Consolidated Environmental Statement 2022

Bayer Bergkamen site

To improve readability, this brochure uses gender-neutral language.

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Dear reader,

At the heart of our actions lie two major social challenges – providing health care 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 as a whole. In particular, these benefits include the health and safety of everyone employed at the Bergkamen site and the people living in the surrounding area, protecting the environment and conserving natural resources. 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.

When it comes to environmental protection and conservation of resources, every single step is governed by the requirements of our systematic environmental management system. This extends from the procurement, processing and use of raw materials and energy to the storage and shipment of finished products. In this way, we pursue a style of corporate governance that centers on collaboration and dialogue 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 undertake to further improve safety, environmental protection and sustainability and, in particular, to further contribute to reducing greenhouse gas emissions. The site management team – and, indeed, all managers – have a particular responsibility in this respect to continuously develop 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 that is focused on sustainability. Our corporate mission puts it in a nutshell – with our products and services, we aim to help improve the lives of people around the world and protect our essential natural resources. "Bayer: Science for a better life."

Dr. Dieter Heinz
Head of Supply Center Bergkamen

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, to a limited extent, 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 60 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 two and a half years after the foundation stone had been laid on April 2, 1962. This marked the start of an industrial company that is now firmly established as the region's largest employer and one of its biggest training providers. Having become part of Bayer AG in 2006, Supply Center Bergkamen, which focuses on hormones and contrast media and also includes a micronization facility in Berlin, is Bayer's biggest production site for active pharmaceutical ingredients and one of the world's largest and most state-of-the-art production sites. Active ingredients for innovative treatments are also set to be manufactured in Bergkamen to a greater extent in the future.

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 sometimes also made 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 generate global sales in the mid-single-digit billions of euros.

Active ingredient	Medicinal product
Drospirenone	Yasmin® (contraception)
Levonorgestrel	Mirena® (contraception)
Cyproterone acetate	Diane® (contraception)
Estradiol valerate/ dienogest	Qlaira® (contraception)
Iopromide	Ultravist® (contrast medium)
Gadobutrol	Gadovist® (contrast medium)
Rivaroxaban	Xarelto (cardiovascular drug)

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.

Contrast medium active ingredients for diagnostic imaging processes

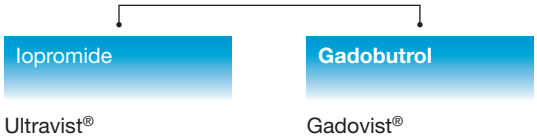


Fig. 1: Bayer is a world market leader for contrast media. The company produces the relevant active ingredients at its site in Bergkamen.

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® and Gadovist®. HRCA (high relaxivity contrast agent), a new contrast medium currently in its development phase, is also to be manufactured there in the future. The volumes necessary for the clinical trial phase will also be produced in Bergkamen.

Women's health care

With close to 100 years of experience, Bayer is a world leader in the field of women's health care. 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.

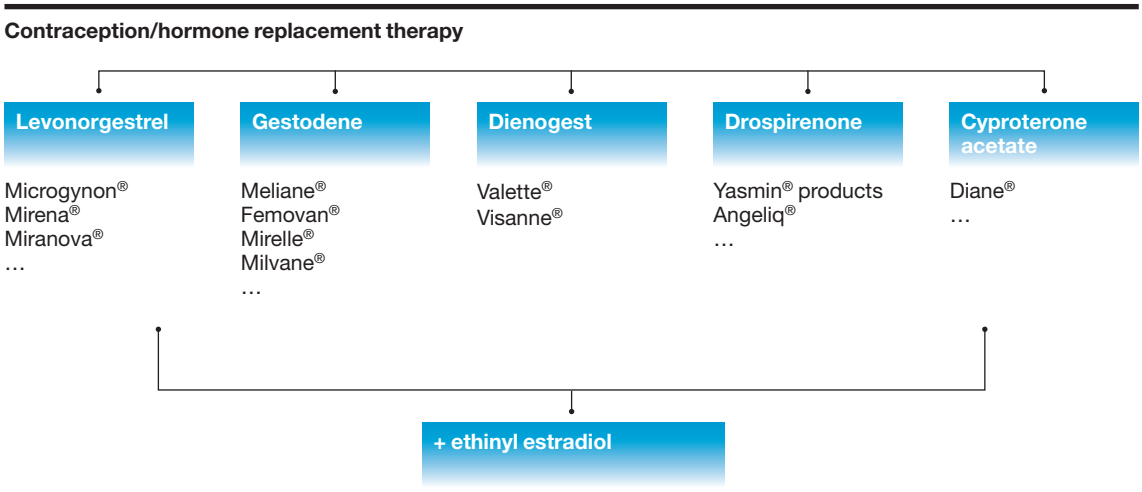


Fig. 2: The Bergkamen site supplies hormones for a large number of contraceptives.

New active ingredients at the site

One of the key objectives for the Bergkamen site is to establish new active ingredients in the facilities. In 2020, two facilities – microbiology and production unit E – were able to report successes, with synthesis stages for DFFP (for Vitrakvi, oncology) and rivaroxaban (for Xarelto, anticoagulant) being manufactured in Bergkamen.

With finerenone and elinzanetant, there is also the potential for the production of two more active ingredients for medicines, each of which have high sales potential. Precursors for finerenone, an active ingredient for treating chronic kidney disease associated with type 2 diabetes, have already been produced. Elinzanetant, a new active ingredient for non-hormonal treatment of common menopausal symptoms, is also set to be manufactured at the site in the future.

Product stewardship

As a manufacturer of active pharmaceutical ingredients, we feel especially committed to human health and environmental protection, 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 around three decades now, the issue of pharmaceuticals in the environment has occupied scientists and the general public alike. Concerns regarding the environmental impact 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 and 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 reduce or exclude the release of active ingredients into the environment, we take further action in our production facilities.

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.

We are also a participant in PREMIER (Prioritisation and Risk Evaluation of Medicines in the EnviRonment), a follow-up project initiated with the IMI (Innovative Medicines Initiative) in 2020 that focuses on assessing and reducing the risk posed by pharmaceuticals in the environment.

In recent years, Bergkamen has made substantial investments in optimized 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 hormone active ingredients and iodized X-ray contrast media.

Ultrafiltration is setting new standards. The plant is able to retain all biomass from biological wastewater treatment.

Environmental protection investments

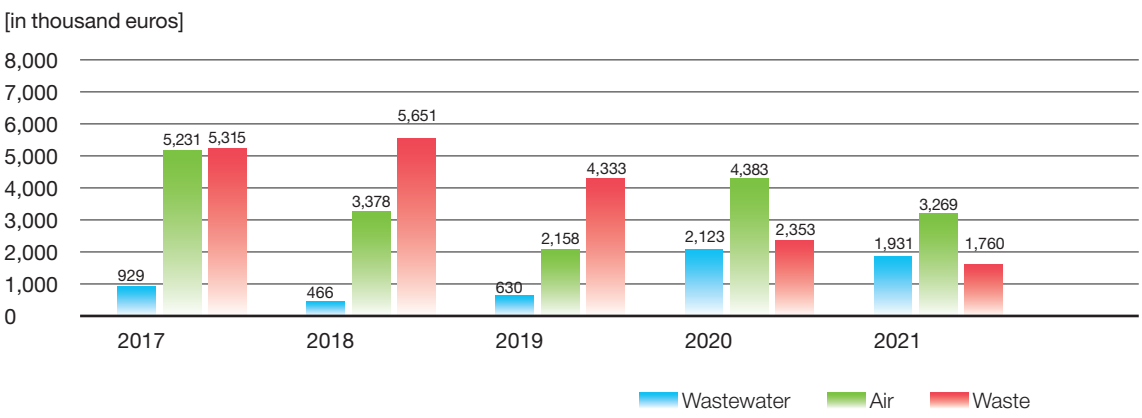


Fig. 3: Environmental protection investments by purpose in the period 2017 to 2021.

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. When it comes to X-ray and MRI contrast media, handling large volumes 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. The purpose of this agreement is to ensure their safe coexistence as envisaged in the Directive. 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. Since other measures have been implemented to increase safety standards, including by Bayer AG, it was possible to reduce the safety buffer in one area. In 2021, this led to an amendment to the agreement, providing the town of Bergkamen with additional development options in the area around the 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 implementing the company's own HSE (health, safety and environment) regulations, as summarized in the document "HSE Key Requirements. Act Safe and Sustainable!", we aim to achieve continuous improvement in the fields of health, safety and the environment.

For the Bergkamen site, this means:

- Continuously improving environmental protection and occupational safety.
- Conserving natural resources. Using energy efficiently so as to 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 support 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 requirements 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 dialogue with the workforce, 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 corporate policy on a regular basis and updating it where necessary.

The entire management team at the Bergkamen site has undertaken to uphold this corporate policy.

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), DIN EN ISO 45001 (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 Stefan Oelrich is responsible for environmental protection, health and safety.

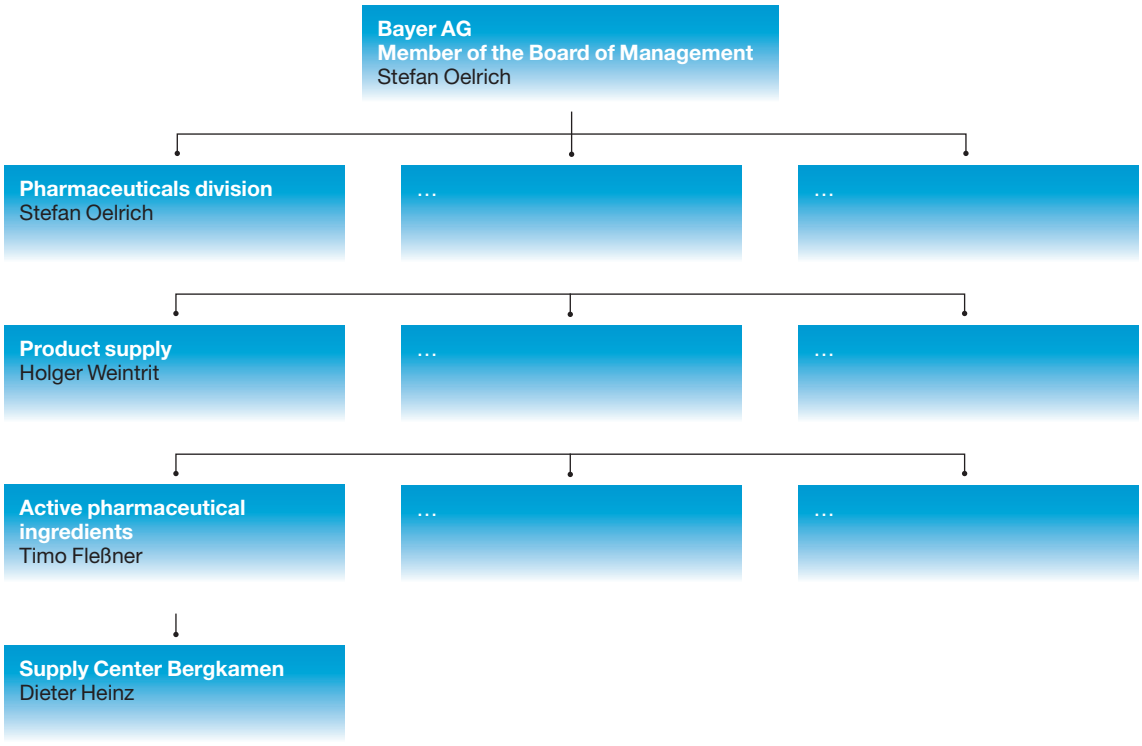


Fig. 4: Quality, safety and environmental protection are an integral part of management tasks and therefore apply equally to all levels in the management hierarchy.

At Supply Center Bergkamen, site manager Dieter Heinz is responsible for the application and practical implementation of the management system.

As part of the API strategy (API = active pharmaceutical ingredient), which includes the production sites in Wuppertal, La Felguera in Spain and Orizaba in Mexico as well as Supply Center Bergkamen, we are aiming to implement a strategic energy concept and establish measures that will help us achieve our sustainability targets. Both these areas have been defined as strategic priorities for Supply Center Bergkamen. To successfully navigate this complex task with the necessary focus, the new "Energy Strategy and Sustainability" function was established on January 1, 2020.

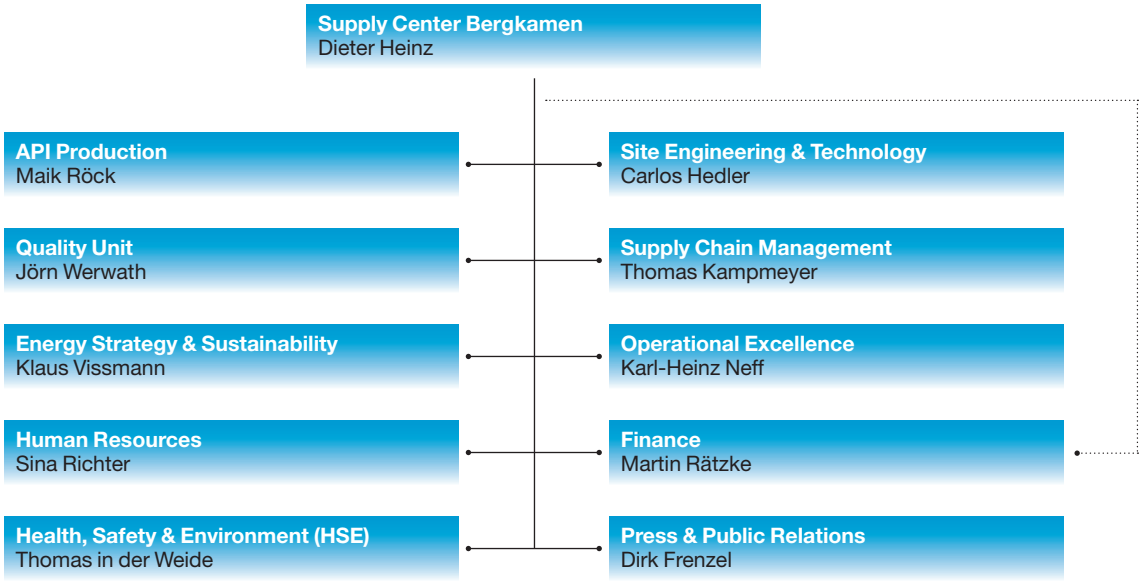


Fig. 5: The function managers report directly to the site manager – including on all issues relating to the management system.

Officers

Supply Center Bergkamen has appointed 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 protection, occupational safety and energy management. Wherever necessary, it notifies the responsible authorities accordingly. These officers advise decision-makers and employees on all issues that are of relevance to 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, occupational safety, environmental protection and energy audits

The officers for the various specialist areas regularly perform joint safety, energy 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
- Warehouses
- Energy and water supplies
- Disposal
- 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[1]

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 (e.g. consequences of climate change or overusage of natural resources) could affect the organization is also assessed during this process.

The context analysis also considers various interest groups, or 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 18 topics overall, recording the opportunities and risks for each topic and stakeholder, deriving appropriate measures and citing any binding obligations.

Excerpt from the context analysis

Stakeholder/topic	Authorities (incl. Arnsberg District Authority, Bergkamen Building Inspection and Consultancy 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

[1] For further details, see the section on "Waste avoidance and recycling measures".

Dialogue

Objective dialogue 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 dialogue takes place at Supply Center Bergkamen with practical initiatives such as:

- Open days,
- Bayer Safety Day,
- Brochures such as this Environmental Statement,
- Annual neighborhood dialogue with local residents,
- Information for neighbors of the Bergkamen site in accordance with the Major Incidents Ordinance (StörfallV),
- Regular exchange of ideas with politicians, government representatives and officials from the responsible supervisory authorities,
- Internal training and advanced training events on HSE issues,
- News on the intranet,
- BGK direkt in-house newspaper,
- Project-specific info sheets relating to measures at the site,
- Safety data sheets and product information documents for customers.

The BGK direkt in-house newspaper has been a source of all the latest news about Supply Center Bergkamen for over 10 years.

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 modernization of the preliminary treatment facility in 2020 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 2017 to 2021 [t = metric tons]

	Unit	2017	2018	2019	2020	2021
Production volumes[1]						
Production volumes, total	t	12,322	12,649	13,181	13,717	13,579
Energy						
Energy usage, total	TJ	1,220	1,180	1,227	1,201	1,249
... related to entire production volume	TJ/t	0.099	0.093	0.093	0.088	0.092
... proportion of renewable energies in total energy	%	2.3	3.8	2.6	3.5	4.0
Energy used from waste and exhaust gas[2]	TJ	439	331	347	366	415
Natural gas used	TJ	664	684	763	697	724
Energy used from liquid fuels	TJ	14.0	39.0	17.6	21.6	13.6
Electricity from external sources	TJ	103	125	100	116	97
Electricity consumption, total	TJ	290	292	294	292	296
... related to entire production volume	TJ/t	0.0235	0.0231	0.0223	0.0213	0.0218
... Proportion of renewable energies in total electricity	%	9.0	14.2	10.2	14.5	16.7
In-house electricity generation	TJ	187	167	193	176	200
Electricity from external sources	TJ	103	125	100	116	97
... Proportion of renewable energies in electricity obtained externally	TJ	26.0	41.4	30.1	42.4	49.4
... Proportion of renewable energies in electricity obtained externally	%	25.2	33.0	30.0	36.7	51.1
Biodiversity (land usage)						
Total area	ha	110	110	110	110	110
Developed & sealed areas in %	%	40.9	40.9	40.8	40.8	40.8
Material efficiency						
Solvent usage	t	39,253	42,190	44,900	45,771	44,307
... related to entire production volume	t/t	3.19	3.34	3.41	3.34	3.26
Recycling volume, solvents	t	23,510	20,931	22,441	22,179	22,019
Recycling rate, solvents	%	59.9	49.6	50.0	48.5	49.7
Waste						
Waste, total	t	49,157	50,180	114,200	58,347	57,877
… related to entire production volume	t/t	4.0	4.0	8.7	4.3	4.3
Production waste, hazardous	t	41,040	40,358	41,935	45,506	44,219
… related to entire production volume	t/t	3.3	3.2	3.2	3.3	3.3
Production waste, non-hazardous	t	2,043	2,161	2,692	959	1,080
… related to entire production volume	t/t	0.17	0.17	0.20	0.07	0.08
Waste from wastewater treatment, hazardous	t	1,983	2,096	5,982	6,002	6,662
Rubble, non-hazardous	t	3,920	5,316	61,972	5,654	5,767
Rubble, hazardous	t	171	249	1,618	226	149
Recycling rate	%	71.3	63.2	50.2	63.6	65.6

[1] With intermediate stages

[2] Energy input from exhaust gases was not previously taken into account. The data for the energy input from these process exhaust gases was determined retrospectively and incorporated in the “Energy used from waste and exhaust gas” line. Taking into account the process exhaust gases, overall energy input is about 7 % higher on average.

	Unit	2017	2018	2019	2020	2021
Emissions						
Carbon dioxide	t	73,664	70,908	74,476	74,222	72,850
… related to entire production volume	t/t	6.0	5.6	5.7	5.4	5.4
Nitrogen oxides	t	70.2	65.1	69.9	66.5	63.4
… related to entire production volume	kg/t	5.7	5.1	5.3	4.8	4.7
Carbon monoxide	t	8.0	1.7	2.2	1.9	2.1
… related to entire production volume	kg/t	0.7	0.1	0.2	0.1	0.2
Organic substances (VOCs)	t	30.7	14.6	17.6	17.0	14.0
… related to entire production volume	kg/t	2.5	1.2	1.3	1.2	1.0
Sulfur dioxide	t	1.02	1.63	0.93	1.03	0.55
… related to entire production volume	kg/t	0.08	0.13	0.07	0.07	0.04
Particulates	t	0.70	0.64	0.40	0.26	0.31
… related to entire production volume	kg/t	0.06	0.05	0.03	0.02	0.02
Special greenhouse gases[3]	t	0	0	0	0	0
Water/wastewater						
Total water consumption	m^3 x 1000	1,363	1,381	1,460	1,509	1,461
… related to entire production volume	m^3/t	111	109	111	110	108
Wastewater volume	m^3 x 1000	1,327	1,249	1,321	1,342	1,350
Nitrogen discharge	t	42.5	38.7	33.2	35.5	32.1
… related to entire production volume	kg/t	3.45	3.06	2.52	2.59	2.37
TOC discharge	t	41.2	41.5	39.4	36.0	35.2
… related to entire production volume	kg/t	3.34	3.28	2.99	2.62	2.59
Phosphorus discharge	t	1.19	0.99	1.35	1.65	1.43
… related to entire production volume	kg/t	0.097	0.078	0.102	0.120	0.106
Discharge of heavy metals	t	0.19	0.19	0.20	0.17	0.23
… related to entire production volume	g/t	15.4	15.0	15.4	12.7	16.6
TOC inflow incl. sludge	t	2,869	2,517	2,603	2,906	2,634
TOC breakdown in PWA	t	1,448	1,289	1,397	1,648	1,289
TOC breakdown in wastewater treatment plant	t	1,370	1,176	1,158	1,211	1,299
Level of TOC breakdown, wastewater treatment plant	%	98.2	97.9	98.2	98.4	98.3

[3] Special greenhouse gases such as methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride are not emitted.

Direct environmental impact

Direct environmental impact is subject to operational control and can therefore be directly 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).

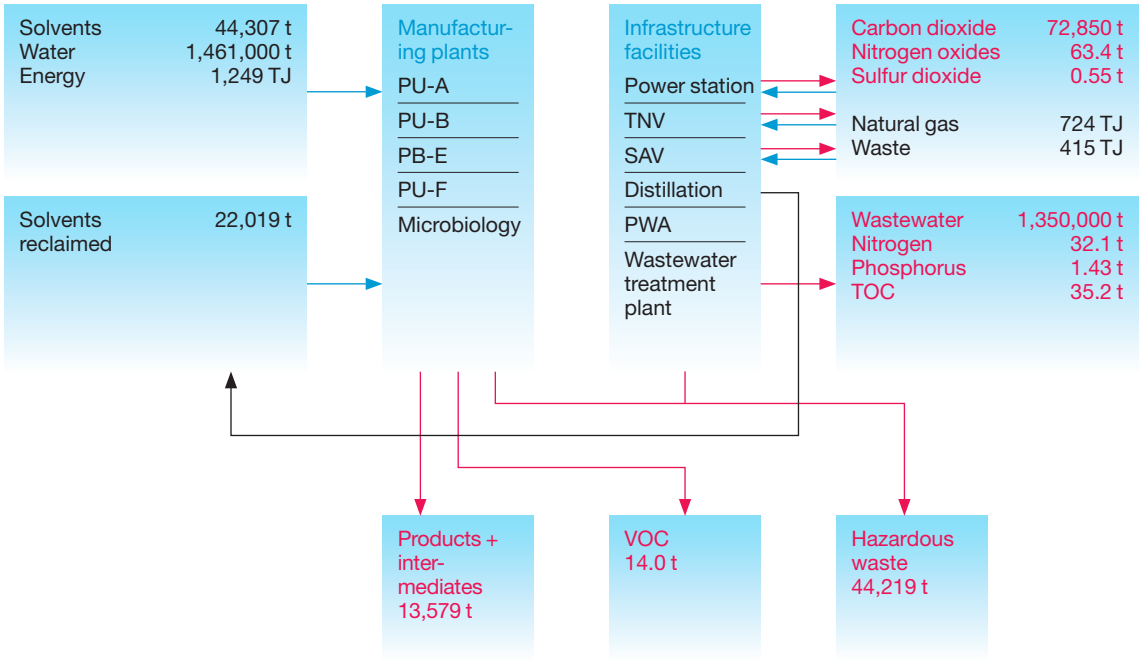


Fig. 6: Simplified overview of incoming and outgoing material flows in 2021 [t = metric tons; TNV = thermal afterburner; SAV = hazardous waste incinerator; PWA = process water treatment plant].

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

Environmental impact from production should be avoided wherever possible or kept to a minimum. For example, 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.

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

Production volumes

The environmental impact of the Bergkamen site depends, among other things, on the volume of intermediates and end products manufactured. This production volume rose by approximately ten percent from 12,322 metric tons in 2017 to 13,579 metric tons in 2021.

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

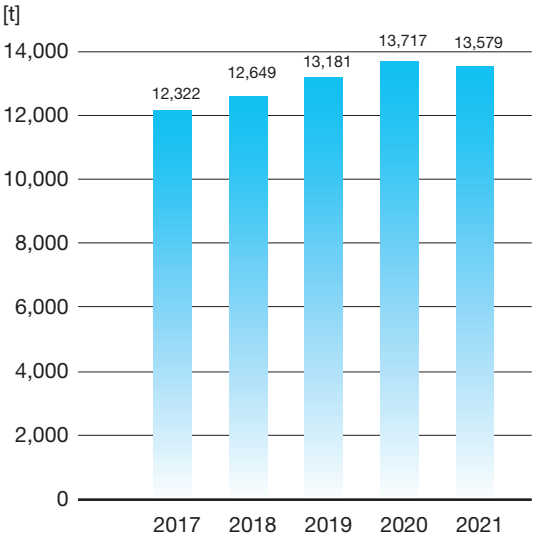


Fig. 7: The volumes of intermediates and end products rose by around 10 % between 2017 and 2021.

Water consumption

For a very long time, 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. As a result,137,000 m^3 could be used e.g. as cooling water for the first time in 2014.

In 2021, water consumption amounted to approximately 1.46 million m^3. Water is mainly used:

- As a solvent, extracting agent and reagent,
- For product precipitation and/or 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.

Drinking water consumption – and therefore total water consumption – had been increasing since 2017 in parallel with rising production volumes. Water consumption – along with production volumes – fell slightly in 2021. Relative water consumption per metric ton of products manufactured remained constant at around 110 m^3/t.

Water consumption

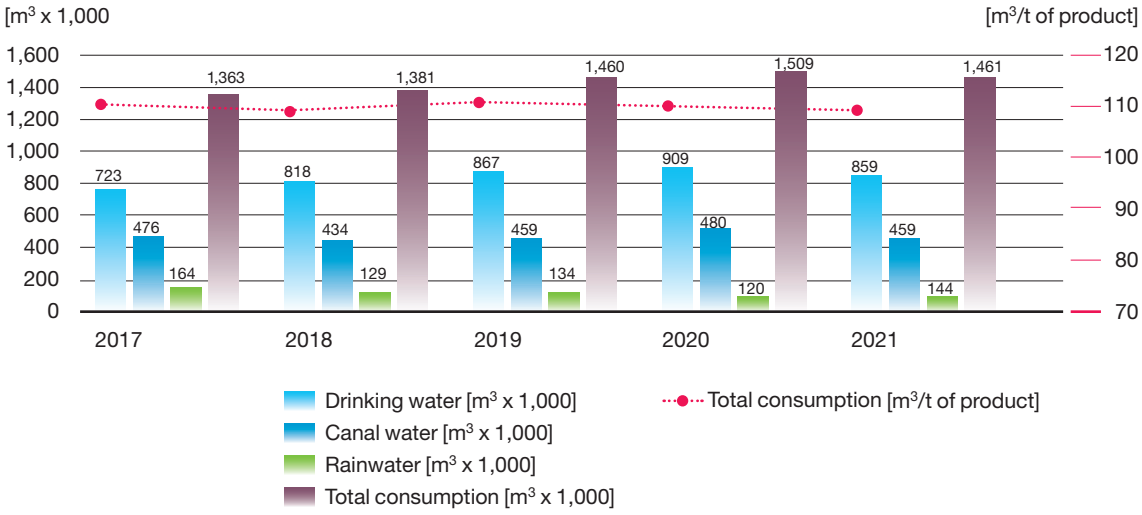


Fig. 8: Consumption of drinking, canal and rainwater between 2017 and 2021.

Wastewater

The total amount of wastewater produced at the Bergkamen site in 2021 – including the production facilities, power plant, hazardous waste incinerator and distillation facility – amounted to approximately 1.35 million m^3. 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 ongoing 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 23,200 m^3 – a volume that is sufficient to hold all wastewater generated at the Bergkamen site for several days.

Wastewater volume

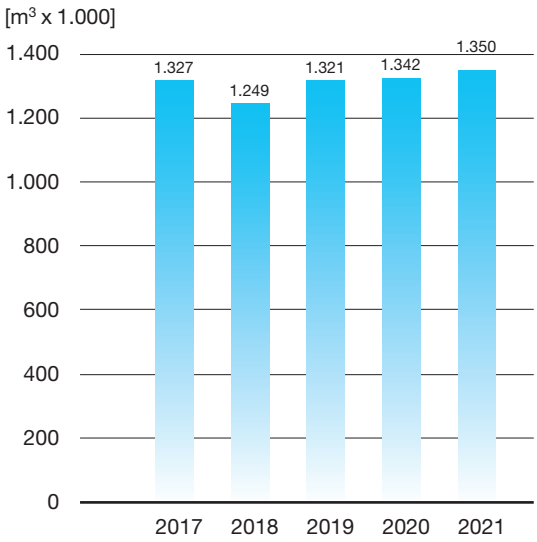


Fig. 9: Change in the amount of wastewater generated.

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

TOC4 and nitrogen loads very much depend on the volumes of particular products that are manufactured. As a result, the product portfolio manufactured in any given year has a major impact on both these parameters. The TOC load in particular is linked to specific production in microbiology. Overall, the loads of both these parameters have been falling significantly since 2017.

[4] 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

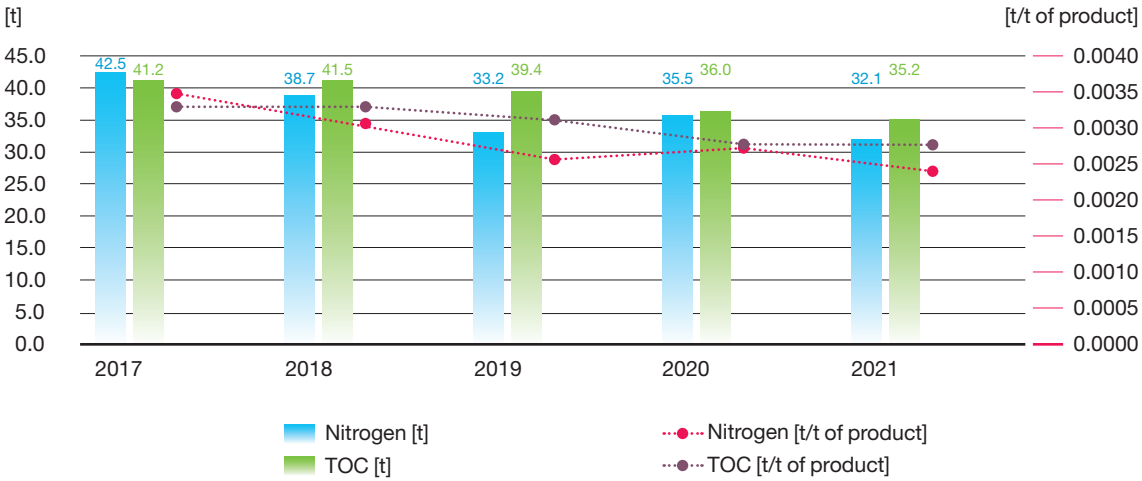


Fig. 10: Nitrogen and organic material (TOC) loads in wastewater.

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 heavily 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

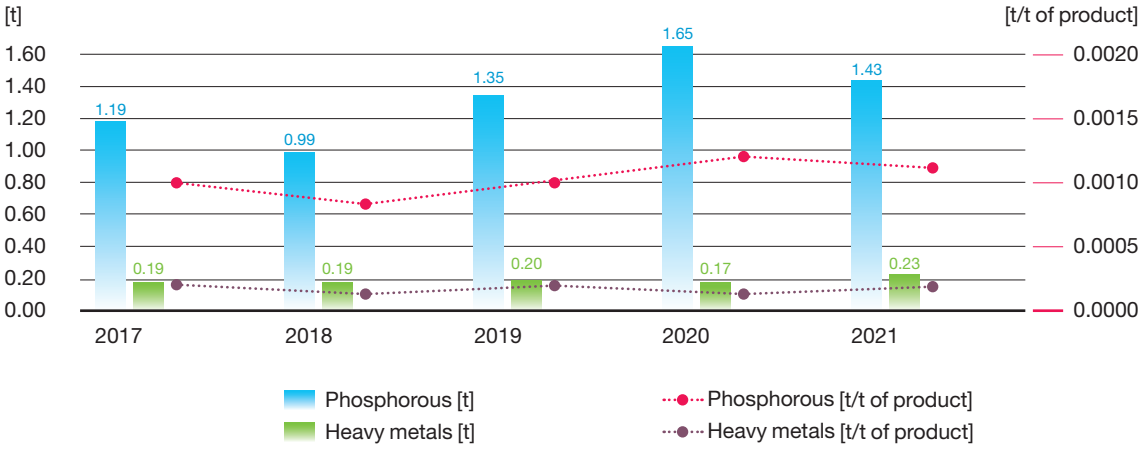


Fig. 11: Phosphorus and heavy metal loads in wastewater.
The heavy metals in question are zinc, nickel and copper [t = metric tons].

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.

In addition to the stages of preliminary treatment, buffer tank and biological treatment with subsequent membrane filtration, an additional downstream activated carbon adsorption station with six activated carbon adsorbers was constructed in the years that followed. Since the volume capacity of the six activated carbon adsorbers limited the throughput of the wastewater treatment plant, a further three activated carbon adsorbers were added to the station in 2019, meaning a total of nine adsorbers are available. Increasing the number of activated carbon adsorbers was one of the environmental objectives in the 2019 Environmental Statement. This means the water that accumulates in the emergency collecting tanks during heavy rainfall can now be processed more quickly and the build-up of odors can be prevented.

To prevent unwanted odors during ongoing operations, 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 sewerage system to the wastewater treatment plant are used.

The "Preliminary treatment modernization" project, which has been running since 2021, will also lead to a reduction in odors. All primary sedimentation basins will be covered and fitted with an off-gas disposal system in the future. This project has been adopted into the environmental objectives of the plant and is expected to be fully implemented in 2024.

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 m², providing a total membrane surface area of 15,840 m². Again, 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 m².

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.

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

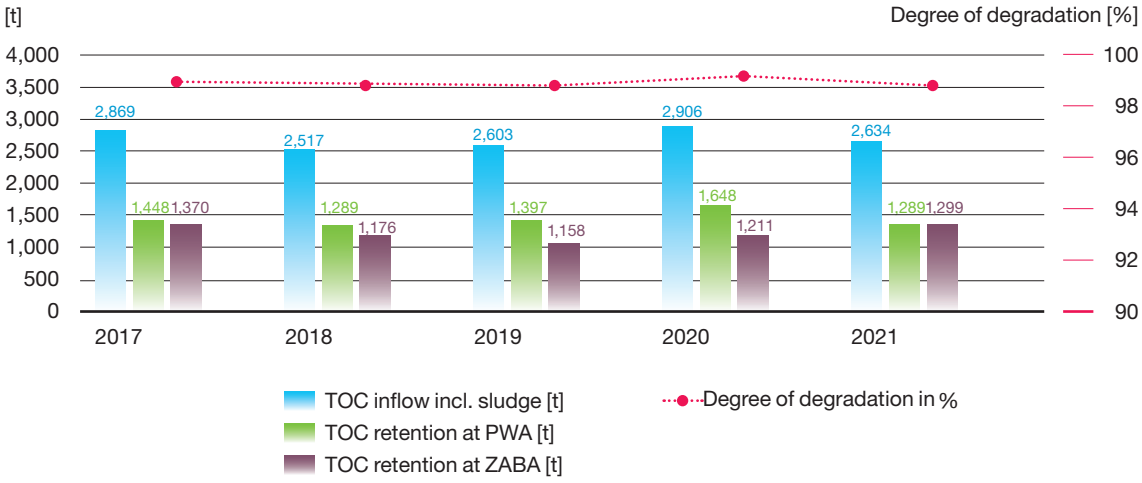


Fig. 12: TOC degradation at the process water and wastewater treatment plants [t = metric tons].

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[5] emissions are generated from the use of various solvents that are an essential part of active ingredient production.

Solvents used in 2021

Solvents	[t]
1.2-dichloroethane	11,169
Alcohol (ethanol)	4,851
Acetone	4,234
Methanol	3,053
Ethyl acetate	2,868
Ethyl acetate hexane	2,350
Methylene chloride	1,778
Other	14,004
Total volume	44,307

[5] VOC = Volatile Organic Compound

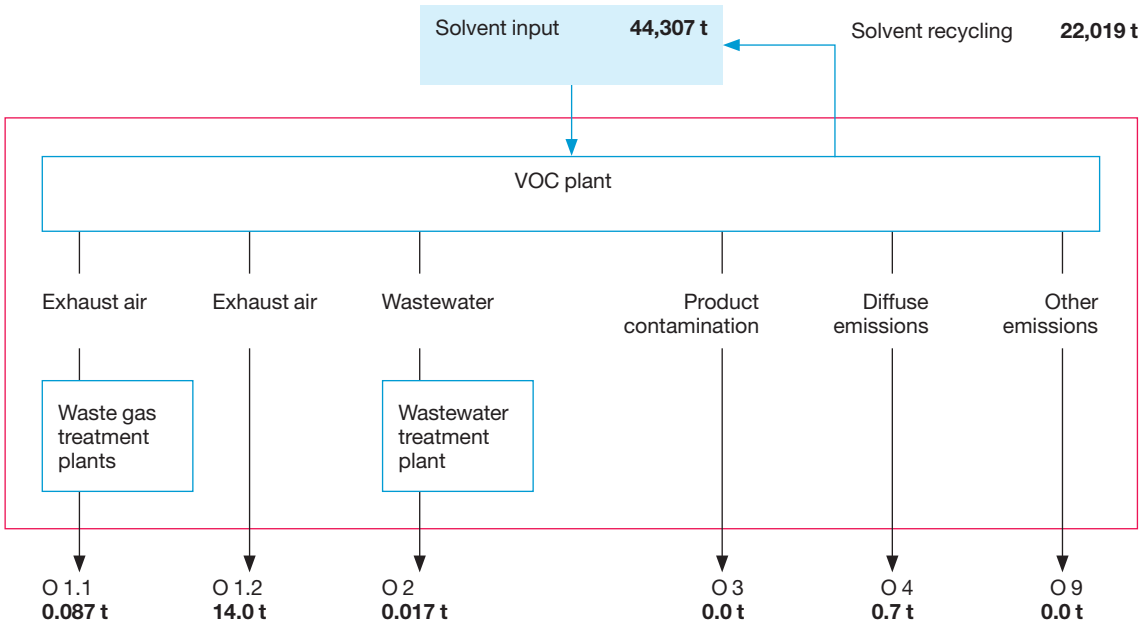
The solvents are located in closed plants from which the waste air is collected centrally and sent for incineration. This means that emissions are restricted to processes that can only be performed in open systems, such as some cleaning processes. The requirements relating to such plants are described 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 2021, 14.8 of the total of 44,307 metric tons of solvents used were released into the atmosphere. This is equivalent to 0.03 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, and diffuse emissions, e.g. through doors, windows and flanges, that escape into the environment. 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 of organic substances determined for 2021



O 1.1 = Emissions in the treated waste gases collected
O 1.2 = Emissions in the untreated waste gases collected
O 2 = Amount of organic solvents in the wastewater, taking into account wastewater treatment
O 3 = Amount of organic solvents remaining in the end product as an impurity or residue
O 4 = Diffuse emissions, e.g. via doors, windows, flanges
O 9 = Organic solvents released in some other way

Limit as per 31st BImSchV:
O 1.1 + O 1.2 + O 2 + O 3 + O 4 + O 9 < 5 % of solvent volume used

0.087 t + 14.0 t + 0.017 t + 0.0 t + 0.7 t + 0.0 t = 14,804 t
corresponding to approx. 0.033 percent of the total volume of 44,307 t of solvents used

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

Emissions (not including carbon dioxide)

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

To continuously monitor 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.

The nitrogen oxide emissions depend on the run times of the boilers, incineration plants and gas turbines, and have consistently been between 60 and 70 metric tons per year over the last few years.

VOC emissions, on the other hand, are primarily the result of solvents that are emitted via the waste ambient air of the plants. 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. As a result, numerous projects (e.g. new gas-tight centrifuges, closed sampling equipment, etc.) across the plant have made it possible to further reduce the open handling of substances and improve the tightness of facilities. The hard work has paid off. After the VOC emissions level had dipped below 15 metric tons once already in 2018, it was possible to achieve the goal formulated in the 2019 Environmental Statement of "Further reducing VOC emissions (permanently < 15 metric tons p.a.)" in 2021. Despite increasing production, we are aiming to maintain this level of 15 metric tons for the next few years.

Carbon dioxide emissions

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

Air emissions excluding carbon dioxide in metric tons [t]

Year	Nitrogen oxides NOx	Carbon monoxide CO	Organic substances VOC	Sulfur dioxide SO_2	Dust
2017	70.2	8.0	30.7[6]	1.02	0.701
2018	65.1	1.7	14.6	1.63	0.637
2019	69.9	2.2	17.6	0.93	0.404
2020	66.5	1.9	17.0	1.03	0.262
2021	63.4	2.1	14.0	0.55	0.311

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

[6] 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.

A key objective of the Bayer sustainability strategy is to achieve net zero by 2030. The company is striving to reduce direct emissions from its own power plants, vehicles and production facilities (scope 1) and indirect emissions from the procurement of electricity, steam and cooling energy (scope 2) so as to limit global warming to a maximum of 1.5 °C. To attain this goal, Bayer will reduce its absolute CO_2 emissions over the next eight years by at least 42 percent compared to the 2019 baseline. To accomplish this, emissions from the company's facilities will be cut by at least one percent each year, and 100 percent of the power the company buys in will be sourced from renewables (see Objectives for 2022 and beyond).

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 as to 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, see 2013 Environmental Statement) to the current value of five to six metric tons for each metric ton of product (2017 to 2021).

To achieve further reductions in direct carbon dioxide emissions, the possibility is currently being examined of drawing a proportion of "green steam" from the neighboring biomass power plant, and, for the longer term, consideration is being given to using hydrogen from renewable sources as a fuel (see Objectives for 2022 and beyond). Together with RWTH Aachen, Jülich Research Center and other partners in the hydrogen network, Bayer's Bergkamen site is therefore particularly supporting the development of innovative burner systems for power plants.

Carbon dioxide emissions

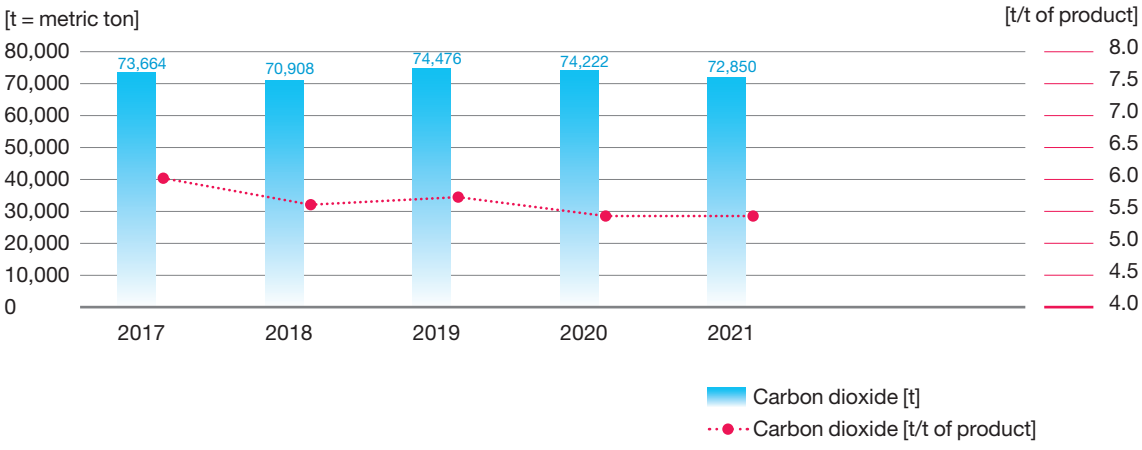


Fig. 15: Carbon dioxide emissions [t = metric ton]

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 1 mg/m³ specified in "TA Luft"[7] for reprotoxic substances 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 pharmaceuticals. A waste incineration plant (SAV) 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 iodine.

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:

Process step	Waste
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 2017 to 2021.

Over recent years, it has not been possible to significantly reduce the relative waste volumes further. Over an extended period, however, the relative waste volumes were reduced from 4.2 metric tons per metric ton of product (2010, see 2013 Environmental Statement) to the current value of around 3.3 metric tons per metric ton of product, that is to say, by around 20 %.

Relative waste is dependent on the volumes of contrast media and hormone active ingredients produced. For example, the production of hormone active ingredients generates approximately 50 times as much waste as the production of contrast media.

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. GMP8 regulations, however, do not permit direct use of the iodine recovered for the site's own production operations. This process makes it possible to recover and recycle more than 200 metric tons of iodine every year.

[7] Germany's technical instructions on air quality control (TA Luft) are essentially split into an immissions section and an emissions section. They specify the requirements that need to be met when licensing industrial and commercial plants.

[8] GMP = Good Manufacturing Practice

Hazardous production waste

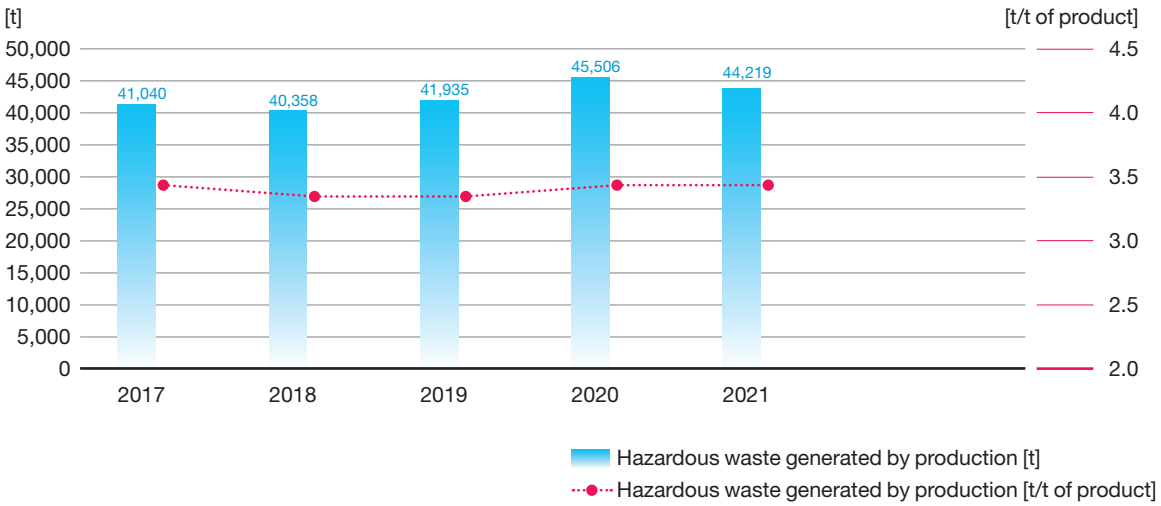


Fig. 16: Amounts of hazardous waste generated in production operations [t = metric ton].

In 2017, the recycling rate was still over 70 %. In 2018, this figure dropped to 63.2 %. This fall in the recycling rate was due to a longer downtime of boiler 2 in our power plant. Boiler 2 can recover energy from residue solvents that cannot be recycled by way of distillation because it features combined heat and power generation. The further drop in the recycling rate to 50.2 % in 2019 was due to several large deconstruction projects at the Bergkamen site. These led to a significant rise in waste going to landfill. In particular, these projects include the demolition of active ingredient plant PU-C (C105) and the removal of a hazardous waste deposit in area A956 (wastewater treatment plant). Since the above-mentioned deconstruction projects were completed at the beginning of 2020, the recycling rate rose again in the years that followed.

Waste recycling/disposal

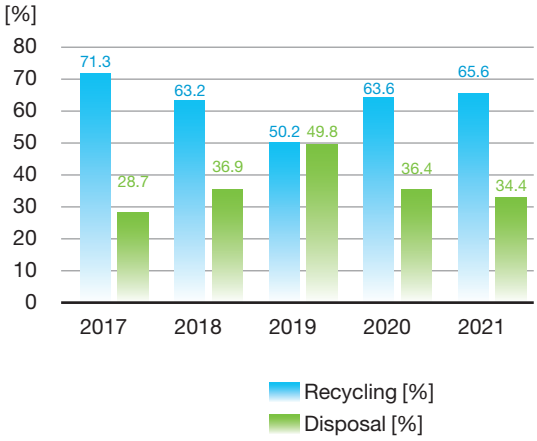


Fig. 17: Due to deconstruction projects, the proportion of waste being sent to landfill rose in 2019 and the recycling rate fell to 50 %.

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^3 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 2017 to 2021, the recycling rate for solvents was around 50 percent. Due to the commissioning of more subsections of the new distillation facility, this figure is set to rise further over the coming years.

Solvent usage

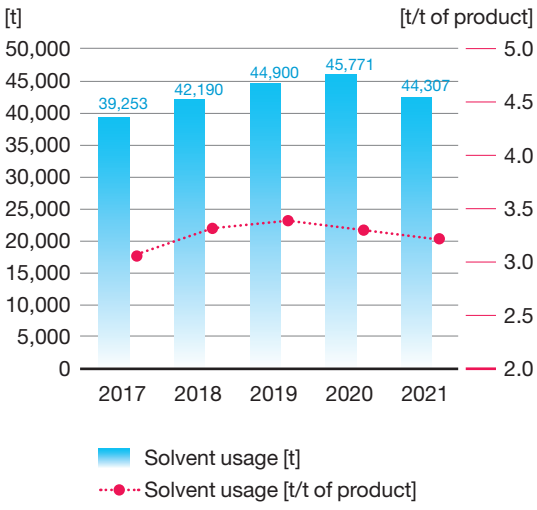
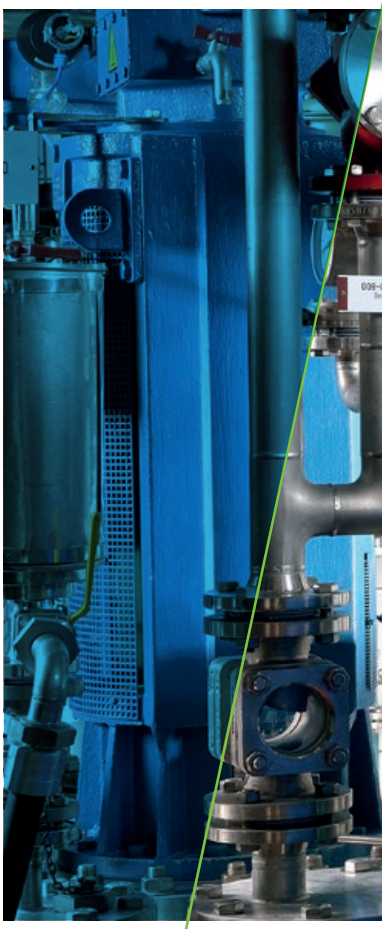


Fig. 18: In the past five years, relative solvent usage has been between 3.2 and 3.4 metric tons [t/t of product].

Computerized plants help further reduce the direct and indirect environmental impact of production processes.



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 experts 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 conducted to date, which now cover almost all IED plants, 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.

In 2015, to further reduce its energy consumption, the Bergkamen site introduced an energy management system to ISO 50001 and secured certification by an external auditor. This makes it possible to better identify potential energy savings and channel investments 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 ten million kilowatt hours in Bergkamen since 2017. In 2019, the two older waste gas ventilators in the thermal afterburner were replaced with new, more energy-efficient, frequency-controlled models. Further long-term savings (see Objectives for 2022 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 consumption

The graph shows energy usage at the Bergkamen site between 2017 and 2021. The most important energy sources at the Bergkamen site are natural gas, waste containing energy (including the process exhaust gases from LANXESS and contaminated solvents or metal alkyl residues) and electricity from external sources. Although production increased by around 10 % in the period under consideration, the absolute energy usage remained almost unchanged. Relative energy usage shows a downward trend and it has been possible to reduce this by approximately 7 %, from 0.099 TJ/t to 0.092 TJ/t. For the future, the Bergkamen site has set the long-term goal of reducing relative energy consumption by 10 % by 2029 (reference year 2019) (see Objectives for 2022 and beyond). This will support the Bayer corporate goal of achieving net zero by 2030.

Energies and total amount of energy used

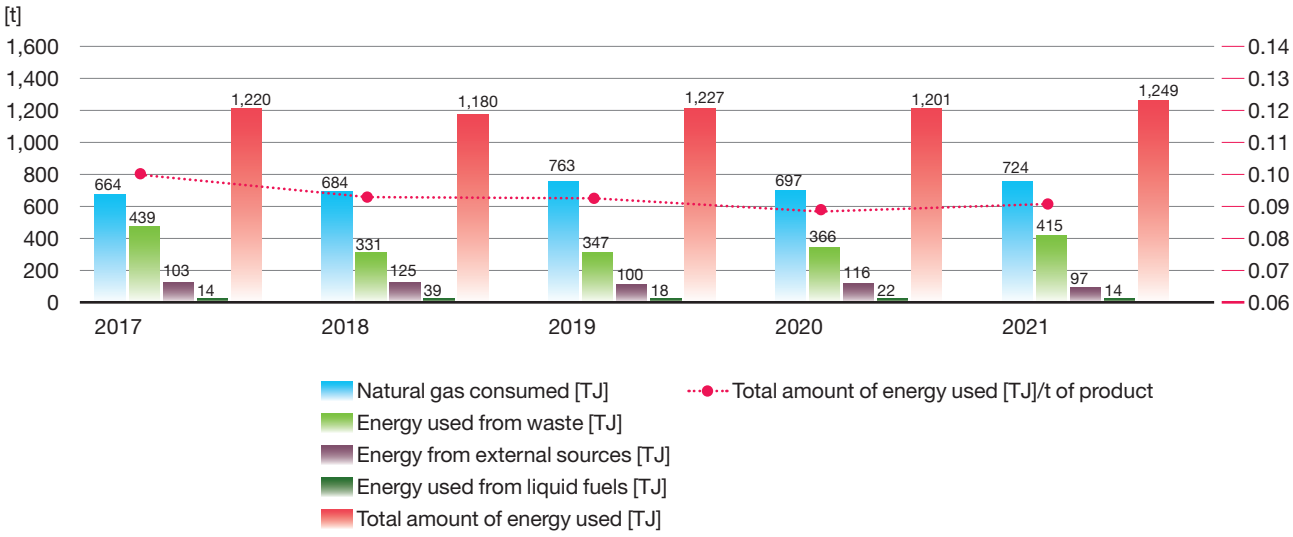


Fig. 19: In the period from 2017 to 2021, the relative amount of energy used fell by around seven percent.

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.

Electricity consumption

The site's electricity requirements are covered through energy from external sources (approx. 40 %) and electricity generated by our own power plant (approx. 60 %). The proportion of electricity generated in-house – and therefore also the amount of energy from external sources required – depends on the run time of the gas turbine in our power plant in the respective year.

Despite a slight increase in 2021, relative electricity consumption was cut by approx. 7 % between 2017 and 2021. Various energy projects conducted over the last few years – some of which are still ongoing – have contributed to this, e.g. only considering models with high levels of efficiency when buying new motors, optimizing cooling water pumps and increased use of LED lighting in all areas.

Electricity consumption

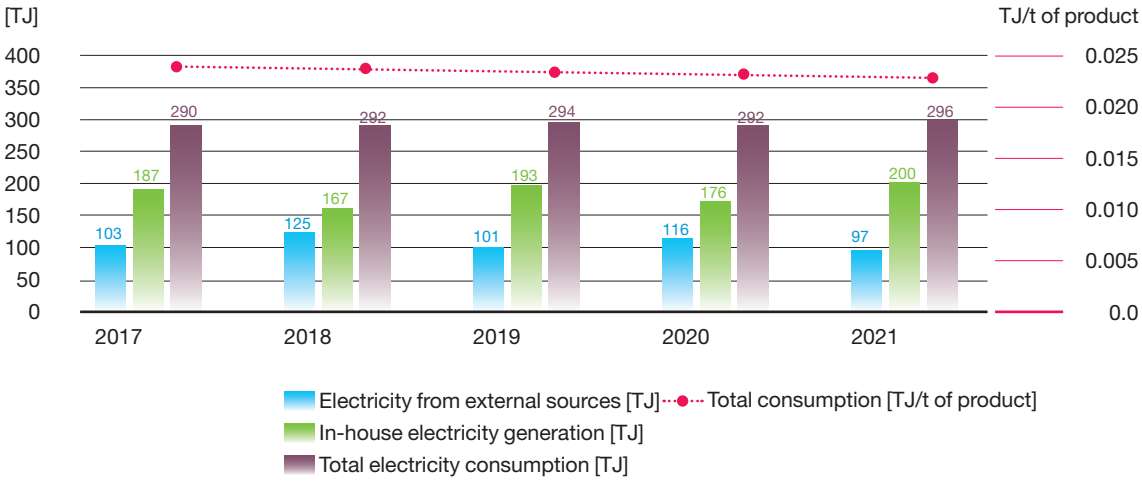


Fig. 20: In the period from 2017 to 2021, relative electricity consumption fell by around 7 percent.

Proportion of renewable energies in electricity obtained externally

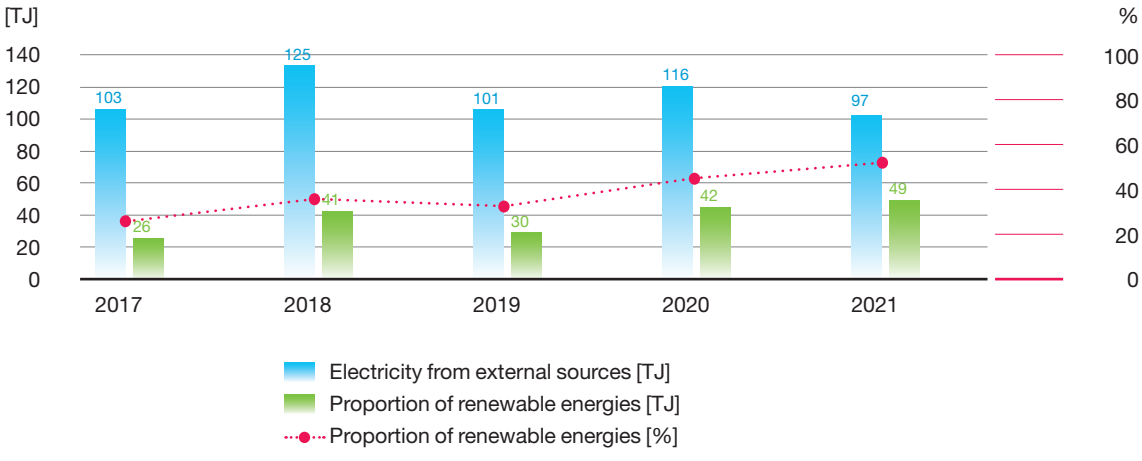


Fig. 21: By 2030, the proportion of electricity from renewable energies in electricity from external sources is to be increased to 100 %.

Proportion of renewable energies in electricity obtained externally

A key objective of the Bayer sustainability strategy is to achieve net zero by 2030. One way of achieving this is to switch exclusively to electricity generated from renewable energies for externally purchased electricity (see Objectives for 2022 and beyond).

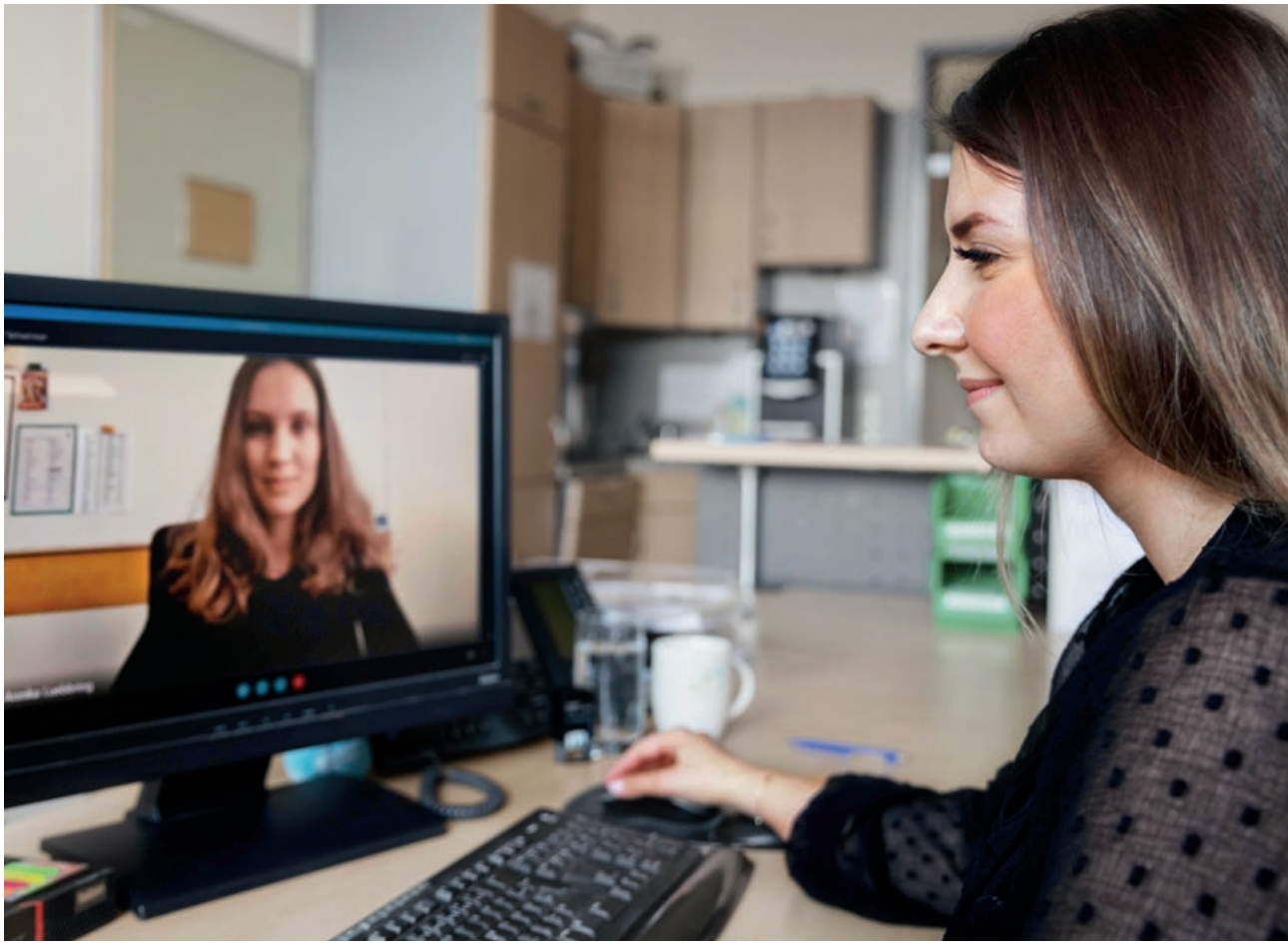
For the Bergkamen site, the proportion of renewable energies in electricity from external sources was just 25.2 % in 2017. This has now been increased to more than 50 % by agreeing appropriate long-term contracts with electricity suppliers for delivering green energy.

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.

Since there is a limit to how much a company can do on its own to cut greenhouse gas emissions along the value chain, Bayer is cooperating with other companies as part of various initiatives. Together, we aim to record greenhouse gas emissions and climate risks and work on reduction targets and strategies. One of these joint projects is the "Together for Sustainability" (TfS) initiative of the chemical industry. Bayer heads the working group for reduction of greenhouse gas emissions in the delivery chain. The aim of this is to standardize the calculation of Product Carbon Footprints (PCFs) for the chemical industry.

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.

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 the 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 the Bayer 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.

Compliance with the code requirements is checked through online assessments of suppliers or on-site audits. Strategically important suppliers, together representing almost 25 % of our total procurement volume, and suppliers with a higher sustainability risk, which combines both country and category risks, are evaluated. Our assessment process also includes supplier evaluations produced within the scope of industry initiatives. In total, our service provider EcoVadis assessed 802 suppliers on our behalf in 2021. In addition to this, 67 suppliers were examined at their premises by external, independent auditors. A further ten suppliers were audited virtually due to the global COVID-19 pandemic. In 2021, 200 suppliers were evaluated through an HSE audit, with the focus on health, safety and environmental protection.

If critical results are recorded in the event of a serious violation or several major findings being identified in a supplier's sustainability performance, specific improvement measures are then jointly defined. In 2021, critical results were determined for 22 suppliers (3 % of all assessed and audited suppliers). In these cases, we ask the suppliers to remedy the identified weaknesses. We monitor the implementation of these activities by way of re-assessments or follow-up audits. We reserve the right to terminate a supplier relationship if no improvement is observed during a re-evaluation. In 2021, Bayer did not have to end any supplier relationship due solely to sustainability performance.

Accidents resulting in lost working days and LTRIR[9]

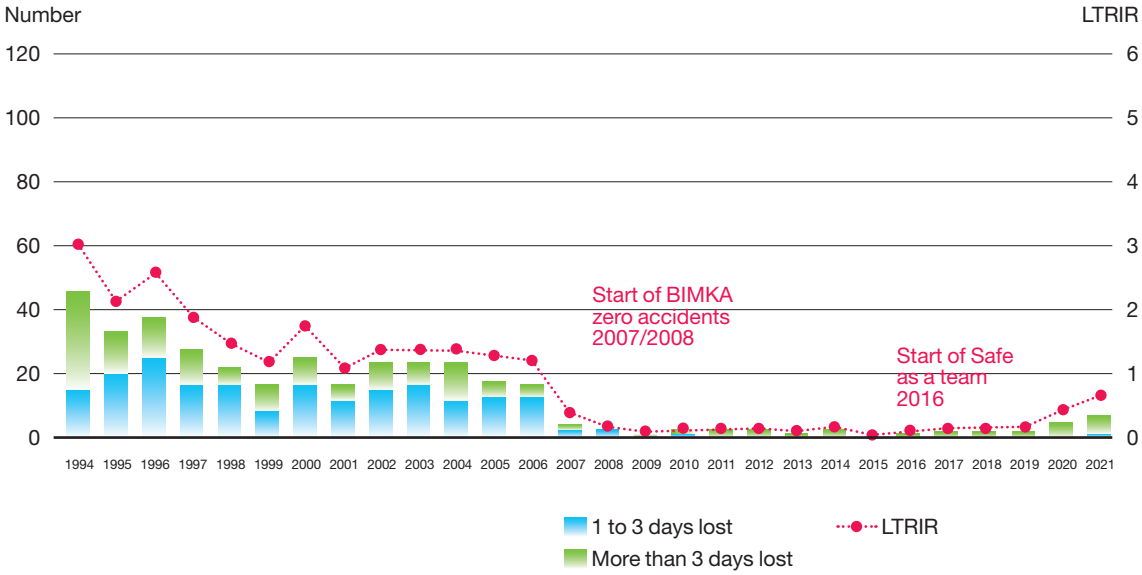


Fig. 22: Historical incident figures and occupational safety programs

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. In 2020, the certification of our occupational safety management system was switched to ISO 45001, the new international standard for state-of-the-art occupational health and 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, the Bergkamen site has been conducting the Group-wide "Managing safety!" accident prevention initiative since 2008 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 an LTRIR of zero!

At the start of 2014, the Behavioral Safety initiative was then adopted by the Bayer Safety Council headed by the Chairman of the Board of Management. This 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 also covers 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 health and 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.

[9] The LTRIR (Lost Time Recordable Incident Rate) calculates the number of work-related accidents leading to days of absence based on 200,000 working hours.

Accidents leading to days of absence, replacement tasks, medical treatment and RIR[10]

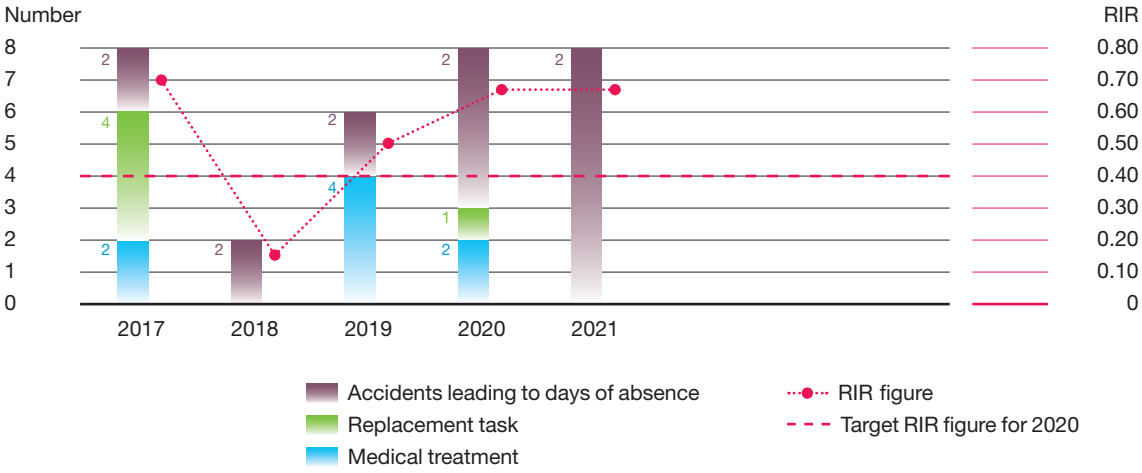


Fig. 23: New focus: The RIR – target for 2022: ≤ 0.38

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. Despite this new occupational safety program, the LTRIR has been rising again slightly since 2016, albeit at a low level (comparative value in the chemical industry is higher by about a factor of three). It has not yet been possible to definitively establish the reasons for this. For 2022, it is therefore planned to involve two external consulting firms to identify expedient additions to the occupational safety program (see Objectives for 2022 and beyond).

Rather than the LTRIR KPI, focus has now moved to the RIR figure. Whereas the LTRIR only takes into account work-related accidents and illnesses with days lost, the RIR also counts medical treatment and replacement positions. In its integrated annual report, Bayer had pledged to maintain an RIR of 0.39 until 2021. The Bergkamen site adopted this target. Once again, however, this objective could not be reached, despite the introduction of the new "Safe as a team" occupational safety program. Further occupational safety activities are therefore required to achieve an improvement in the incident figures. As a result, the plan for 2022 is to optimize the involvement of the Site Leadership Team in the occupational safety program and to conduct safety performance dialogues for the plant management teams (see Objectives for 2022 and beyond).

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. Due to the COVID-19 pandemic, the last two years have seen the first virtual Safety Days in the history of the event, which includes a variety of occupational health and safety activities. Recent focal points have been as follows:

2019: "Be prepared!"
2020: "Be aware – check twice!"
2021: "Together towards a healthy and safer workplace"

[10] 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 dialogue – supervisors and staff regularly discuss ways of optimizing occupational safety and preventing accidents.

Operational 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. These workshops, run by external specialists, address health concerns on site and use these to develop measures to improve the situation.

Back 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 site's own 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.

COVID-19 pandemic

In the last two years, society has faced a particular challenge in the shape of the COVID-19 pandemic. The Robert Koch Institute called on all branches of society to play a part in boosting commitment to preventing infection.

Bayer also called on people to consistently comply with all decisions made regarding infection prevention and adjusted its own rules to the latest situation on an ongoing basis so as to protect the health of its staff and the care of our patients. The local pandemic team of the Bergkamen plant provided regular communication on these measures in the form of "Coronavirus updates". The numerous measures included:

- The option of working from home wherever operationally possible,
- Only conducting meetings and training courses in person when absolutely necessary,
- Avoiding multiple occupancy of offices,
- Reducing business travel to an absolute minimum,
- Wearing a mask whenever and wherever necessary,
- Providing rapid tests.

In addition, the Medical Department (ASD) offered on-site vaccinations to Bayer employees and their families from mid-2021 at a specially set up vaccination center on the Bergkamen site. Some 1,696 vaccine doses were administered to Bayer employees and their families in this center. In the first half of the campaign, 881 of them received their first vaccine or only vaccination after recovery. In the second half of the campaign, 815 people received their second dose or vaccination after recovery. This initiative played a major role in protecting the health of our staff and making it safe to work together in the plant.

From the end of 2021, this on-site vaccination provision was also available for booster vaccinations.

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

machtfit health platform

Many of the existing occupational health management activities have been continued and refined over the last few years.

Bayer launched the machtfit health platform for occupational health management in October 2019. It provides staff with a central point of contact for all health-related offerings from Bayer.

Employees receive a diverse range of needs-oriented information and offers relating to exercise, nutrition, relaxation and more. Whether they are looking for something close to their workplace, near where they live or while on the move, they will find something to suit on this platform. Due to the COVID-19 pandemic, the offerings could only be provided in a limited form from 2020. However, numerous additional digital health offerings were also set up to make it possible to stay fit, even during lockdown. Beginners and experienced athletes alike can find what is right for them.

Preventive activities

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 from the 2019 Environmental Statement

Objectives/programs/measures Occupational health and safety	Implemented by	Comments
LTRIR rate < 0.17 (number of accidents leading to days of absence), RIR rate < 0.40 (number of recordable accidents) **➔ Implementing Bayer's Behavior Based Safety occupational safety initiative (Safe as a team) at the Bergkamen site**	2020	● Long-term objective not achieved. LTRIR 0.42 in 2020, RIR 0.67.
Maximum of 4 RIR accidents at Bergkamen site in 2019	2019	● The objective for 2019 was not achieved. A total of six accidents leading to days of absence or medical treatment at the Bergkamen site.
LTRIR rate < 0.17 (number of accidents leading to days of absence), RIR rate < 0.40 (number of recordable accidents) **➔ Implementing Bayer's Behavior Based Safety occupational safety initiative (Safe as a team) at the Bergkamen site**	2020	
• Conducting final workshops to establish safe habits for two functions that have yet to undergo training	2019	● Final workshops were held in the two functions.
Reducing number of accidents at external companies **➔ Initiating activities for reducing accidents at external companies**	Ongoing objective	
• Conducting an External Company Day in 2019	2019	● External Company Day was held with great numbers of participants.
• More inspection patrols and better occupational safety at major construction sites	2020	● Patrols were conducted, particularly during the demolition of PU-C.
• Maximum of six external company accidents leading to days of absence at the Bergkamen site in 2019.	2019	● The plant objective was not achieved. A total of 13 external company accidents at the Bergkamen site in 2019.
Reducing the absence rate to less than 5.75 % **➔ Conducting health promotion activities**	2020	● Long-term objective achieved. The rate of paid sick leave was approx. 4.8 % in 2020.
• Continuing and updating the risk assessment of psychological stress	2019	● The risk assessment on psychological stress has been updated. This involved conducting a health survey, including analysis of psychological stress.
Reducing the absence rate to less than 5.75 % **➔ Conducting health promotion activities**	2020	
• Conducting a Health Day for all staff	2020	● The Health Day had to be canceled in 2020 due to the pandemic.
Reducing the absence rate to less than 5.75 % **➔ Conducting health promotion activities**	2020	Medical history review and initial measuring of mobility with an external trainer, training units carried out over six weeks before repeating the test.
• "Five" study in the health center	2019	● "Five" study was conducted.
Reducing employees' exposure to hazardous substances at the workplace **➔ Adopting targeted individual measures to reduce exposure to hazardous substances**	Ongoing objective	● The basic investigations on this subject were completed. Development work on the details is ongoing.
• Reviewing development of TIP synthesis free of ethylene chloride (PU-F) Updating target set in the 2016 Environmental Statement	End of 2020	

Reducing employees' exposure to hazardous substances at the workplace ➔ **Adopting targeted individual measures to reduce exposure to hazardous substances**	Ongoing objective	
• Installing a sieving system for active ingredients as a closed operation in PU-A	2020	Closed operation reduces the amount of dust emitted during sieving processes. ● The PU-A product portfolio was subjected to a review. The outcome is that PU-A will not sieve any active ingredients in the future. The stages currently sieved either will not be produced any longer or will be transferred. It was therefore decided not to implement the closed sieving project.

Objectives/programs/measures
Environment/air pollution control

Avoiding complaints from neighbors, particularly about odors ➔ **Adopting measures to improve odor situation**	Ongoing objective	
• Installing two more activated carbon adsorbers in the wastewater treatment plant	2019	The installation of two more adsorbers makes it possible 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. ● Project was completed in 2020.
Avoiding complaints from neighbors, particularly about noise ➔ **Adopting measures to improve noise situation**	Ongoing objective	
• Installing soundproofing equipment at the induced-draft fan for boiler 2/chimney B313	2019	The installation of soundproofing equipment at the induced-draft fan is expected to reduce noise spreading via the 120-meter-high chimney and prevent noise complaints from the neighborhood. ● The induced-draft fan was installed as planned during plant downtime in mid-2019.
Further reducing VOC emissions (permanently < 15 metric tons p.a.) ➔ **Continuing the plant-wide program to reduce VOC emissions**	2021	● Objective was achieved. The VOC emissions level was 14.0 metric tons in 2021.
• Installing a new cleaning system for small parts in PU-E and using a new cleaning agent	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 the other plant operations. ● The switchover to Imsol is complete. Acetone only has to be used for follow-up cleaning in a few individual cases.
Reducing relative energy consumption by five percent by 2020 ➔ **Conducting energy-saving projects**	2020	● Long-term objective achieved. Relative energy consumption 2020: 0.088 TJ/t; reference year 2014: 0.099 TJ/t
• Replacing lighting (energy-efficient LED technology) in A001, B002, B245, B249, B311 and C119	2021	● Projects completed.

Reducing relative energy consumption by five percent by 2020 **➔ Conducting energy-saving projects** • Replacing and optimizing lighting in PU-A, including with LED technology	2020 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 safety requirements. ● Project delayed, start 2020, completion 2022. Will be adopted as an objective in the 2022 Environmental Statement.
Reducing relative energy consumption by five percent by 2020 **➔ Conducting energy-saving projects** • Continuing the plant-wide program to replace old motors with high-efficiency models. Annual exchange of approx. 1,500 – 1,700 kW drive power. Potential savings of approx. 200,000 kWh p.a. once all motors have been changed. Updating target set in the 2016 Environmental Statement	2020 Ongoing	The replacement of motors is an ongoing, plant-wide project. Current status at the end of 2020: 30.7 % are achieving the maximum possible drive power. ● Project is ongoing. Will be adopted as an objective in the 2022 Environmental Statement.
Reducing relative energy consumption by five percent by 2020 **➔ Conducting energy-saving projects** • Replacing the two older waste gas ventilators in TNV C147 with new, more energy-efficient, frequency-controlled models	2020 By 2020	● Project implemented in 2019.
Reducing relative energy consumption by five percent by 2020 **➔ Conducting energy-saving projects** • Renovating pipe bridges: Improving insulation of the relevant pipes to reduce heat losses. In 2019, this affected approx. 250 m of pipes along the 300 line/power plant.	2020 2019	● Project implemented in 2019.
Reducing relative energy consumption by five percent by 2020 **➔ Conducting energy-saving projects** • Constructing a new, more energy-efficient distillation plant at the Bergkamen site to replace the old plant Updating target set in the 2016 Environmental Statement	2020 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. ● First subsection (fine vacuum plant TA105) commissioned in 2019, lower heating temperature (approx. 130 °C) thanks to falling film evaporator rather than outer surface heating (approx. 160 °C), further subsections are to be commissioned in the course of 2020/2021. Will be adopted as an objective in the 2022 Environmental Statement.
Reducing relative energy consumption by five percent by 2020 **➔ Conducting energy-saving projects** • Replacing the compound refrigeration system at the power plant with a new, more energy-efficient system, while also swapping the R404A refrigerant for R449A	2020 2021	The new R449A refrigerant has a significantly lower global warming potential (GWP = 1397) than R404A (GWP = 3922). ● Project implemented in 2020.

Reducing relative energy consumption by five percent by 2020	2020	
→ Conducting energy-saving projects		● Project implemented. Due to delays, the compressors were not replaced until 2020 and 2021 respectively.
• Exchanging two compressors used in microbiology for new, more energy-efficient equipment	First compressor switched in 2019	
Potential annual savings of approx. 550,000 kWh following exchange		Two further compressors will be replaced by mid-2022. Will be adopted as an objective in the 2022 Environmental Statement.
	Second compressor switched in 2020	
Reducing relative energy consumption by five percent by 2020	2020	
→ Conducting energy-saving projects		
• Inspecting steam traps throughout the entire Bergkamen plant	Ongoing	● Ongoing project.
Updating target set in the 2016 Environmental Statement		

Objectives for 2022 and beyond

Objectives/programs/measures Occupational health and safety	Implemented by	Comments
Reducing occupational accidents ➔ Implementing Bayer's Behavior Based Safety occupational safety initiative (Safe as a team) at the Bergkamen site	Ongoing objective	
• Achieving RIR ≤ 0.38	2022	
• Optimizing involvement of the Site Leadership Team in the occupational safety program	2022	
• Conducting safety performance dialogues for management teams	2022	
Reducing the absence rate ➔ Conducting health promotion activities	Ongoing objective	
• Conducting a Health Day for all staff	2022	• As far as pandemic developments allow.
• Musculoskeletal concept pilot project	2022	• Identifying musculoskeletal hazards in everyday work and drawing up and implementing suitable measures.
• Certified online prevention course for biokinematic whole-body training	2022	• Guided eight-unit prevention course focusing on joints and muscles as a certified online offering.
• Discussing the results of the 2019 Health Survey on psychological stress in all functions, deriving measures and creating function-specific risk assessments for psychological stress	2023	• Implementing measures from the relevant department's idea meetings on site.
Reducing exposure to hazardous substances ➔ Adopting targeted measures to reduce exposure to hazardous substances	Ongoing objective	
• PU-E: Acquiring another special inline sampler	2023	• The new sampler is designed to have very little dead space and to reduce employees' exposure during the sampling process.
• PU-E: Installing two big bag filling stations to replace filling via containers	2023	• Improved tightness of the filling station reduces exposure to hazardous substances in the working area.
• PU-E: Strengthening an existing big bag emptying station on the third floor	2023	• Improving tightness in the emptying station.
• Automated disposal of liquid waste in PU-A	Middle of 2023	• The complex connections with hoses are currently carried out manually. The project involves an automation that can be carried out via the recipe control. This reduces the trip hazard while also minimizing the risk of substances being released.
• Replacing hoses with rigid pipes in the process water treatment area	End of 2023	• Reducing the trip hazard, minimizing the risk of substances being released. The measures will be implemented as part of a larger PWA project for increasing capacity by the end of 2023.
• Distillation, laboratory: Taking samples for process control of recycled solvents via closed samplers in the fume cupboard	2023	• Sampling is conducted through a circuit system in the fume cupboard, which is where the samples are taken. This prevents any emissions into the room or the environment.
• Microbiology: Installing an improved sampling system in tank farm MPD	2022	• The new sampling systems reduce employee exposure.

Objectives/programs/measures Occupational Environment /Energy	Implemented by	Comments
Reducing relative energy consumption by ten percent (reference year 2019)	2029	Supporting Bayer's goal of achieving net zero by 2030
➔ Conducting energy-saving projects		
• Continuing the plant-wide program to replace old motors with high-efficiency models. Annual exchange of approx. 1,500 – 1,700 kW drive power. Potential savings of approx. 200,000 kWh p.a. once all motors have been changed. Updating target set in the 2016, 2019 Environmental Statements	Ongoing	• The replacement of motors is an ongoing, plant-wide project. Current status at the end of 2021: 31.5 % are achieving the maximum possible drive power.
• Constructing a new, more energy-efficient distillation plant at the Bergkamen site to replace the old plant. Updating target set in the 2016, 2019 Environmental Statements	2022	• 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. First subsection (fine vacuum plant TA105) commissioned in 2019, lower heating temperature (approx. 130 °C) thanks to falling film evaporator rather than outer surface heating (approx. 160 °C), further subsections are to be commissioned in the course of 2022.
• Distillation: Saving energy by boosting the efficiency of solvent recovery by 10 % compared to 2019	2024	• The solvent recovery process is to be optimized in such a way that a 10 % greater yield is achieved with the same machine run time. The shorter run time or increased yield is equivalent to a 10 % reduction in the amount of steam. Ethyl acetate was selected as a representative process. Once this has been successfully optimized, other solvents will be included.
• Obtaining additional qualifications as energy scouts for three trainees from the IHK	2022	• As was previously the case in 2021, trainees are to act as energy scouts in their training departments and help identify energy saving potential, document it and suggest improvements.
• Wastewater treatment plant: Cutting energy consumption in the wastewater treatment plant aeration by 10 % by 2029	2029	• Continuous improvement of the aeration equipment, the operation of the activated sludge tanks and improved distribution of the wastewater streams in the facility.

Reducing relative energy consumption by ten percent (reference year 2019) ➔ Conducting energy-saving projects	2029	Bergkamen site long-term objective: Supporting Bayer's goal of achieving net zero by 2030
• Determining energy consumption specific to stages of synthesis and the carbon footprint in all active ingredient facilities	2023	
• Pipe network: Installing an air compressor optimized to the requirements and procuring an acoustic camera for efficient leak detection in the compressed air system	2022	• Using less energy to generate compressed air. The acoustic camera makes it possible to quickly and reliably identify leaks.
• Replacing lighting (energy-efficient LED technology) in C064, D158, A035, A112, B320, D232, B105	2024	• Continuing the switch to LED lighting in more buildings/areas.
• Replacing and optimizing lighting in PU-A, including with LED technology. Updating from 2019 Environmental Statement	2024	• 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 safety requirements. The PU-A cellar has already been completely switched to LED lighting. Other floors will follow.
• Microbiology: Exchanging two more fermenter air compressors for new, more energy-efficient equipment	2022	• The last two fermenter air compressors are to be replaced by mid-2022.
• Analyzing the energy saving potential of 20 climate control and ventilation systems	2023	
• PU-B: Switching the lighting in production areas to LED over the next few years. Office areas have already been switched to LED in previous years. Previous electrical power: approx. 20,280 W; after switch to LED: approx. 6,850 W; annual saving operating all day every day: approx. 118,000 kWh/year	2025	• LED lighting was installed on the second/third floors in 2021. In 2022, work began to do this for the first floor. To date, around EUR 60,000 has been invested in LED lighting.

Objectives/programs/measures **Occupational Environment/air pollution control**	**Implemented by**	**Comments**
Reducing indirect carbon dioxide emissions ➔ Adopting measures to reduce carbon dioxide emissions	Ongoing objective	Bayer objective: Reducing indirect carbon dioxide emissions by procuring 100 % "green electricity" by 2030.
• Increasing the proportion of renewable energies in electricity obtained from external sources to 100 % by 2030	2030	Bergkamen, proportion of green electricity in electricity obtained from external sources, 2021: 51.1 %.

Reducing direct carbon dioxide emissions by 10 % relative to 2019 (=74,476 metric tons) ➔ Adopting measures to reduce carbon dioxide emissions	2029	Supporting Bayer's goal of achieving net zero by 2030
• Assessing collaboration with the neighboring biomass heating plant	2023	• Obtaining a proportion of "green steam" via the neighboring biomass power plant. Declaration of intent has been signed. Feasibility study is in progress.
• Distillation: Resuming solvent processing for the azeotrope mix THF methanol (7:3)	2023	• The recycling process was stopped years ago due to quality concerns. As a result of the increased separation effect and performance of the new distillation facilities, the recycling process is being resumed. The recovered volume of THF methanol does not need to be incinerated/ disposed of. In addition to recycling materials and reducing waste, the recovery process therefore also helps cut CO_2 emissions.
• Feasibility study for biogas from wastewater Integrating an anaerobic wastewater treatment facility with generation of biogas. In preliminary studies, wastewater streams from PU-F with high levels of organic substances were identified. Anaerobic treatment of these is promising.	2022	• Approx. 8,000 MWh of biomethane could be produced each year. The biogas could be used e.g. in the hazardous waste incinerator. A feasibility study will establish whether the wastewater streams are actually anaerobically degradable.
Avoiding complaints from neighbors ➔ Adopting measures to improve odor/noise situation	Ongoing objective	
• Wastewater treatment plant: Constructing a pretreatment facility with waste air adsorbers to minimize odors	2024	• Rebuilding the pretreatment facility in the wastewater treatment plant area. All basins will be covered in the future and fitted with an off-gas disposal system.
• Installing soundproofing equipment at the induced-draft fan for boiler 1 (chimney B313) as part of the renewal of the induced-draft fan	2022	• The installation of soundproofing equipment at the induced-draft fan is expected to prevent noise spreading via the 120-meter-high chimney and avoid noise complaints from the neighborhood.
Material-efficient, resource-friendly production ➔ Implementing measures to improve recycling processes and reduce raw material and material consumption	Ongoing objective	
• Improving ADD synthesis processes in microbiology Certification campaign in 2022 Switchover to new synthesis from 2024	2022 2024	• Refining the process will make it possible to eliminate the 2-naphthol cracking stage entirely (incl. raw materials, solvents, energy, wastewater, etc.).
• Gadolinium recovery from the gadobutrol synthesis wastewater streams in PU-F, check process	2022	• For complete, cost-covered implementation, a membrane facility for concentrating the wastewater must be set up in Bergkamen. Further details on this are to be drawn up in 2022 and an ROI analysis will be conducted.
• Further optimization of ethanol recovery in PU-F	Ongoing	• Since 2017 (reference year = 100 %), the optimization of ethanol recovery in PU-F has reduced ethanol procurement to 87 %. This figure will be further improved over the next few years.
• PU-B: Saving liquid nitrogen	2023	• Two-point control for liquid nitrogen will be replaced with temperature control. This results in lower consumption (approx. 5 %).

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 konsolierte 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 (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) i.V.m. (EU) 2017/1505 und EU) 2018/2026 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 Verordnungen VO (EG) 1221/2009 i.V.m. (EU) 2017/1505 und EU) 2018/2026 durchgeführt wurden,

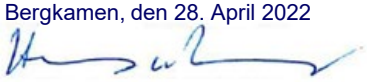
— das Ergebnis der Begutachtung und Validierung bestätigt, dass keine Belege für die Nichteinhaltung der geltenden Umweltvorschriften vorliegen,

— die Daten und Angaben der konsolidierten Umwelterklärung des o.b. Standortes mit 1500 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 2025 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 28. April 2022



Henning von Knobelsdorff
Umweltgutachter
DE-V-0090

Certificates

Zertifikat

Der
Umweltgutachter Henning von Knobelsdorff bescheinigt hiermit, dass die

Bayer AG
Ernst-Schering-Straße 14
D - 59192 Bergkamen

für die Tätigkeiten

Herstellung von pharmazeutischen Grundstoffen, Herstellung von pharmazeutischen Spezialitäten und sonstigen pharmazeutischen Erzeugnissen

ein

Energiemanagementsystem

in Übereinstimmung mit dem Standard

DIN EN ISO 50001:2018

eingeführt hat und anwendet.

Das Zertifikat ist gültig bis zum 25. April 2023.
Das Managementsystem wird jährlich überprüft.
Zertifikat-Nummer 270417 Bayer_BEK EM 00

Bonn, den 24. April 2020

Zertifikat

Prüfungsnorm **ISO 14001:2015**

Zertifikat-Registrier-Nr. **01 104 000692**

Unternehmen: **Bayer AG**
Ernst-Schering-Str. 14
59192 Bergkamen
Deutschland

Geltungsbereich: Herstellung von pharmazeutischen Grundstoffen, Herstellung von pharmazeutischen Spezialitäten und sonstigen pharmazeutischen Erzeugnissen

Durch ein Audit wurde der Nachweis erbracht, dass die Forderungen der ISO 14001:2015 erfüllt sind.

Gültigkeit: Dieses Zertifikat ist gültig vom 31.05.2021 b
Erstzertifizierung 2001

28.06.2021

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Zertifikat

Prüfungsnorm **ISO 45001:2018**

Zertifikat-Registrier-Nr. **01 213 060019**

Unternehmen: **Bayer AG**
Ernst-Schering-Str. 14
59192 Bergkamen
Deutschland

Geltungsbereich: Herstellung von pharmazeutischen Grundstoffen, Herstellung von pharmazeutischen Spezialitäten und sonstigen pharmazeutischen Erzeugnissen

Durch ein Audit wurde der Nachweis erbracht, dass die Forderungen der ISO 45001:2018 erfüllt sind.

Gültigkeit: Dieses Zertifikat ist gültig vom 31.07.2021 bis 30.07.2024.
Erstzertifizierung 2006

28.06.2021

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Am Grauen Stein · 51105 Köln

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Top:
Environmental management system certification
Top right:
Energy management system certification

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.

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).

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.

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.

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.

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.

Iodine
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.

ISO 14001
International environmental protection management standard

ISO 45001
International occupational safety management standard

ISO 50001
International energy management standard

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, replaced by DIN EN ISO 45001

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.

RIR
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.

Safe as a team (SiT)
Current occupational safety program at the Bergkamen site

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.

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.

X-ray contrast media
Designation for substances exhibiting stronger or weaker adsorption of radiation than the surrounding body tissue during medical radiography.

ZABA
Central wastewater treatment plant

Masthead

Bayer AG
Ernst-Schering-Strasse 14
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Germany

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