weide, Head of Health, Safety & Environment (HSE).

Since joining the program, staff members from Energy Supply have come a long way toward making safe behavior part of their daily routine. In November 2018, they made the joint decision to initially focus on improving safety when driving.

Their efforts more than paid off. Not only are they now safer on the road, but a small ceremony was even held to celebrate their success. At the event, staff from different functions joined forces to consider what safety-related practices could be improved next and decided to raise awareness of the importance of wearing ear protectors.





## The Lippe's fish population is on the rise thanks to the company fishing club

## Successful brown trout campaign

Fishing is more than just reeling your catch out of the water. Fishing enthusiasts are increasingly committed to protecting nature and acting against water pollution. One prime example is the stock campaign that saw members of the company fishing club, with support from the Bayer Foundation, release 18,000 brown trout into the River Lippe this April.

"The aim of this three-year campaign is to support the brown trout population in the Lippe," says Michael Prill, a technical site support employee at Production Unit B who also volunteers as a fishery consultant for Unna District Authority. Participants released farmed fish measuring two to three centimeters in length.

The first inventory checks were carried out in early November – and everyone involved was delighted with the results. Trout released in April were found at five different locations. Attaining 16 cm in length on average, they had come on in leaps and bounds, and were of course carefully set free again after they had been measured.

The fish in the Lippe have since spread to neighboring waters, including the River Seseke and the Heerener Mühlenbach Channel. "The results are highly encouraging because they prove our efforts have really paid off. It's unusual for these kinds of campaigns to be so successful," says a cheerful Prill.

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