HUNTSMAN
Enriching lives through innovation

INEOS Solvents

ENVIRONMENTAL DECLARATION 2021

INEOS Solvents Germany GmbH
INEOS Solvents Marl GmbH
Huntsman Products GmbH

Disclaimer

This is a direct translation from the German version, which can be found on our website.

The translation was performed by a professional translation company however some grammatical inconsistencies may remain.

CONTENT

1 PREFACE

Dear reader,

This is the first detailed environmental statement issued by the INEOS Solvents Germany GmbH and the Huntsman Products GmbH together with the INEOS Solvents Marl GmbH. The INEOS Solvents Marl GmbH was previously validated (under its previous company name ISP Marl GmbH) in the framework of the Marl Chemical Park together with the operator of the park (Evonik Degussa GmbH).

The many years of successful cooperation between the Huntsman Products GmbH and the INEOS Solvents Germany GmbH will be continued, and the INEOS Solvents Marl GmbH will join the cooperation without reserve.
This guarantees continuity in all respects. All the companies involved, including those in the extended group, are firmly convinced that only companies who operate sustainably, use the world's limited resources responsibly, and accept their social responsibility to preserve an environment worth living in for future generations can be economically successful in the long term. The fact that we put this conviction into practice in our day-to-day operations is checked every year by independent experts based on strict international guidelines. As a result, INEOS Solvents Germany, Huntsman Products, and INEOS Solvents Marl have been certified and validated according to the quality and environmental standards ISO 9001, ISO 14001, and EMAS. Furthermore, the energy management system of INEOS Solvents Marl is certified according to ISO 50001. Regular audits of our integrated management system serve to ensure continuous improvement, among other things.

A look at the development of our performance indicators on the sustainability topics of environmental protection as well as of energy and raw material efficiency in the past year 2020 would indicate that we were unfortunately not equally successful in all areas. This is due on the one hand to the significantly lower capacity utilization of most plants as a result of the pandemic, and on the other hand to downtime caused by technical malfunctions. In addition, some projects aimed at improving our efficiency could not be implemented as planned due to the pandemic.

Due to the coronavirus crisis, we are all currently facing very great challenges. This applies in particularly to our two plants in Moers and Herne, where we produce ethanol and isopropanol, the main components of the commonly used disinfectants that are currently urgently needed. For this reason, we are doing everything we can to protect our employees and partner companies from the virus so that we do not have to shut down these important production facilities. During this difficult time, we have received a great deal of support from the cities of Moers and Herne as well as from the various authorities involved. In return, we are helping out local organizations in particular as unbureaucratically as possible and to the best of our ability with raw materials and disinfectants. This shows how important transparency, information, communication, dialog with our neighbors, and trusting cooperation with the authorities has been in the past and will continue to be in the future.

The failure to achieve some of our goals encourages us to focus our priorities at our plants on the health and safety of our own and partner company employees as well as on environmental protection, plant safety, raw material and energy efficiency, and to concentrate our activities on these priorities. This is reflected in the environmental program objectives and measures for the years 2021 to 2023.

Of course, we are still open for your questions, requests, and suggestions outside of times of crisis. Give us a call. We look forward to talking with you.

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Managing Director
INEOS Solvents Germany and Marl

Herbert Peters
Managing Director
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Head of SHE (interim)
INEOS Solvents Germany

2 The companies (and their management system)

2.1 Scope of the environmental statement

This joint environmental statement applies to the Moers, Herne, and Duisburg-Homberg sites of the INEOS Solvents Germany GmbH as well as to the facilities of INEOS Solvents Marl GmbH in the Marl Chemical Park and the Huntsman Products GmbH in Moers.

2.2 INEOS

INEOS was founded in 1998 and is now one of the world's largest chemical companies. Around 22,000 employees at more than 180 locations worldwide generate annual sales of about 60 billion US dollars.

The INEOS Enterprises business unit has approximately 2,500 employees and comprises a portfolio from a variety of business areas including solvents with a total of 25 locations in the UK, France, Germany, Spain, Poland, Finland, Sweden, Switzerland, China, Canada, and the USA.

With its plants in Herne, Marl, and Moers and its port in Duisburg-Homberg, INEOS Solvents is one of Europe's leading manufacturers of oxygenated solvents. In addition to solvents, around 650 employees also produce fine chemicals and plasticizers for the chemical processing industry (B2B). The Marl plant produces acetylene, tetrahydrofuran (THF), formaldehyde, 1,4-butynediol, 1,4-butenediol and 1,4-butanediol.

The production facilities of INEOS Solvents Germany GmbH and INEOS Solvents Marl GmbH in Moers, Herne and Marl have a total capacity of over 800,000 tons per year. The products are used, for example, in paints, varnishes and coatings, tires, gloves, seals, aromas and vitamins, cleaning agents and disinfectants, adhesives, temperature-resistant plastics, hairsprays and personal care products, as well as in cosmetics and pharmaceutical products.

INEOS has a strong competitive position, utilizes leading technologies, and has secure access to global commodity markets. INEOS stands for innovation and sustainable growth, reliable quality and customer satisfaction, responsible action and excellence in safety, health, and environmental protection, as well as for continuous improvement of the company's performance in all of these areas. To achieve this, INEOS relies on competent, experienced, and creative employees to ensure the company's success.

For INEOS, the safety and health of its employees and those of partner companies as well as environmental protection, energy efficiency, and plant safety are top priorities. This is reflected in the corporate policies of INEOS Enterprises, INEOS Solvents Germany GmbH, and INEOS Solvents Marl GmbH. The "7 Life Saving Rules" and the "20 Safety Principles" (10 principles each for plant safety and a behavioral approach to occupational safety) with an elaborate INEOS-internal auditing system also underscore the particular importance of safety and health.

2.3 Huntsman Products

Huntsman Products has been producing maleic anhydride (MA) at its facility in Moers since 1997.

Huntsman Products is the owner and operator of the MA plant while INEOS Solvents Germany and its employees provide essential services on-site and are responsible for operational management on the basis of long-term service contracts. A team of around eight people at Huntsman Products is also primarily responsible for marketing the product. In addition to operating the facility, INEOS Solvents Germany also maintains the facility in the framework of the contracts mentioned above.

With an annual capacity of 105,000 tons, the Moers production facility is the largest of its kind in Europe. The product is then processed by customers, primarily into unsaturated polyester resins. These resins are used to produce durable plastics used in the construction, automobile, and shipbuilding industries. Other important applications include lubricants, water treatment chemicals, foods, pharmaceuticals, and herbicides and pesticides.

2.4 The management system

The companies involved have an integrated management system that is used to control, review, and continuously improve all important processes in the companies. A prerequisite for this system is the comprehensive description of all operational processes. This serves to ensure the transparency of all activities and is therefore an integral part of the management system.

Within the integrated management system, the chapter on environmental management constitutes a large part of the system. It creates structures and incentives for continuous improvement of our environmental performance and enables the company to measure itself against its own targets.

Environmental protection, quality, and occupational safety have always been of great importance to the companies involved and their sites.

2.4.1 Direct and indirect environmental aspects

The environmental aspects of an organization are the components (aspects) of an activity (process), product or service, customer, supplier, or service provider (contract partner) of an organization that can interact (positively or negatively) with the environment. The aspects are categorized as fully controllable and not fully controllable (direct and indirect, respectively).

From the general activities of an organization (such as production, energy consumption / generation, internal and external storage, internal and external transport, determination of the infrastructure, selection of a contracting party), the activities that are significant in terms of their (potential) environmental impact throughout the entire product life cycle (raw material use, water / energy consumption, soil / land consumption, packaging requirements, transport routes, infrastructure, waste / wastewater generation, noise, and other emissions) under normal and exceptional operating conditions (incl. emergency situations) are identified and evaluated on the basis of weighted criteria (such as legal requirements, third party interests, risks and opportunities, economic efficiency, and social acceptance), and then documented with appropriate mitigation measures.

The most significant direct environmental aspects for this organization are:
- Material efficiency
- Energy consumption
- Water consumption
- Wastewater generation
- Waste generation
- Emissions

Less significant to this organization, but still taken into account, include the following indirect environmental aspects:
- Water and energy mix (source)
- Raw material deliveries (supplier qualification, transport routes)
- Product shipping (packaging selection, container size, transport routes)
- Hazardous materials handling (safeguards, safety information for the recipients of the goods)
- Waste and wastewater disposal (disposal company qualification, transport routes)
- Employee commuting (choice of means of transport, carpooling)
- Business trips (necessity review, choice of means of transport)
- Visitor traffic (justification, accumulation)

2.4.2 Compliance with (environmental) legal requirements and voluntary commitments

In their corporate policies, the companies involved have committed themselves to meet and fulfill all environmental legal requirements. The essential legal requirements to be met are:

- The German Federal Immission Control Act (BImSchG) and the associated ordinances (the production facilities require a permit in accordance with the BImSchG)
- The German Hazardous Incident Ordinance (StörfallV) (the sites represent operational areas in terms of BImSchG and StörfallV)
- The German Water Resources Act (WHG) and the associated ordinances (relevant wastewater volumes are produced and relevant quantities of liquids hazardous to the aquatic environment are handled at the plants).
- The German Closed Substance Cycle Act (KrWG) and the associated ordinances (relevant quantities of waste are generated at the plants)

To ensure that compliance with all environmental regulations does not remain a mere declaration of intent, processes were established some time ago to ensure that all relevant legislation and their revisions are systematically recorded and complied with.

Legal changes are tracked with the help of an online database, among other things, and are reviewed internally for relevance. This ensures access to the latest standards and laws at all times. The SHE department informs the functional units about the specific need for action resulting from changes to the law. In the Production and Technology departments, the directories of operating and building permits with their ancillary provisions and requirements (e.g. on periodic inspection requirements) help to ensure legal compliance.

In addition to the regular checks (inspections) of the operational safety and environmental protection situation by independent experts and authorities, control rounds and inspections, intercompany meetings, and audits are also carried out periodically in which the topics of environmental protection, occupational safety, health protection and fire protection are handled. If any deviations or deficiencies are identified, they are discussed and analyzed, and measures for improvement are defined. The implementation of the measures is monitored based on specific lists or via a database and, if necessary, they are also checked through inspections. This ensures that the operation of the facilities complies with the law.

In addition to fulfilling the legal requirements, INEOS Solvents and Huntsman Products are also contributing to the voluntary commitments made by their industry associations to implement more extensive measures, e.g. to reduce specific CO_2 emissions as well as the specific energy consumption.

2.4.3 Objective

The management of INEOS Solvents Germany, INEOS Solvents Marl, and Huntsman Products have defined their respective strategic environmental goals in their environmental policies. The resulting measures are documented in the environmental program. This program also states the time frames for achieving the goals, the responsibilities, the personnel requirements, and the necessary financial resources. These financial resources are included in investment and cost budgets and are approved by the management of the respective company. The environmental program is revised on a regular basis.

Tables 1 and 2 below provide information on how the last environmental program was implemented in the years from 2018 to 2020 and what goals and measures have been defined for the next three-year period from 2021 to 2023.

Review of the environmental program 2018 – 2020
Table 1: Environmental Program 2018 – 2020

Area	Goal	Measure	Site	Impl. status at end of 2020
Waste, material efficiency	Simplification of waste handling, reduction of caustic consumption to zero	Direct disposal of the IPA catalyst when emptying the reactors without neutralization or intermediate storage at the plant	Moers	Already completed according to plan in 2018
		Direct disposal of the activated carbon from the AOX absorbers without neutralization	Moers	Already completed according to plan in 2018
Energy efficiency, material efficiency	Reduction of energy and raw material consumption	Optimization of the selectivities and specific energy consumptions based on benchmarks and validation of cost models for the IPA, SBA, and EtOH plants.	Moers Herne	Extensive analyses, balances, models, and optimizations were performed for the facilities stated above. As a result of benchmarking, an energy traffic light was developed for the Moers IPA and SBA plant that is currently being tested. In Herne, a simulation study on steam savings in the DA604, DA605 column system was completed. Based on this study, a test plan will be created and the tests will be conducted in 2021.
		Conduct a study for optimization of the OLEX plant	Moers	The project has been completed. The OLEX plant is operated with the optimized operating parameters.
		Set up and monitor energy and material balances for the ISM area and the AC plant.	Moers	The balancing of the ISM area is almost complete. The balances already created are regularly reviewed. Due to the decommissioning of the AC plant, work on the energy and material balances of the AC plant was stopped.

Area	Goal	Measure	Site	Impl. status at end of 2020
Energy efficiency, air pollution control	Continuous reduction of the specific energy consumption.	Application of benchmarks and development of cost models for the SBA plant.	Moers	This measure is still in progress.
		Extension of the demineralized water preheating system.	Moers	The start of engineering has been postponed until 2021. Realization is planned for 2022.
		Reduction of steam losses by overhauling the TG-7 turbogenerator.	Moers	The overhaul will be performed during the plant shutdown in Sep / Oct 2021, which has been postponed by one year.
		Preheating of demineralized water with waste gas in the power plant.	Moers	The measure was completed according to plan in 2018
Plant safety	Further increasing the safety standards and awareness as well as prevention of accidents, substance releases, fires, and explosions.	Application of the 20 INEOS Safety Principles	Moers Herne	The internal audit program was significantly intensified in 2020 through the use of an electronic system.
		Implementation of the safety initiative “IIF - Incident and Injury Free”.	Moers Herne	The workforce has been involved in safety improvements through regular meetings. Numerous ideas for improving safety have been implemented.
		Preparation of all required job safety analyses (JSAs)	Moers Herne	JSAs for routine activities have been created.
		Continuous monitoring and regular reporting of the safety performance indicators.	Moers Herne	A large number of safety performance indicators are determined and evaluated on a monthly basis.
		Application of a system for the systematic documentation and analysis of near misses and incidents	Moers Herne	Numerous “near miss” entries were entered into a database by the staff. The processing of the entries was reviewed on a monthly basis.
		Testing the suitability of a risk-based inspection program for production facilities based on a pilot project.	Moers Herne	The pilot project in SBA synthesis was completed.
Plant safety, emergency response	Optimization of preventive fire protection at the Port of Duisburg-Homberg	Implementation of an optimized fire protection concept.	Moers	Final approval from the authorities is not available yet. Detailed inspections are still being conducted by the building authority. Implementation of all project measures planned by the
Emergency response	Optimization of the emergency response	Regular execution of evacuation and emergency exercises (in part together with public fire departments and other institutions)	Moers Herne	Emergency and evacuation exercises were conducted regularly. Due to the pandemic, the exercises were cancelled in 2020.

Area	Goal	Measure	Site	Impl. status at end of 2020
Communication, dialog	Continuation of public relations work	Maintain communication with neighbors and other interested parties through information events such as open houses and plant tours for groups of visitors	Moers Herne	Due to the pandemic, access by non-factory personnel was greatly reduced. Questions from the neighborhood were answered directly by the plant manager on duty.

In the context of our environmental goal setting program, we have also been working on measures stemming from legal requirements.

Area	Goal	Measure	Site	Impl. status at end of 2020
Wastewater, soil and water protection	Prevention of the release of pollutants into the soil and groundwater	Continuation of the investigation and rehabilitation work on the internal sewer system in accordance with the legal requirements (SüwVO Abw)	Moers Herne	Inspections were carried out according to plan. The evaluations of the inspections carried out in 2020 are still in progress. The determination of the remaining inspection work and necessary rehabilitation measures will take place upon completion.
Soil and water protection	Prevention of the release of pollutants into the soil and groundwater	Carry out the necessary rehabilitation work on the catchment areas and drainage surfaces in accordance with the legal requirements (AwSV)	Moers Herne	The work is proceeding appropriately.
	Compliance with new requirements from the EU Industrial Emissions Directive (IED)	Preparation of the required soil status reports in the framework of potential permit applications.	Moers Herne	Soil status reports have been prepared to date for the following Moers facilities: MA, IPA, SBA, AC. For Herne, the soil status report is available in its entirety.
Hazardous substances	Maintain REACH compliance	Conducting the required studies and updating the REACH dossiers as needed.	Moers Herne	The work is proceeding appropriately.

New Environmental Program 2021 – 2023
Table 2: Environmental Program 2021 – 2023

Area	Goal	Measure	Site	Time
Waste, material efficiency	Reduction of the amount of catalyst to be disposed of annually	Install a catalyst test facility to examine the regenerability of the catalyst support material and thus reduce the amount of used catalyst that must be disposed.	Herne	06/2022
	Ensure internal disposal of waste streams (soot, BxD residues) to avoid external transport after closure of the power plant.	Commission our own residue incineration plant	Marl	12/2021
	Ensure internal disposal of the waste streams (high boilers of the MA plant) to avoid further transport to external companies after withdrawal of the external disposal company.	Thermal utilization of the MA plant's high boilers in the plant	Moers	12/2024
Wastewater, soil and water protection	Optimize the wastewater treatment process	Connect the BDO plant to the Fenton plant	Marl	06/2021
	Safe storage of sulfuric acid	Build a new sulfuric acid storage tank	Marl	03/2021
	Improved monitoring of wastewater flows	Define and implement improvement measures for monitoring the central wastewater treatment system	Moers	12/2021
Hazardous substances	Central storage of all operating instructions for hazardous substances of both plants	Completely enter operating instructions for hazardous substances of the B1D plant into the Quentic software tool	Marl	12/2021
	Creation of a central hazardous substances register in the Quentic software tool	Merge decentralized hazardous substance documentation by the individual departments	Marl	12/2022
Energy efficiency, air pollution control	Continuous reduction of the specific energy consumption.	Extent the demineralized water preheating system through heat recovery in the IPA plant.	Moers	12/2023
Energy efficiency	Use of waste for steam generation	Independent thermal utilization of soot waste	Marl	12/2021
		Thermal utilization of BxD residues in the new soot incinerator	Marl	12/2021
		Return condensate from the butanediol plant to the soot incineration plant	Marl	12/2021
		Thermal utilization of low boilers in the power plant	Moers	12/2023

Area	Goal	Measure	Site	Time
		Thermal utilization of the MA plant's high boilers in the plant	Moers	12/2024
	Reduction of heat losses in the demineralized water production	Optimize condensate polishing	Moers	12/2021
	Improve the deployment and scheduling of utilities.	Develop performance indicators for the availability of utilities	Moers	12/2021
	Fewer boiler shutdowns, and therefore increased availability	Revise shutdowns in terms of the required test cycles and maintenance measures	Moers	12/2021
	Utilization of waste heat from the cooling water network	Supply Shamrockpark with low temperature heat by withdrawing heated cooling water from the plant cooling water network	Herne	06/2022
Energy efficiency, material efficiency	Reduction of energy and raw material consumption	Define and monitor performance indicators for energy and material consumption in the ethanol and IPA plant	Herne	06/2022
		Optimize the selectivities and specific energy consumption of alcohol plants through process modeling and simulation	Herne	Continuously
		Further optimize of the OLEX plant (dead space volume, mass flow measurement, support for linking the settings data table to the process control system)	Moers	12/2021
	Reduction of the consumption of additives	Optimize cooling plants in terms of biocide dosing to reduce water and sodium hypochlorite	Herne	12/2022
Plant safety	Maintain high safety standards and awareness to prevent accidents, substance releases, fires, and explosions.	Apply the 20 INEOS Safety Principles	Marl Moers Herne	Continuously
		Continuously monitor and regular report the safety performance indicators.	Marl	Continuously
		Use a system for the systematic recording and analysis of near misses and incidents in the Quentic software tool.	Marl	12/2021
		Extend risk-based inspection program to cover the entire SBA synthesis and OLEX plant	Moers	06/2022
		Systematically revise failure mode and effect analyses and explosion protection documents and implement the resulting measures	Marl Moers Herne	12/2023
		Continue rehabilitation of pipe bridges on the plant site	Moers	12/2023
		Demolish decommissioned production facilities	Moers	12/2023
		Revise lightning protection concepts of all plants and buildings and implement the measures identified	Herne	12/2022

Area	Goal	Measure	Site	Impl. status at the end of 2020
Plant safety, emergency response	Optimization of preventive fire protection at the Port of Homberg	Optimize and implement fire protection concept for the Port of Homberg	Moers	12/2022
Emergency response	Optimization of the emergency response	Refurbish and rebuild fire truck to ensure fire protection at the Herne site	Herne	12/2021
		Revise fire protection concept of ether tank farm and implement the resulting measures	Herne	12/2023
		Regular execution of evacuation and emergency exercises (in part together with public fire departments and/or chemical park fire department and other institutions)	Moers Herne Marl	Continuously
		Plan, conduct, and evaluate emergency exercises as an audit in the Quentic software tool.	Marl	Continuously
Communication, dialog	Continuation of public relations work	Maintain communication with neighbors and other interested parties by reviving the EMAS registration.	Marl	Continuously

In the years from 2021 to 2023, we will continue to work on environmentally relevant goals resulting from legal requirements.

Area	Goal	Measure	Site	Impl. status at the end of 2020
Wastewater, soil and water protection	Prevention of the release of pollutants into the soil and groundwater	Continue inspection and rehabilitation work on the internal sewer system	Herne Moers	12/2023
Hazardous substances	Maintain REACH compliance	Update REACH registrations as needed and fulfill all ECHA requirements	Herne Moers	Continuously

2.4.4 Continuous improvement

The continuous improvement of all work processes runs in a so-called management cycle according to the Plan-Do-Check-Act procedure (also called the PDCA model). Based on the environmental policy and taking into account the legal requirements and the most important environmental aspects, environmentally relevant goals and measures are planned in the first step and then implemented. The third step involves monitoring the activities, checking the effectiveness of the measures, and evaluating the achievement of the goals. In the final step, management reviews the achievement of the goals and, if necessary, takes corrective action by adjusting the measures.

After passing through this management cycle, the process starts from the beginning again. Progress is made with each successive cycle, resulting in a continuous improvement process.

2.4.5 Strategic company goals

Based on the corporate policy and the site or business strategies as well as previous developments, goals for the corresponding site or business area are defined by the executive committee at the beginning of each fiscal year. In addition to economic goals, these goals also include objectives relating to organizational, safety, and environmental protection requirements and serve as a basis for sustainable and continuous development.

2.4.6 Internal audits / environmental audits

The management system is subjected to a target-performance comparison by independent auditors as part of regularly planned and executed internal audits or environmental audits. These audits involve checking the extent to which the environmental objectives set have been reached, if the applicable regulations are being complied with, and if the environmental management system implemented is effective and appropriate.

2.4.7 Evaluation of the management system (management review)

In management reviews performed annually at a minimum, the corresponding management evaluates the environmental management system in terms of its suitability, appropriateness, and effectiveness. During this review, the environmental policy and strategic objectives are also reviewed and, if necessary, adapted to reflect any changes to the conditions.

2.4.8 Environmental statement

With this environmental statement, we provide the public with a comprehensive overview of our environmental performance at the various sites. It is updated annually and made available to all interested parties.

In accordance with the requirements of EMAS III, we regularly have the company's environmental management system audited by an independent environmental auditor who has been accredited for this purpose. The auditor verifies the plausibility and credibility of the information contained in the environmental statement and then declares it valid (see the declaration of validity, Chapter 4).

2.4.9 Documentation

The management system of the companies involved is clearly described in an integrated management manual (for occupational and plant safety, raw material and energy efficiency, health and environmental protection, quality and risk management) in accordance with the requirements of DIN EN ISO 9001 and 14001. The organizational structure and process organization, including the processes that have or could have a relevant impact on the environment, are described there. The manual is regularly reviewed to ensure that it is up to date and, if necessary, adapted to reflect any changes to the conditions.

The management manual is supplemented by process and work instructions (incl. forms, checklists, and other process descriptions). Process instructions contain the basic objectives for an overall procedure to be described and applied to all areas. For each process, they identify the opportunities and risks (including appropriate mitigation measures) and specify the methods to be used and criteria to be met. Work instructions define specific procedures for employees to follow when performing tasks on-site and within the various areas. For example, they describe the operation of equipment, the monitoring of legally prescribed limit values, and corrective measures in the event of deviations.

2.4.10 Environmental monitoring

In order to monitor the impact of activities at the sites on the environment, regular – and in some cases continuous – analyses of the water, soil, noise, and air are performed. This ensures that all environmental protection measures implemented are effective, the environmental protection standard is continuously improved, and the environmental impact of activities is continuously reduced.

2.4.11 Emergency procedures and crisis management

Effective emergency response procedures enable the necessary safety measures to be taken quickly in case of danger from the substances processed in the plants. Essential components of the safety organization include:

- Qualified fire departments at the sites
- Emergency service at the sites
- On-call emergency service in the departments
- Alarm and emergency response plans of the plants

The alarm and emergency response plans define the reporting channels for notifying any external emergency and rescue teams that may be required and for informing the authorities.

The sites have a so-called “environmental telephone” that can be used to receive inquiries and notifications at any time. The individual incidents are logged, forwarded to the SHE department or the plant emergency service and processed there.

In addition, there is a nationwide, voluntary transport accident information and emergency response system of the German chemical industry (TUIS), which is used in the event of transport and storage accidents involving hazardous substances. TUIS supports public fire departments, the police, and other authorities. They can request advice, experts, and special equipment at any time.

2.4.12 Education and training

The companies involved attach great importance to the qualification and training of their employees, including in matters concerning operational environmental protection. For this reason, only technically qualified employees who have been trained in their area of responsibility are employed. The training and instruction requirements are determined on an individual basis. The ongoing training program, the requirements of which can also be met by attending external training events, includes:

- Documentation and instruction for new employees or for employees who have changed workplaces
- Workplace-related training of employees by company managers and through modern computer-based instruction (also referred to as e-learning)
- Up-to-date information for all employees on the intranet
- Information for all managers about current developments in environmental protection and environmental law

2.4.13 Communication with employees, customers, and the public

INEOS Solvents and Huntsman Products consider dialogs with employees, customers, and the public on environmental issues to be very importance.

For example, in terms of environmental protection and safety, an intensive dialog is maintained with the works councils and all employees. In addition to discussions in everyday working life across all hierarchical levels of the company, employees participate very actively in the company suggestion scheme (CSS), which is an important element in the continuous improvement of the company's performance, including in terms of environmental protection and safety.
Incentives (e.g. safety competitions) are used to reward employees' efforts to meet accident rate goals.

Customers are provided with comprehensive product information (e.g. safety data sheets). In addition, close contact with customers is maintained for the purpose of providing information and advice, for example on possible applications, product properties, and potential optimizations in the handling, transport, and disposal of our products.

We maintain close contact with the public and our immediate neighbors in a variety of ways.

2.4.14 Support and specifications from the management bodies of the companies

The executive committees of the companies involved issue targets and guidelines to the individual organizational units or sites. This is done within the framework of our self-imposed corporate governance. Corporate governance is understood to be an instrument with which companies can be managed and controlled.

An important part of corporate governance is the audit of the sites in terms of, among other things, plant and occupational safety as well as orderliness and cleanliness. As part of these audits, a lively exchange of experience, including examples from experience, with auditors from other INEOS sites is also maintained.

One example of corporate governance is the implementation of the INEOS corporate guideline on knowledge-based inspection (IGGN 30). In this case, all plant components and equipment within the production facilities are subjected to a systematic risk assessment with respect to potential damage through operational use and specific monitoring measures are derived. These measures include in particular inspection procedures that enable adequate and quantifiable assessment of the condition of the component being inspected. According to the risk classification, the scope and cycle of the inspections are determined in such a way that reliable forecasts of the progression of wear are possible. This enables potential damage to be identified at an early stage and take appropriate countermeasures such as the replacement of the affected component.

This elaborate procedure goes far beyond the legal requirements and methods commonly used in Germany in terms of the scope of testing, but also in terms of the number of plant components and equipment covered by the procedure. At the same time, though, it also demonstrates the high requirements the organization places on the integrity of its production and work equipment in order to ensure safe and trouble-free operation.

3 The sites

3.1 Moers Plant and Rheinpreußen Port in Duisburg-Homberg

3.1.1 Description

Our plant in Moers is one of the largest producers of oxygenated solvents in Europe. Our employees here primarily produce isopropanol (IPA), secondary butyl alcohol (SBA), and methyl ethyl ketone (MEK), but also produce plasticizers on contract for Sasol Germany GmbH as well as fine chemicals. In addition, maleic anhydride (MA) is produced in a production complex of the Huntsman Products GmbH.

There are some residential buildings located directly next to the Moers plant. The plant is secured against unauthorized entry by a fence and a guarded entry gate.

Figure 1: Bird's eye view of the Moers plant

From an organizational point of view, the Rheinpreußen Port in Duisburg-Homberg also belongs to the Moers plant. From here, the solvent products can be loaded onto barges and transported to the Rotterdam and Antwerp seaports. Products are transported from the plant to the port by rail tank car using a dedicated railway line. The products can be temporarily stored in a tank farm before they are filled into the ships.

Figure 2: Tank farm in the Port of Duisburg-Homberg

Figure 3: Port entrance

3.1.2 Organization

Within the framework of the environmental management system, the responsibilities, tasks, and competencies are clearly defined, and not only for environmental protection issues. The managing director responsible for operations is ultimately responsibility for the company and the plant. This person ensures the application and efficiency of the environmental management system. The managing director obtains expert advice regarding his duties from a variety of operations officers (see also section 3.1.5.1). The officers support the managing director when performing internal controls.

The managing director responsible for operations is subordinate to the Manufacturing Excellence, Project Management & Engineering, and SHE departments as well as the Moers plant manager.

The plant manager, through the operations manager, the plant area manager and the operational teams, ensures that the production facilities operate as intended.

The Logistics department is responsible, among other things, for the storage and loading of raw materials and products as well as the corresponding rail operations.

Among other things, quality control of the products and environmental monitoring, in particular in the area of wastewater, are performed in the Analytics / Process Support departments.

The Technical Service department is responsible for the maintenance, inspection, and repair of the plants.

The plant's fire department ensures fire prevention and protection. The fire department is also responsible for plant security and occupational safety.

The SHE department includes the various company officers and is responsible for coordinating activities in the areas of emission control, wastewater, and waste. It also acts as a representative of the site for authorities and maintains the neighborhood contacts. The SHE department's tasks also include maintaining and monitoring the integrated quality, environmental, and safety management system.

The Human Resources (HR) department is responsible for selecting and monitoring employee training in coordination with the heads of the individual organizational units.

The Huntsman Products GmbH is represented by a managing director who is based at the Moers plant. The tasks of the management system, incl. the system manager position, are provided for the most part as a service by the INEOS Solvents Germany GmbH. In addition, one employee of the Huntsman Products GmbH from the Customer Service department is assigned as the MS coordinator. Sales & Marketing takes care of marketing the product. The Technology department deals with the improvement and optimization of the MA plant and acts as an interface to the licensor, the Huntsman Corporation.

3.1.3 Products and their applications

The following products can be manufactured at the Moers site in the annual quantities specified (see Table 3):

Table 3: Products

Production	Annual Quantity
Isopropanol (IPA)	approx. 155,000 t
Secondary butyl alcohol (SBA)	approx. 60,000 t
Methyl ethyl ketone (MEK)	approx. 60,000 t
Maleic anhydride (MA)	approx. 105,000 t
Plasticizers (PL)	approx. 22,000 t
Aluminum alcoholates / derivatives	approx. 1,100 t
Various specialty chemicals	100 to 1,000 t each

Over the past four years from 2017 to 2020, the total production volumes were as shown in Figure 4:

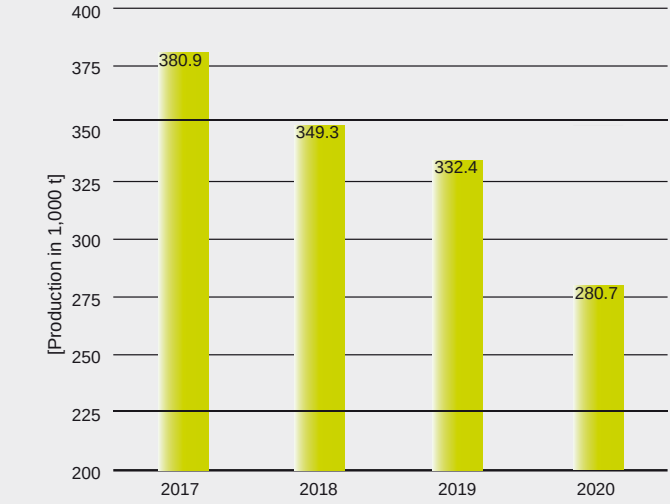


Figure 4: Production quantities

Production at the Moers site dropped significantly in 2020. This can be explained by the lower demand for some products due to the pandemic and longer plant shutdowns for TÜV inspections and catalyst changes, but drops in production were also caused by technical problems.

The annual tonnages shown in Fig. 4 were used to calculate the specific values, i.e. the values per ton of product stated in the following chapters on performance indicators.

The **solvents** IPA, SBA, and MEK have a wide range of applications. For the most part, they are used to manufacture paints and coatings, but they are also contained in cleaning agents, antifreezes, adhesives, and hairsprays. In their highly pure form, the products are also used in medicines and cosmetics. Diisopropyl ether (DIPE) is mainly used as a special solvent in the pharmaceutical industry.

The **fine chemicals** product group includes aluminum alcoholates (Dorox®) and their derivatives. Aluminum alcoholates are important components in printing inks, but are also needed as catalysts, for example in the production of vitamins A and E.

Plasticizers are primarily needed in the plastics industry. They are important components in cable insulation and are needed in vehicle interiors, for example for the production of dashboards or various panels.

Maleic anhydride (MA) is processed mainly into unsaturated polyester resins, which are then used to manufacture durable plastics. Additional applications include the production of detergent additives, crop protection products, and as additives in motor oils.

3.1.4 Production processes and raw and auxiliary materials

To manufacture its products, the production site primarily uses propylene, butylene, and butane as well as fatty alcohols and other basic chemicals. Production takes place mainly in continuous operation, but also in the discontinuous batch process (individual batches). The wide range of products includes the following:

Oxygenated solvents: production at the Moers site focuses mainly on these types of solvents. The production of isopropyl alcohol (IPA) and secondary butyl alcohol (SBA) is based on processes developed in-house in which propylene or butylene are reacted with water. SBA is processed at the plant mainly into methyl ethyl ketone (MEK) through catalytic dehydrogenation.

Diisopropyl ether is also produced during the production of IPA. The solvents isopropyl alcohol and secondary butyl alcohol are also starting materials for the production of aluminum alcoholates.

Aluminum alcoholates (Dorox®) and their derivatives belong to the **fine chemicals** product group. Aluminum alcoholates are produced by reacting the corresponding alcohols with aluminum.

For the production of **plasticizers**, the Moers site continues to work closely with the Sasol plant in Brunsbüttel, Schleswig-Holstein. This is where most of the fatty alcohols come from. They are converted into specialty esters in Moers together with acids or acid anhydrides.

The process used for the production of maleic anhydride (MA) is based on the process for the catalytic partial oxidation of n-butane in the shell-and-tube reactor in a catalytic fixed-bed reactor.

Figure 5 below provides an overview of the production scheme at the Moers site:

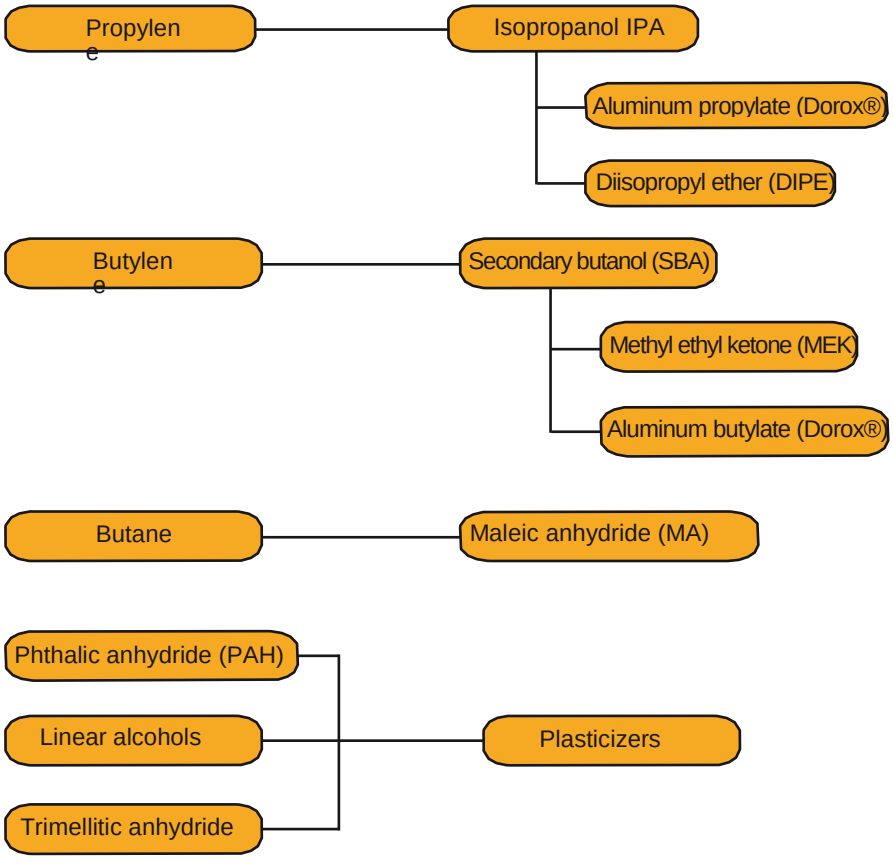


Figure 5: Moers production scheme

The majority of the products manufactured are transported by ship, tanker trucks, or rail tank cars. A very small portion of the products manufactured are filled in drums (up to 200 l). In total, about 14% of the products produced are transported by ship, about 28% by rail, and about 58% by road. The good connection to the waterway (Port of Duisburg-Homberg) ensures that local residents are less affected by truck and car traffic to and from the plant.

The continuous plants are supplied on-site over permanently installed lines with the raw materials propylene, butylene, and butane from the central liquefied gas tank farm and with the auxiliary materials nitrogen, compressed air, steam, and electrical energy. For propylene, a connection to an external pipeline system has been available since 2009. Other important raw materials at the plant include fatty alcohols and acid anhydrides. Auxiliary materials include hydrochloric acid, sulfuric acid, and caustic soda. The consumption of raw materials and auxiliaries (see Table 4) is constant most of the time due to the largely continuous operation of the plants.

Table 4: Raw and auxiliary materials

Raw/Auxiliary Material	Annual Quantity
Propylene	approx. 110,000 t
Butylene	approx. 70,000 t
Butane	approx. 120,000 t
Fatty alcohols	approx. 11,000 t
Phthalic anhydride, trimellitic anhydride	approx. 5,000 t
Hydrochloric acid, sulfuric acid, caustic soda	100 to 1,000 t each
Various fine and specialty chemicals, catalysts	10 to 100 t each

3.1.5 Environmental protection and safety at the Moers site

3.1.5.1 Company officers

The topic of environmental protection is a top priority at the Moers site. The responsibilities for environmental protection are distributed throughout the entire organization as already explained above in section 3.1.2:

- Environmental Officer for the following legal areas:
  - Immission Control Officer (Art. 53 ff BImSchG)
  - Hazardous Incidents Officer (Art. 58a ff BImSchG)
  - Water Protection Officer (Art. 64 ff WHG)
  - Waste Management Officer (Art. 59 ff KrWG)
- 3 officers for limiting the effects of hazardous incidents (Art. 12(1) StörfallV)
- 1 Dangerous Goods Officer (Art. 1 GbV)
- 1 qualified person (Art. 11 ChemVerbotsV)
- 1 qualified person according to Annex II REACH
- 1 Fire and Explosion Protection Officer (No. 5.12.3 IndBauRL NRW)
- 1 Occupational Physician (Art. 2 ASiG)
- 1 safety engineer & 2 occupational safety specialists (Art. 5 ASiG)
- approx. 25 safety officers (Art. 22 SGB VII)
- 1 Railway Operations Manager (Art. 1 EBV)

The officers support the managing director and the site managers within the scope of their legally defined function as operations officer.

- They act in an advisory and proactive capacity and propose specific measures to improve environmental protection and safety standards.
- They monitor and document compliance with environmental protection and safety regulations, permit requirements, voluntary commitments, and internal regulations.
- They report regularly on their activities, in particular on the status of environmental protection and safety, and prepare an annual report. If a need for action is identified, then the persons responsible ensure remedial action is taken.
- The officers are involved in informing all employees about current changes to legislation, environmental impacts, and possible optimization measures.
- When planning projects that affect their area of responsibility, they are involved in good time so that their opinion can be taken into account in upcoming decisions.

To the extent necessary to perform their duties, the officers shall be provided with adequate material and financial resources as well as personnel.

3.1.5.2 Fire protection and technical assistance

Preventive fire protection measures that have already been taken into account during the planning of plants, potential improvements that are subsequently identified during regular fire inspections, as well as the monitoring of our plants (e.g. by continuous measuring equipment such as Ex meters or regular plant tours by the operating personnel) minimize the possible risk of fires in the plants. In addition, there are stationary fire alarm and foam extinguishing systems as well as the mobile equipment belonging to the plant fire department, for example fire trucks that are equipped with the necessary technology. Fire protection concepts are continuously improved in close coordination with the relevant supervisory authorities.

One example of this is the automatic fire alarm system, to which more and more buildings and spaces are being connected for the purpose of early fire detection.

In addition to these technical measures, effective emergency response procedures are also required to enable the necessary safety measures to be taken quickly in case of danger from the substances processed in the plants. Essential components of our emergency response are:

- A plant fire department recognized by the supervisory authority and commissioned in accordance with Art. 12(1) StörfallV consisting of 23 full-time firefighters and approx. 40 part-time firefighters. (These firefighters are not only responsible for fire prevention and protection, but also check part of the environmental impact of the site and are immediately called upon to respond to questions and complaints from the neighborhood).
- Plant emergency service consisting of qualified managers who coordinate the necessary measures on site in the event of an emergency and, if necessary, summon any additional help required.
- On-call emergency service in the departments
- Alarm and emergency response plans that define the reporting channels for notifying emergency responders and authorities so that measures to protect the public can be initiated.

A particularly important means of communication for the plant is the environmental telephone, which is used to receive inquiries and messages at any time. The individual incidents are logged, forwarded to the SHE department or the plant emergency service, and processed there as described above.

In addition, there is a nationwide, voluntary transport accident information and emergency response system of the German chemical industry (TUIS), which is used in the event of transport and storage accidents involving hazardous substances. TUIS supports public fire departments, the police, and other authorities. They can request advice, experts, and special equipment around the clock, 365 days a year.

The effectiveness of the measures described was demonstrated in several exercises involving all relevant departments of the plant as well as the on-call emergency service and the plant fire department.

3.1.5.3 Occupational and plant safety

The topics of occupational safety and plant safety also play an important role in environmentally friendly and sustainable production. As already mentioned in section 3.1.5.1 “Company officers”, all officers have been appointed in accordance with the German Occupational Health and Safety Act (ArbSchG) and Social Code Book VII (SGB VII). These persons and the responsible managers fulfill their tasks with great dedication. The employees act with the necessary care and caution.

With respect to the topic of plant safety, it should be noted that the production facilities for manufacturing chemical products are subject to the Federal Immission Control Act and have been approved by the authorities. The Moers plant and the port in Duisburg-Homberg also constitute operational areas in accordance with the Hazardous Incident Ordinance. Accordingly, a safety report as well as a general safety concept have been submitted to the authorities. The safety management system comprises the organizational regulations on safety and is integrated into the existing system for quality and environmental protection. A hazard prevention concept was developed in agreement with the fire protection and civil protection authorities. In this concept, the plant’s alarm and emergency response plan was coordinated with the plans of the city of Moers and the district of Wesel.

3.1.5.4 Environmentally relevant incidents

During the reporting period, there were no reportable, environmentally relevant events according to the Hazardous Incidents Ordinance.

Despite the measures described in sections 3.1.5.1 to 3.1.5.3, though, several non-notifiable disruptions to the normal operation of the plants occurred during the reporting period, some of which involved local releases of substances. However, none of these events led to a serious hazard in the sense of the Hazardous Incidents Ordinance or to a significant environmental impact because the internal rescue and emergency services intervened promptly and effectively. In general, optimization and countermeasures were defined to prevent the recurrence of such events.

During the reporting period, there were only a few reports and inquiries from the neighborhood. They related mainly to loud noises caused by the operation of the flare or the blowing off of steam while starting up the steam turbines. For most of the reports of unusual odors, it was not possible to determine whether these were actually caused by the plant.

In all cases, the concerns and worries of the residents were documented and the technical requirements and contexts explained to them. Wherever possible, the cause of the disruption was eliminated immediately. Furthermore, measures were initiated to prevent their recurrence.

3.1.5.5 Material properties

Most of the materials handled at the plant are subject to the Hazardous Substances Ordinance and the Hazardous Incidents Ordinance. However, by continuously keeping the facilities up to the state of the art and implementing the necessary protection measures for personnel and the environment, the risk involved in handling these substances is minimized. This is presented in detail in the relevant safety reports, which have been duly submitted to the corresponding supervisory authorities.

Overall, the material properties can be divided into four hazard groups:

- Fire and explosion hazards
- Health hazards, poisoning hazards
- Chemical burn hazards
- Environmental hazards

In addition, substances are classified according to their degree of water hazard. For this reason, most of the substances used in the plant are classified in **W**ater **H**azard **C**lass 1 (WHC 1: slightly hazardous to water), for example isopropanol and maleic anhydride. To a lesser extent, there are also substances classified in WHC 2 (clearly hazardous to water). The legal requirements imposed on WHC 3 (highly hazardous to water) have also been implemented in the affected areas.

Table 5: Properties of the substances handled at the Moers plant

Hazardous Substances Group	Hazardous Substance Symbol	Signal Word	Substance (occurrence)	Potential Hazards	Precautions
Flammable substances (Cat. 1)		Danger	**Propylene** (pipeline, isopropanol plant) **Butylene** (SBA plant) **Butane** (MA plant) **Propane** (isopropanol plant) **Natural gas** (power plant) **Hydrogen** (MEK plant, butene hydrogenation, power plant)	"extremely flammable"; explosive mixtures can form with air.	Keep away from heat / sparks / open flames / hot surfaces. No smoking.
Flammable substances (Cat. 2)		Danger	**Isopropanol** (isopropanol plant) **Methyl ethyl ketone** (methyl ethyl ketone plant) **Diisopropyl ether** (isopropanol plant)	"highly flammable"; Vapors can form explosive mixtures with air.	Keep away from heat / sparks / open flames / hot surfaces. No smoking.
Flammable substances (Cat. 3)		Caution	**Secondary butyl alcohol** (SBA plant) **n-Butanol** (multi-substance plant) **Various aluminum alcoholates derivatives (DOROX)** (multi-substance plant)	"flammable"; Vapors can form explosive mixtures with air.	Keep away from heat / sparks / open flames / hot surfaces. No smoking.
Substances hazardous to health		Danger	**Maleic anhydride** (MA plant) **Phthalic anhydride** (plasticizer plant) **Trimethyl phosphate** (MA plant) **Dibutyl phthalate** (MA plant)	Respiratory sensitization; mutagenicity, reproductive toxicity	Avoid contact with eyes, skin, and clothes using special protection measures; Do not inhale vapors!
Toxic substances		Danger	**Heat transfer salt GV** (MA plant)	Toxic by inhalation, skin contact, and if swallowed	Avoid contact with eyes, skin, and clothes using special protection measures; Do not inhale vapors!
Oxidizing substances		Danger	**Heat transfer salt GV** (MA plant)	Contact with combustible material may cause fire, may intensify fire	Keep away from clothing / combustible materials / store away from other materials.

Table 5: Properties of the substances handled at the Moers plant

Hazardous Substances Group	Hazardous Substance Symbol	Signal Word	Substance (occurrence)	Potential Hazards	Precautions
Corrosive substances		Danger	**Maleic anhydride** (MA plant) **Hydrochloric acid** (various plants) **Caustic soda** (various plants) **Sulfuric acid** (various plants)	Cause severe chemical burns	Avoid contact with eyes, skin, and clothes using special protection measures; Do not inhale vapors!
Environmentally hazardous substances		Caution	**DOROX D230** (multi-substance plant) **Catalyst** (MA plant) **Dibutyl phthalate** (MA plant)	Toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment	Keep container tightly closed; do not allow to enter sewage system or bodies of water!

3.1.5.6 Production-related emissions

Continuous improvements have been made in the area of volatile organic compounds (VOCs). The vent gas system, with which the emissions of organic compounds from tanks, containers, and loading and unloading procedures are collected and fed to the power plant, has been available since 1972. Over the years, almost all plants have been connected to the vent gas system. This has significantly reduced emissions of organic compounds. In cases where connection is not possible, the waste gases are run through a closed loop system (also referred to as a vapor recovery system). Organic emissions were reduced even further by switching to zero or low emission pumps and sealing systems.

Flue gas emissions from the power plant, which operates with natural gas as the standard fuel, and the MA plant are continuously monitored. Both plants are also connected to the official remote emission monitoring system (EFÜ). Furthermore, the power plant has been participating in emissions certificate trading since 2005 for its CO_2 emissions, which also requires the submission of detailed reports to the authorities. The MA plant has been participating in the European emissions trading system since the beginning of the third period (starting on 01 January 2013).

The emission quantities of all plants are regularly reported to the supervisory authorities as part of the emission declarations.

3.1.5.7 Waste

The following main waste fractions are generated at the Moers site: For recycling/reuse:

- Solvent residues
- Used catalysts
- Filter cake
- Scrap metal
- Soil and construction waste

For disposal:

- Solvent residues containing halogens
- Used catalysts
- Contaminated building materials and plastic containers

The waste is disposed of depending on its corresponding monitoring requirements and in accordance with the statutory requirements. For the most part, we use certified waste management companies for this purpose.

The quantity of waste is minimized through the use of reusable bulk containers. Waste from the offices, workshops, and production facilities is collected separately in order to be able to recycle as much of the waste material as possible. During the reporting period from 2017 to 2020, the recycling rate ranged from about 74% to 92% (see also section 3.1.6.2). The quantities and types of waste are reported annually to the authorities through the German waste register.

3.1.5.8 Energy

3.1.5.8.1 Steam supply

The amount of steam required at the site is generated in-house by a steam boiler plant with a total of three boilers. The plant has a total steam capacity of 190 t/h. Natural gas serves as the primary fuel. Waste gases (vent gas system) from production and hydrogen, which is produced as a by-product, are also used as fuels. The option of using heating oil EL as a reserve fuel was abandoned in January 2015.

Steam is also generated using the waste heat from the reaction to produce MA (up to 180 t/h). Most of the steam not consumed in the MA plant itself is fed into the plant's steam network after generating power in the power plant and used to supply consumers. Some of the residual heat is sold to the regional district heating company.

3.1.5.8.2 Electric power supply

The electrical power needed is generated from the steam itself via combined heat and power using cogeneration turbines. Surplus power is fed into the public power grid. Temporary fluctuations are compensated for by the regional power utility company. The electricity is mainly used in production for pumps, agitators, compressors, lighting, etc. The “minute reserve” power market introduced at the end of 2014 with a marketer for tertiary control energy to compensate for load fluctuations (e.g. due to additional production from renewable sources) in the public power grid was used when needed during the reporting period.

3.1.5.8.3 Auxiliary energy

Some plants and machines use compressed air, which is generated in dedicated, electrically operated compressors, for control purposes. Nitrogen is primarily required as an inerting agent for preserving products and for fire prevention purposes. The nitrogen is generated for the most part at the site itself using an air separator.

Hot oil at a temperature of approx. 300ºC is required in the MEK plant. The oil is heated in our thermal oil furnace, which is operated in a closed circuit and, in its second function as a thermal afterburner (TAB), is fired with gaseous fuels as well as with liquid residues from production.

The energy consumption of the production facilities has been and will continue to be optimized through various technical measures (heat integration, multiple use, thermal insulation).

3.1.5.9 Water and soil protection

3.1.5.9.1 Water use

Up to 99% of the site’s water consumption is covered by groundwater supplied by the Left Bank of the Lower Rhine Valley Drainage Cooperative (LINEG) and the Lower Rhine Water Board (WVN). Most of this is sump water from mines that has to be extracted due to damage resulting from mining. The share of water required as drinking water, which is approx. 1%, is drawn from the public network.

Circulation water, which is recooled in evaporative cooling towers, is used for the most part to cool the production equipment. In addition to the approx. 40 million m^3/year of circulation water, approx. 0.6 million m^3/year must be added to cover the losses from evaporation and blowdown.

3.1.5.9.2 Wastewater

The site operates a separate sewer system whose structural condition is inspected at regular intervals in accordance with statutory requirements.

Uncontaminated rainwater and cooling water from once-through cooling systems is fed into the Rhine receiving water body over the so-called K-sewer.

Chemical wastewater and polluted rainwater is collected in the so-called C-sewer, pre-treated in the neutralization system, and since November 2013, discharged into the neighboring LINEG wastewater treatment plant. At the treatment plant, over 90 percent of the pollution is biodegraded in several steps. All internal wastewater flows are recorded in a wastewater register. This enables both the pollutant concentrations and the water volumes, as well as the resulting pollutant loads, to be forecast and monitored on a regular basis.

Sanitary wastewater is collected via the so-called F-sewer and treated together with municipal wastewater in the LINEG wastewater treatment plant.

The outflowing wastewater from the C-sewer and K-sewer is continuously monitored. Both wastewater flows are monitored online. In addition, the C-sewer wastewater is analyzed every workday as part of our self-monitoring process. In addition, there are regular official analyses of the wastewater in the C-sewer and K-sewer.

3.1.5.9.3 Soil protection

Precautions have been taken and equipment installed on all areas used to reliably prevent soil and groundwater contamination: Tanks are installed in appropriately sized and sealed drip trays, liquid raw materials and products are loaded and unloaded in specially secured and leak-proof transfer buckets, and pipes carrying product are not laid in the ground but on pipe bridges so that leaks can be detected immediately.

According to Article 5 of the amended 9th BImSchV, an initial status report (ISR) documenting the condition of the soil and groundwater in the area of the planned modification must be submitted together with the application documents since January 2014 when planning major modifications to a plant that is subject to the Industrial Emissions Directive (IED). This requires relatively extensive analyses of the soil and groundwater in coordination with the district government. A separate report on the initial status is currently available for a total of the four plant areas named below (according to IED):

- MA plant
- IPA plant
- SBA plant
- AC plant

During the examination of the initial status of the plant areas mentioned above, no indications of soil or groundwater contamination by the substances currently handled at the plant were found.

3.1.5.9.3.1 Contaminated site situation at the Moers plant

The site owned by INEOS Solvents Germany GmbH is approximately 80 hectares large, of which about 40 hectares are the actual plant premises including the production facilities.

Due to its complex history of use, the entire Moers plant site is registered in the Wesel district's register of contaminated sites. Detailed analyses of the site revealed contamination of the soil due to the previous use of the Rheinpreußen mining pit (coking plant and by-product plant) and necessitated remediation of the site, which was completed for the most part in 1997. The results were evaluated and documented in a soil registry.

3.1.5.9.3.2 Contaminated site situation at the Port of Duisburg-Homberg

The site owned by INEOS Solvents Germany GmbH on Duisburg city area covers a total area of about 27.3 hectares, of which about 1.7 hectares are covered by the actual port tank farm and about 19.5 hectares are a former coal storage area.

Here, too, the entire site is listed in the register of contaminated sites of the City of Duisburg due to its complex history of use.

3.1.5.10 Noise and odor

The Moers plant is located in an industrial area directly next to residential areas in the south and about one kilometer away from residential areas in the northwest. An internal noise register was created that documents all sources of noise. For new construction or modification projects, a noise emission forecast is produced in advance with the aid of dispersion calculations. After completion of the projects, noise measurements are taken to verify that noise levels are within the approved limits.

When selecting machines or equipment, care is taken to ensure that the units are as quiet as possible. Where necessary or possible, machines and plant components are retrofitted with soundproofing and are encapsulated or enclosed.

In the event of an odor nuisance due to a plant malfunction, a rapid response chain has been established in accordance with an agreement made with the official environmental monitoring department, according to which gas samples are taken by the plant fire department in order to be able to make better and timelier statements about the substances released.

3.1.5.11 Storage, loading, and transport

The finished products are stored in tanks that are installed in drip trays to contain any product that may leak in accordance with water regulations. In addition, measures have been taken to minimize emissions. These measures include connection to the plant's central gas collection system, sun shields, and reflective paint on the tanks.

Emissions generated while filling the tank with product are extracted and fed into the plant's central waste gas collection system. Overfill protection, drainage surfaces, and catch basins prevent product from entering the soil when loading.

The use of tanker trucks, rail tank cars, and reusable drums for the liquid products and big bags for the solids avoids or reduces corresponding packaging waste when delivering our products to our customers.

To keep the noise nuisance in our neighborhood as low as possible, the loading times have been limited to the workdays between 06:00 AM and 10:00 PM, with loading normally not being done on Saturdays or loading only until 2:00 PM. By selecting suitable shipping company and inspecting all vehicles as well as the transport documents, we ensure the safe transport of our products to our customers.

Furthermore, since a large portion of our products are transported by ship from the plant's own port, the impact of traffic on local residents is lower.

3.1.6 Performance indicators 2017 - 2020

3.1.6.1 Material efficiency / production

The annual tonnages shown in Fig. 4 (see section 3.1.3) were used to calculate the specific values, i.e. the values per ton of product stated in this section and the following sections.

Figure 6 shows the specific raw material requirement of the Moers site. The figure shows that the specific raw material requirement has remained constant over the last 4 years at about 0.79 t of raw material per t of product. The specific raw material requirement is different for each of the products manufactured at the Moers site, so that the specific raw material requirement of the site also depends on the product mix produced in that year. There is a minimum chemical raw material requirement for each product that must be met. The values are less than one because the water required for the reaction to form the alcohols and the oxygen from the air for the reaction to form maleic anhydride are not taken into account, and only the actual chemical raw materials used are taken into account.

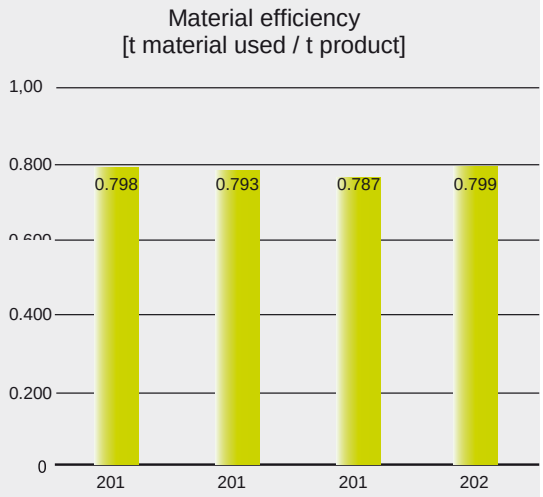


Figure 6

3.1.6.2 Waste

Table 6: Waste quantities

Waste fraction		2017	2018	2019	2020
	Production quantity [1,000 t]	380.9	349.3	332.4	280.7
	Total waste quantity [1,000 t]	4.866	3.171	5.511	3.972
1	Hazardous wastes [1,000 t]	2.276	2.669	2.847	2.498
1a	Material recovery of hazardous wastes [1,000 t]	0.028	0.042	0.005	0.016
1b	Thermal recovery of hazardous wastes [1,000 t]	1.862	1.948	2.030	1.529
1c	Hazardous wastes eliminated [1,000 t]	0.386	0.679	0.812	0.953
2a	Other wastes recovered [1,000 t]	2.591	0.501	2.664	1.474
2b	Other wastes eliminated	0.000	0.002	0.000	0.000

Table 6 shows the amounts of waste generated at the plant in the years from 2017 to 2020. The total amount of waste does not show a consistent trend. The large total amount of waste in 2019, for example, is due to approximately 1,964 t of construction waste from the demolition of an old building. This waste is not directly related to production, which is why, like in the other years, it was excluded from the calculation of the total waste together with the other soil, construction waste, metal scrap, and household waste-like portions in the presentation of production-related waste in Figures 7 and 8.

The amount of essentially production-related waste decreased in 2020 in line with the lower production volume. This is illustrated in Figure 7.

Figure 7

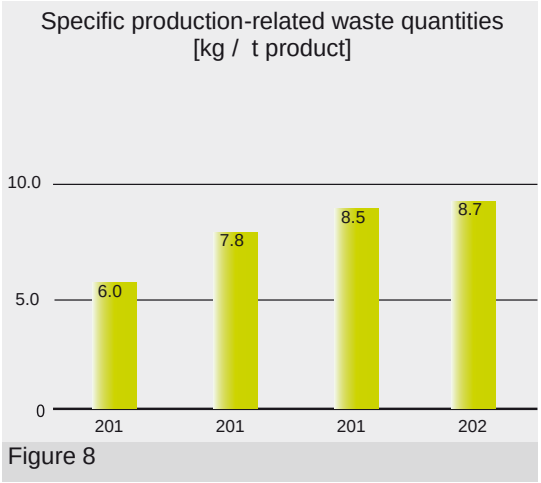


Figure 8

Figure 8 shows the specific production-related waste quantities for the years from 2017 to 2020. This figure indicates a mixed picture. In 2020, it was possible to reduce the absolute quantity of production-related waste, but not down to the very low level of 2017.

Table 7 below shows the five largest waste fractions for 2020. These accounted for 70% of the total waste generated. Table 7A shows waste fractions by waste type and quantity for 2020.

Table 7: Waste fractions 2020

EWC code	Waste description	Quantity [t]	Portion of waste fraction according to Table 6
17 05 04	Soil and stones other than those mentioned in 17 05 03*	1,146	2a
07 01 08*	Other still bottoms and reaction residues	751	1b
07 01 04*	Other organic solvents, washing liquids, and mother liquors	410	1b
16 10 01*	Aqueous liquid wastes containing hazardous substances	245	1c
16 08 07*	Spent catalysts contaminated with hazardous substances	225	1c
Total		2,777	
Portion of the total waste * Hazardous waste		70%	

Table 7A: Waste fractions by waste type and quantity for 2020.

Waste type according to WCO chapter	Waste description	Quantity [t]
07	Wastes from organic chemical processes	1,822.37
17	Construction and demolition wastes (including excavated soil from contaminated sites)	1,390.21
16	Wastes not otherwise specified in the list	479.89
15	Waste packaging, absorbents, wiping cloths, filter materials, and protective clothing (n.o.s.)	131.54
20	Municipal wastes (household waste and similar commercial, industrial, and institutional wastes) including separately collected fractions	121.97
11	Wastes from chemical surface treatment and coating of metals and other materials; non-ferrous hydro-metallurgy	12.13
14	Waste organic solvents, refrigerants, and propellants (except 07 and 08)	6.80
13	Oil wastes and wastes of liquid fuels (except edible oils, and those in chapters 05, 12, and 19)	5.76
18	Wastes from human and animal health care and/or related research (except kitchen and restaurant wastes not arising from immediate health care)	1.00
06	Wastes from inorganic chemical processes	0.29
	Total	3,972

3.1.6.3 Water

Figure 9 shows the absolute fresh water consumption at the Moers site. Figure 10 shows the specific fresh water consumption per t of finished product:

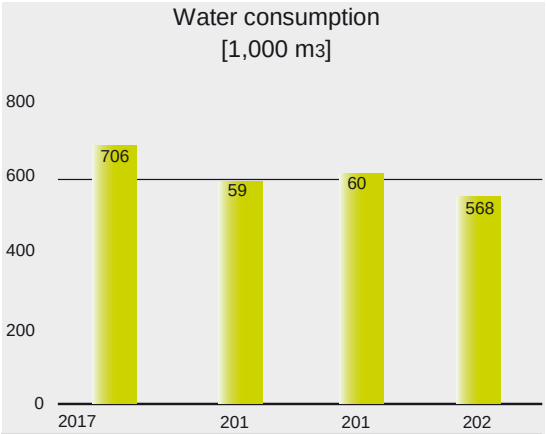


Figure 9

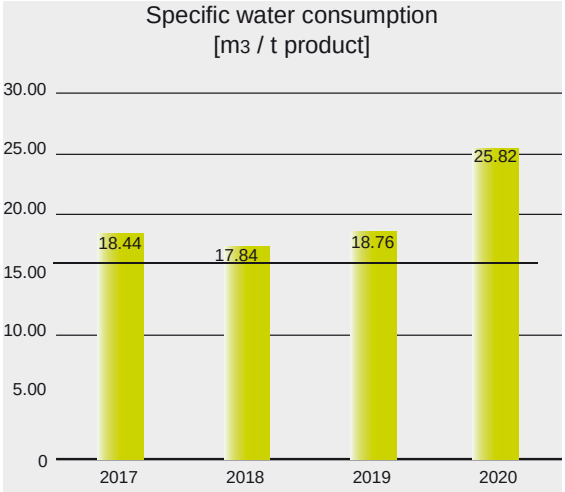


Figure 10

It can be seen that in 2020, both the absolute and specific fresh water consumption increased significantly. The increase in fresh water consumption was primarily due to our IPA plant (approx. 660,000 m^3). In addition, there was a large difference between the plant input measurement and the consumption measurements of about 600,000 m^3, the cause of which has not yet been clarified.

Figures 11 and 12 show the absolute wastewater volume and the specific wastewater volume of the Moers plant, respectively.

Figure 11

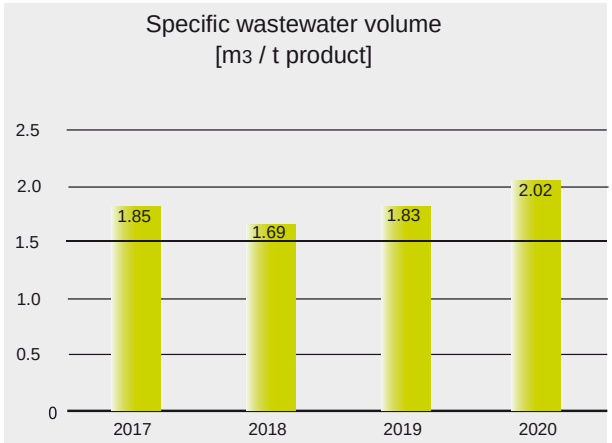


Figure 12

The wastewater volume in 2017 was significantly higher than the volume of approx. 590,000 m^3 from the other years. The much lower production volume in 2020 resulted in the absolute wastewater volume dropping to the smallest value of 568,000 m^3 in the 4 year period. However, the specific wastewater volume increased to 2.02 ^{3} of wastewater per t of product. This is due to the fact that for some production processes, the wastewater volume is independent of the production volume.

Since the closure of the plant's biological central wastewater treatment plant in November 2013, the wastewater from the C sewer (see 3.1.5.9.2) is now completely discharged after neutralization to the neighboring LINEG municipal wastewater treatment plant for treatment.

3.1.6.4 Energy

We use the energy sources shown in Fig. 13 to manufacture our products, of which natural gas accounts for the largest share. The second largest energy source is the off-gas from the production of MA. Renewable energies are not used. The natural gas purchased and used to generate electric power for used by the company and fed into the public power grid does not contain a renewable share. The natural gas required to generate the electricity fed into the public power grid is deducted from the values shown in Figures 13 and 14.

The absolute energy consumption of the plant is relatively constant over the period from 2017 to 2020. Due to plant shutdowns at the MA plants, less energy was supplied in the form of off-gas by the MA plants in 2020. Accordingly, the amount of natural gas consumed increased significantly.

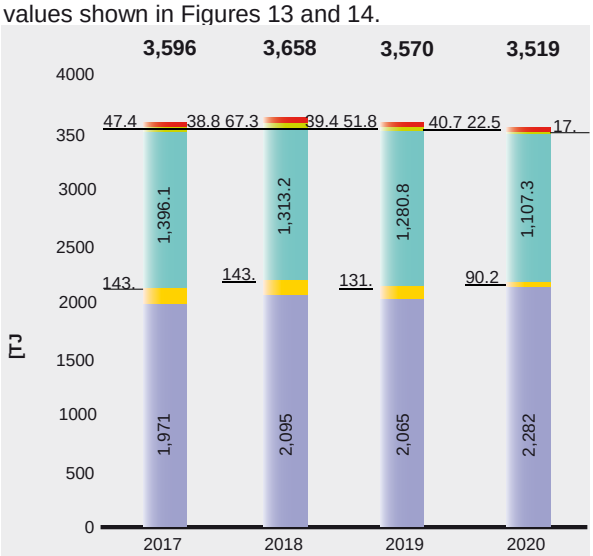


Figure 13: Energy consumption

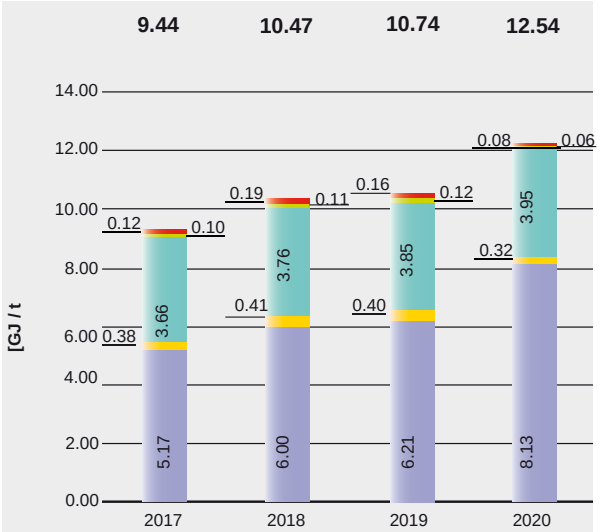


Figure 14: Specific energy consumption

Ext. el. power Other Off-gas Hydrogen Natural gas

The reduced production volume combined with a relatively constant absolute energy consumption leads to an increased specific energy consumption. The very high value for 2020 can be explained on the one hand by several technical problems and the associated shorter and longer production interruptions:

- Since shutting down and starting up chemical plants always takes several days, only sections of the plant are often taken out of operation in the event of technical problems. The remaining sections of the plant consume energy without producing any product. Furthermore, energy is also consumed for several days without production during complete shutdowns and subsequent restarts.
- Due to leaks inside the waste gas heat exchanger in the MA 2nd train, CO from the off-gas side got into the clean gas side. To maintain the emission values within limits, the combustion chamber temperature was increased to the maximum permissible value. This resulted in significantly increased natural gas consumption during operation of the 2nd train in 2020. However, the higher combustion chamber temperature also resulted in increased steam production, which partially compensated for the increased energy consumption. Energy losses caused by the associated increase in the stack temperature could not be compensated.

On the other hand, only material flows that are combusted, such as natural gas or off-gas from the MA plant, are counted as energy. The steam generated by the exothermic MA reaction is not taken into account when determining the energy consumption. MA production has little effect on the amount of fuel required for steam generation. A lower MA production reduces the production volume while consuming an almost constant amount of energy/fuel. For this reason, a lower MA production inevitably leads to a higher specific consumption of natural gas and energy when the other plants consume the same amount of energy. This concealed the energy improvements made in the production facilities in 2020.

3.1.6.5 Air

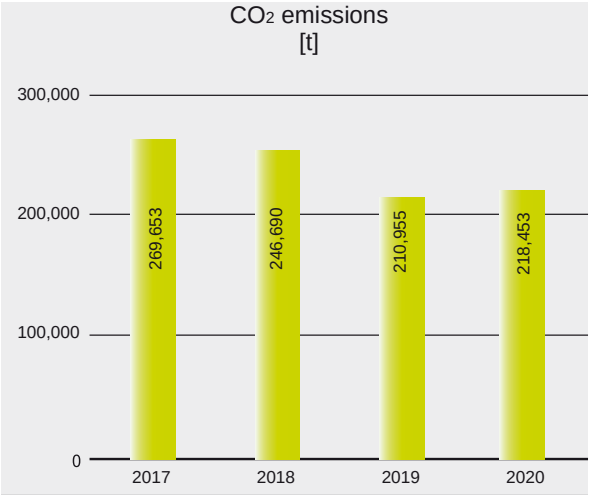


Figure 15

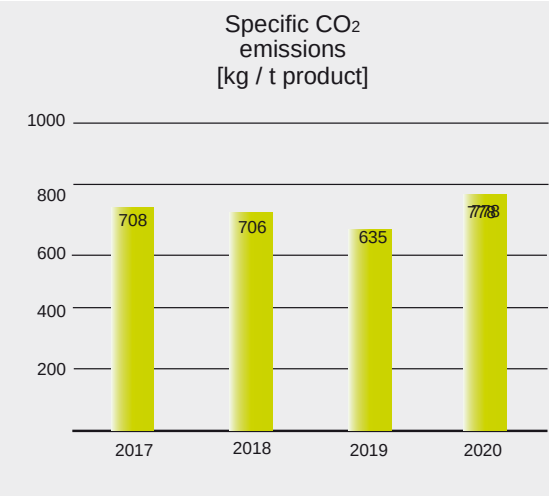


Figure 16

The CO_2 emissions from combustion processes (primarily in the power plant and in the flue gas scrubbing system of the MA plant) are monitored within the framework of the currently valid CO_2 emissions trading system. Figures 15 and 16 show the absolute and specific CO_2 emissions of the Moers plant for the period from 2017 to 2020.

Due to the slightly fluctuating fuel mix, the absolute and specific CO_2 figures in Figures 15 and 16 do not show a clear trend and do not align with the absolute and specific energy demand (see Figures 13 and 14).

The figures above do not include CO_2 emissions resulting from the generation of electricity that is fed into the public power grid. Indirect CO_2 emissions resulting from purchased electricity generated from fossil fuels are not included either.

Due to the predominant use of the low-emission fuel natural gas and the use of modern combustion technology, the air pollutants listed in Table 8 “Other emissions” are only produced in comparatively small amounts.

Table 8: Other emissions

Year	2017	2018	2019	2020
NOx emissions [t]	61.89	65.85	57.48	54.30
Emissions of volatile organic compounds (VOCs) [t]	15.30	15.30	15.30	15.30
CO emissions [t]	92.59	88.43	64.61	44.56
SO_2 emissions [t]	3.98	3.99	4.47	2.97
Inorganic dust [t]	0.92	0.89	0.94	0.86
Organic dust [t]	0.66	0.66	0.66	0.66

The NOx, CO, and SO_2 emissions have dropped significantly in some cases over the course of the year.
The two air pollutants “organic dust” and “volatile organic compounds (VOC)” in the table above are only determined every four years when preparing the emissions statement in accordance with the 11th BImSchV and are thus entered as constants for this period. The next test will take place in the course of 2021 and will be reported in the Environmental Statement 2022.

At the Moers site, various air conditioning systems and units are operated that contain partially halogenated hydrofluorocarbons (HFCs) as refrigerants. These substances have a much higher global warming potential than CO_2 and are therefore particularly in focus. During the mandatory regular maintenance of the equipment by a certified specialist company, minor refrigerant losses are sometimes detected. The conversion of these HFC emissions into CO_2 equivalents resulted in the values shown in Table 9. The values fluctuate over time and are very low compared to the actual CO_2 emissions. In 2020, a greater amount of CO_2 equivalent had to be replenished compared to previous years. The greenhouse gases N_2O, HFC, NF_3 and SF_6 are not used at the site. CH_4 is produced in technically tight systems and is also only used as a fuel.

Table 9: HFC emissions

Year	2017	2018	2019	2020
CO_2 equivalent [t]	20.4	36.7	24.8	80.0

3.1.6.6 Biodiversity

Activities at the plant site do not affect biodiversity because the sites have been used for industrial purposes for more than 100 years and new industrial areas have not been developed. The Moers plant and the associated port in Duisburg-Homberg cover a total area of 43.3 hectares, of which 13.4 hectares are built up or sealed. For the most part, the administrative and service buildings on the site date back to the early days of the chemical activities (starting 1936), but they have been continuously renovated and adapted to current requirements or demolished and replaced by new buildings.

3.1.6.7 Investments in environmental protection

Figure 17 shows the environmental protection expenditures in the period from 2017 to 2020.
Expenditures for environmental protection measures increased significantly from 2017 to 2020. In 2018, a 10 year program to rehabilitate pipelines and pipe bridges was initiated. Since then, several million euro have been spent each year on rehabilitating and replacing pipelines and renewing corrosion protection and insulation. On the one hand, this reduces the likelihood of leakages and the resulting environmental damage. On the other hand, the new insulation of the pipelines reduces heat losses.

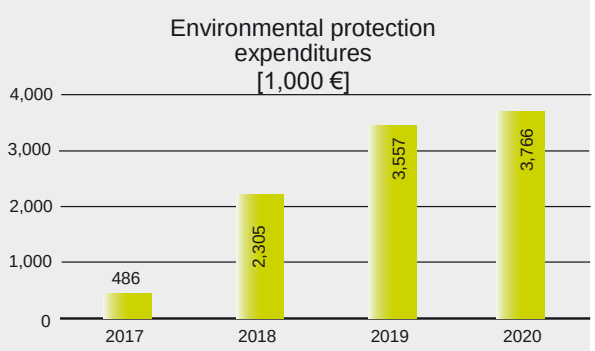


Figure 17

A large part of the expenditures in 2018 was used to finance extensive rehabilitation work on our sewer system. In addition, there is annual expenditure of about 180,000 euro in the area of contaminated site / soil remediation, which was spent on cleaning up contaminated sites from the mining and coking period. About 200,000 euro were spent on energy-saving measures in 2020.

3.1.6.8 Problems in 2020

There are basically three main energy consumers at the Moers site: The IPA plant, the SBA / MEK plant, and the MA plant. The MA plant is a net energy producer since generates more energy than it consumes. There were technical problems in the IPA and SBA / MEK plants in 2020, which led to increased specific energy consumption in the plants and thus also for the plant as a whole. At the same time, production failures in the MA plant resulted in less steam production in the MA plant, which had to be compensated for through the use of natural gas in the power plant.

SBA plant:

Due to mechanical damage inside the SBA reactor, it could only be filled and operated with 40% of the normal amount of catalyst for several months. This also initially led to a corresponding reduction in the plant's production capacity.
In order to meet our supply obligations and partially compensate for the reduced production capacity, the entire SBA plant had to be operated more inefficiently - i.e. with a higher specific energy consumption. The specific steam consumption of the SBA plant increased by approximately 23% in 2020. However, the catalyst output (product generated per unit volume of catalyst) increased significantly as a result of this measure, so that approx. 5,300 t more SBA could be produced than without the more inefficient method of operation.

IPA plant:

In the IPA plant, heat is reused several times at many points by using high temperature waste heat flows to heat plant components at lower temperature levels. This saves steam as a heat transfer medium, and ultimately natural gas.
One such heat exchanger for heat recovery had to be taken out of operation at the beginning of 2019 due to an internal defect. It was not possible to repair it while the IPA plant was in operation. It was not until the fall of 2020 that the heat exchanger could be repaired and put back into operation. This heat exchanger alone saves about 1.3 t / h of steam. If this heat consumption is deducted from the specific energy consumption of the IPA plant, then the specific energy consumption of the IPA plant was at a constantly low level in the period from 2018 to 2020.

The distillation columns are the largest heat consumers of the IPA plant as well as of the SBA / MEK plant. In these columns, mixtures of liquid substances such as alcohols and water are separated. To achieve a certain purity of the products, a minimum amount of energy must be input.
However, if the energy input was to fall below this minimum, then the product would not comply with the specification. In order to achieve the goal of achieving the most energy-efficient production possible, the energy input to most of the distillation columns in the IPA plant is controlled automatically as a function of the production volume in such a way that the product produced complies with the specification but is not “too pure”. Therefore, the steam consumption remains at an almost constantly low level after deducting the extra amount consumed due to the malfunction of the stated heat exchanger.

MA plant:

The MA plant consists of 2 trains of similar capacity but that were built in different years (1999 and 2011, respectively). MA is produced by reacting liquid butane with atmospheric oxygen. During the reaction of butane and atmospheric oxygen to form MA, heat is released that is used to generate steam in the MA plant. The unreacted butane is furthermore combusted using additional natural gas, which also generates steam. Some of the steam generated in the MA plant is consumed within the MA plant and some is delivered to the heat consumers of INEOS. Most of the energy consumed comes from the reaction itself. The 2nd train of the MA plant requires significantly less natural gas for the reaction, which means it is more efficient than the 1st train of the MA plant. In 2020, the 2nd train of the MA plant was out of operation for several months due to technical problems. The average specific energy consumption of the MA plant inevitably increased as a result.

3.1.6.9 Improvements in the period from 2018 to 2020

MA plant: Optimization of the waste gas heat exchanger

Due to an internal leak, the waste gas heat exchanger of the 2nd train of the MA plant had to be replaced. The reason for replacement in the period from July to October 2020 was to improve the heat transfer, and thus the heat recovery. The waste gas temperature on the stack was reduced significantly. This results in permanent natural gas savings in the 2nd train of the MA plant of approx. 20% and a corresponding savings in CO_2 emissions.

SBA plant: Lower specific raw material consumption through optimization of the OLEX plant

The product SBA is produced by reacting the liquefied gas butene with water. The raw material for SBA production is a mixture of butene and butane. The (incomplete) separation of butene from butane is performed in the upstream OLEX plant.

In the framework of the 2018 to 2020 environmental program, options for optimizing the OLEX plant were examined and found. By optimizing the control parameters of the OLEX plant, more butene can be extracted from the butene/butane mixture, with the result that less raw material has to be used. However, this increases the specific energy consumption of the OLEX plant.

In 2020, it was therefore possible to reduce butene losses from approx. 5.3% to 3.1% based on the total input stream.

IPA plant: Less catalyst for disposal

By changing the operating parameters, it was possible to extend the lifespan of the catalyst used for IPA production from 12 months to 15 months. This resulted in correspondingly less waste. However, these savings were counteracted by an increase in the amount of waste generated in other areas.

Power plant: Heat recovery by saving steam

In the power plant's water treatment system, control of the temperature of the condensate returning from the production plants was improved. The amount of fresh water needed to cool the condensate has been significantly reduced. This not only saves cooling water, but also reduces the amount of steam consumed to subsequently reheat the condensate. Specifically, the fresh water requirement has been reduced by approx. 17 m^3/h and the steam consumption by approx. 500 kg/h or approx. 300 kW since July 2020.

Implementation of the INEOS guideline on knowledge-based maintenance

Implementation of the INEOS guideline on knowledge-based maintenance has begun. The probability of substance releases, and therefore of damage to the environment, is reduced by targeted testing that goes well beyond the legal requirements.

Installation of outdoor LED lighting

In the SBA plant, the installation of energy-saving LED lights has begun. This resulted in electricity savings of approx. 80,000 kWh/year.

Power-saving outdoor LED lights were also installed at the MA plant. The savings here amount to approx. 29,000 kWh/year.

Pipeline rehabilitation

A multi-year program to rehabilitate our pipelines is currently being implemented at the Moers site. This program costs several million euro per year. The goal is to ensure our production facilities are permanently leak-tight. This rehabilitation program significantly reduces the probability of pipeline leaks and the corresponding substance releases and environmental pollution. Furthermore, heat losses are reduced by new insulation.

Safety assessment of plants and retrofitting safety technology

In a multi-year program, the safety equipment of our plants at the Moers site is being examined in great detail. The goal is to identify and realize opportunities for improvement that go beyond the high standard already implemented. The implementation of these measures will further reduce the probability of substance releases and the resulting negative impact on the environment. We spend several hundred thousand euro annually on this program.

Unsealing surfaces

There are several decommissioned chemical facilities at the Moers site. As part of a multi-year program, these facilities are being demolished and the built-up area unsealed.

3.1.7 Contact and directions to the site

You can also use the general contact options provided at any time.

INEOS Solvents Germany GmbH
Moers plant
Römerstraße 733
47443 Moers

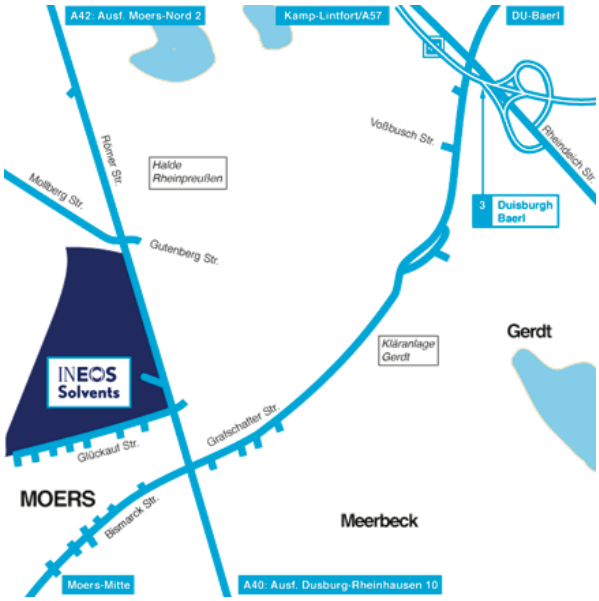
Phone: +49 (0) 2841 49-0
Environmental phone: +49 (0) 2841/ 49-245
Email: info.solvents@ineos.com

We look forward to your call or visit.

How to find us: If you are coming from Düsseldorf Airport, please take the autobahn. At the Meerbusch junction (27), please merge into the Autobahn 57 in the direction of Nijmegen/Krefeld. At Exit 10, change autobahns and merge into the Autobahn 40 in the direction of Essen/Duisburg/Moers. On Autobahn 40, please take the exit “Duisburg-Rheinhausen/Moers-Ost (10)” and drive in the direction of Moers-Ost. You are now on the Römerstraße (L237). After about 2.5 km, you will see the INEOS Solvents plant in Moers on the left-hand side.

If you are coming from the north, please follow Autobahn 3 in the direction of Oberhausen. Please exit the autobahn at the Oberhausen junction. Now follow Autobahn 42 in the direction of Kamp-Lintfort/Venlo. At the exit “Duisburg-Baerl (3)” please exit the autobahn and drive in the direction of Moers-Meerbeck. Now turn right and then immediately left onto the Grafschafter street in the direction of Moers-Meerbeck. Follow this road for about 2.5 km and then turn right onto Römerstraße. After about 300 meters, you will see the INEOS Solvents plant in Moers on the left-hand side.

If you are coming from the south, please follow Autobahn 40 in the direction of Venlo/Duisburg. On Autobahn 40, please take the exit “Duisburg-Rheinhausen/Moers-Ost (10)” and drive in the direction of Moers-Ost. You are now on the Römerstraße (L237). After about 2.5 km, you will see the INEOS Solvents plant in Moers on the left-hand side.



3.2 Herne

3.2.1 Description

At the Herne site, our employees primarily produce the oxygenated solvents isopropanol and ethanol as well as diethyl ether and hydroperoxides.

Some of the buildings are listed as industrial monuments of the city of Herne.

The Herne plant is directly surrounded by residential areas. The property is secured against unauthorized access by a fence and a guarded entry gate.

Figure 18: Bird's eye view of the Herne plant

3.2.2 Organization

Within the framework of the environmental management system, the responsibilities, tasks, and competencies are clearly defined, and not only for environmental protection issues. The managing director responsible for operations is ultimately responsibility for the company and the plant. This person ensures the application and efficiency of the environmental management system. The managing director obtains expert advice regarding his duties from various operations officers (see also section 3.2.5.1). The officers support the managing director when performing internal controls.

The managing director responsible for operations is subordinate to the Manufacturing Excellence, Project Management & Engineering, and SHE departments as well as the Herne plant manager.

The plant manager and his operations managers, together with their teams, are responsible for the proper operation of the production facilities.

The Logistics department is responsible, among other things, for the storage and loading of products as well as the corresponding rail operations. Among other things, quality control of the products and environmental monitoring, in particular in the area of wastewater, are performed in the lab. The Technical Service department is responsible for the maintenance, inspection, and repair of the plants.

The plant's fire department ensures fire prevention and protection. The fire department is also responsible for plant security and occupational safety.

The departments responsible across all plants have already been described in section 3.1.2.

3.2.3 Products and their applications

The following products can be manufactured at the INEOS Herne plant in the annual quantities indicated:

Table 10: Products

Production	Annual Quantity
Ethanol	approx. 140,000 t
Isopropanol	approx. 85,000 t
Hydroperoxide	approx. 2,400 t
Diethyl ether	approx. 5,000 t
Catalysts for the production of ethanol and isopropanol	approx. 1,000 t

Ethanol and isopropanol are used in numerous everyday products. Such products include pharmaceuticals, disinfectants, liquid detergents, liquid cleaners, and antifreeze. As ingredients in perfumes, deodorants, and aftershaves, they are familiar to most people in an “up close and personal” way. In addition, the site’s products are also used as industrial solvents or used as materials in chemical production processes.
The increase in production volume to 158,300 t is due to the pandemic-related increase in demand for ethanol and isopropanol for the production of disinfectants.

Over the past four years from 2017 to 2020, the total production volumes were as shown in Figure 19: These values were used to calculate the specific consumption and emissions shown in section 3.2.6 of this environmental statement.

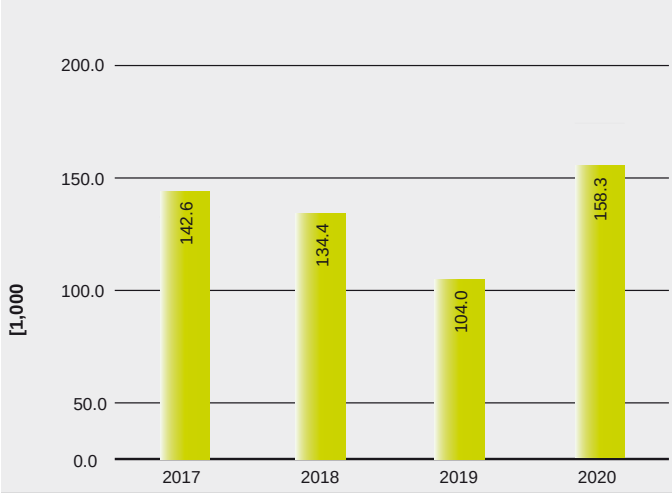


Figure 19: Production volumes

3.2.4 Production processes and raw and auxiliary materials

The processes for manufacturing these products were all developed at the Herne site and are licensed worldwide. The production of ethanol and isopropanol is performed using basically the same process - although under different reaction conditions. A simplified diagram for ethanol production is shown as an example in Figure 20.

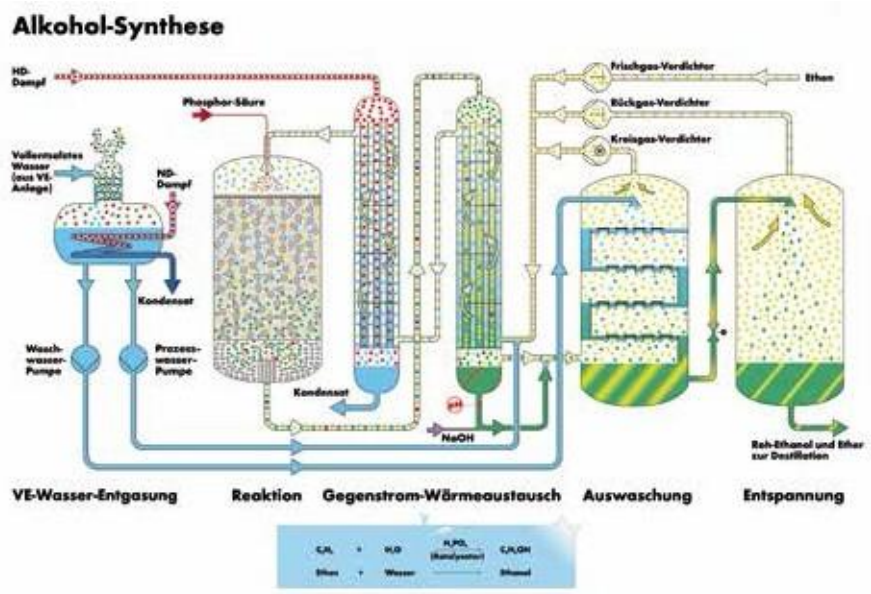


Figure 20

The production of ethanol results in by-products such as diethyl ether and the so-called fusel oils, which are separated and processed for further use or recycling.

In addition, paramenthane hydroperoxide (PMHP) and diisopropylbenzene hydroperoxide (DIHP) are also produced in Herne.

The products manufactured are transported by tanker trucks (up to 25 m³) or rail tank cars (up to 60 m³). Small quantities of the diethyl ether and hydroperoxides produced are filled in drums (up to 200 l). On average, about 63% of our products are transported by road and about 37% by rail. The good connection to the waterway (Port of Duisburg-Homberg) ensures that local residents are less affected by car and truck traffic to and from the plant.

An overview of the production network at our plant is shown in Figure 21 “Plant and product overview”:

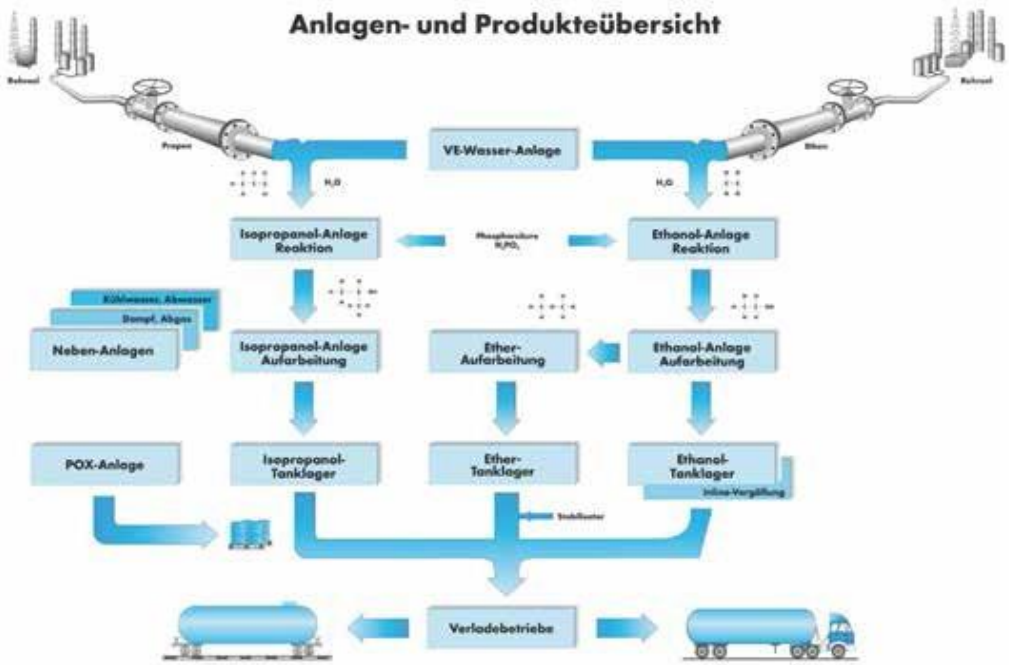


Figure 21: Plant and product overview

The plants are supplied over permanently installed lines with the raw materials ethylene, propylene, and water as well as with the auxiliary materials nitrogen, compressed air, steam, and electrical energy. The long-distance pipelines that supply the plant with ethylene and propylene from the refinery in Gelsenkirchen-Scholven were acquired from the previous owner in 2016. Only a small proportion of the raw and auxiliary materials are delivered via road and rail links. These auxiliary materials include, for example, hydrochloric acid, phosphoric acid, sulfuric acid, caustic soda, and the denaturants needed to denature ethanol as required by customs law. The consumption of raw and auxiliary materials (see Table 11) is constant most of the time due to the largely continuous operation of the plants.

Table 11: Raw and auxiliary materials

Raw/Auxiliary Material	Annual Quantity
Ethylene	approx. 75,000 t
Propylene	approx. 60,000 t
Precursors of hydroperoxides	approx. 2,800 t
Water for the reaction to form alcohols	approx. 70,000 t
Hydrochloric acid, caustic soda, phosphoric acid, denaturants, catalyst support materials	100 to 1,000 t each
Sulfuric acid, sodium hypochlorite, soda	10 to 100 t each

3.2.5 Environmental protection and safety at the Herne site

3.2.5.1 Company officers

The topic of environmental protection is a top priority at the Herne site. The responsibilities for environmental protection are distributed throughout the entire organization as already explained above in section 3.2.2:

An important task in the implementation and monitoring of environmental protection and safety measures is performed by the operational officers, who are appointed to the Herne site in accordance with statutory requirements and are registered with the relevant authorities:

- Environmental Officer for the following legal areas:
  - Immission Control Officer (Art. 53 ff BImSchG)
  - Hazardous Incidents Officer (Art. 58a ff BImSchG)
  - Water Protection Officer (Art. 64 ff WHG)
  - Waste Management Officer (Art. 59 ff KrWG)
- Officer for limiting the effects of hazardous incidents (Art. 12(1) StörfallV)
- 1 qualified person (Art. 11 ChemVerbotsV)
- 1 qualified person according to Annex II REACH
- 1 Dangerous Goods Officer (Art. 1 GbV)
- 1 Occupational Physician (Art. 2 ASiG)
- 1 safety engineer & 1 occupational safety specialists (Art. 5 ASiG)
- approx. 13 safety officers (Art. 22 SGB VII)
- 1 Railway Operations Manager (Art. 1 EBV)

The officers support the managing director and the site managers within the scope of their legally defined function as operations officer.

- They act in an advisory and proactive capacity and propose specific measures to improve environmental protection and safety standards.
- They monitor and document compliance with environmental protection and safety regulations, permit requirements, voluntary commitments, and internal regulations.
- They report regularly on their activities, in particular on the status of environmental protection and safety, and prepare an annual report. If a need for action is identified, then the persons responsible ensure remedial action is taken.
- The officers are involved in informing all employees about current changes to legislation, environmental impacts, and possible optimization measures.
- When planning projects that affect their area of responsibility, they are involved in good time so that their opinion can be taken into account in upcoming decisions.

To the extent necessary to perform their duties, the officers shall be provided with adequate material and financial resources as well as personnel.

3.2.5.2 Fire protection and technical assistance

Preventive fire protection measures that have already been taken into account during the planning of plants, potential improvements that are subsequently identified during regular fire inspections, as well as the monitoring of our plants (e.g. by continuous measuring equipment such as Ex meters or regular plant tours by the operating personnel) minimize the possible risk of fires in the plants. In addition, there are stationary fire alarm and foam extinguishing systems as well as the mobile equipment belonging to the plant fire department, for example fire trucks that are equipped with the necessary technology. Fire protection concepts are continuously improved in close coordination with the relevant supervisory authorities.

Examples of this include the semi-automatic fire extinguishing system for the intermediate tank farm that was put into operation in 2010 as well as the automatic fire alarm system, to which more and more buildings and spaces are being connected for the purpose of early fire detection.

In addition to these technical measures, effective emergency response procedures are also required to enable the necessary safety measures to be taken quickly in case of danger from the substances present in the plants. Essential components of our emergency response are:

- A plant fire department recognized by the supervisory authority and commissioned in accordance with Art. 12(1) StörfallV consisting of 12 full-time firefighters and approx. 42 part-time firefighters. (These firefighters are not only responsible for fire prevention and protection, but also regularly check part of the environmental impact of the site and are immediately called upon to respond to questions and complaints from the neighborhood.)
- Plant emergency service consisting of qualified managers who coordinate the necessary measures on site in the event of an emergency and, if necessary, summon any additional help required.
- On-call emergency service in the departments
- Alarm and emergency response plans that define the reporting channels for notifying emergency responders and authorities so that measures to protect the public can be initiated.

A particularly important means of communication for the plant is the environmental telephone, which is used to receive inquiries and messages at any time. The individual incidents are logged, forwarded to the SHE department or the plant emergency service, and processed there as described above.

In addition, there is a nationwide, voluntary transport accident information and emergency response system of the German chemical industry (TUIS), which is used in the event of transport and storage accidents involving hazardous substances. TUIS supports public fire departments, the police, and other authorities. They can request advice, experts, and special equipment around the clock, 365 days a year.

The effectiveness of the measures described was demonstrated in several exercises involving all relevant departments of the plant as well as the on-call emergency service and the plant fire department.

3.2.5.3 Occupational and plant safety

The topics of occupational safety and plant safety also play an important role in environmentally friendly and sustainable production. As already mentioned in section 3.2.5.1 “Company officers”, all officers have been appointed in accordance with the German Occupational Health and Safety Act (ArbSchG) and Social Code Book VII (SGB VII). These persons and the responsible managers fulfill their tasks with great dedication. The employees act with the necessary care and caution.

With respect to the topic of plant safety, it should be noted that the production facilities for manufacturing chemical products are subject to the Federal Immission Control Act and have been approved by the authorities. The plant also constitutes an operational area according to the Hazardous Incident Ordinance. Accordingly, a safety report as well as a general safety concept have been submitted to the authorities. The safety management system comprises the organizational regulations on safety and is integrated into the existing system for quality and environmental protection. A hazard prevention concept was developed in agreement with the fire protection and civil protection authorities. In this concept, the plant’s alarm and emergency response plan was coordinated with the plans of the city of Herne.

3.2.5.4 Environmentally relevant incidents

Due to the measures described in sections 3.2.5.1 to 3.2.5.3, no reportable event pursuant to Article 19 of the Hazardous Incident Ordinance was recorded during the reporting period. However, there have been several non-notifiable disruptions to the normal operation of the plants occurred during the reporting period, some of which involved local releases of substances and operation of the flare. None of the events resulted in a serious hazard in the sense of the Hazardous Incident Ordinance or had a significant impact on the environment.

Support from external emergency crews was required in two cases: In the first case, an external emergency crew was called due to a car accident outside the plant at the Holsterhauser Straße autobahn bridge, where a long-distance pipeline carrying ethylene runs. The pipeline was only slightly damaged by the falling car and could be stabilized using a carbon collar. In the second case, a small fire occurred in the disinfectant filling area. The fire had already been extinguished by the plant personnel present before the arrival of the plant fire department and the local fire department.

During the reporting period, there were a few reports and inquiries from the neighborhood. They were mainly related to the unavoidable operation of the flare when shutting down and starting up the plant, intermittent noise (e.g. from a running diesel locomotive engine or lawn work), and vibrations in residential buildings located a greater distance from the plant.

In all cases, the concerns and worries of the residents were documented and the technical requirements and contexts explained to them. Wherever possible, the cause of the disruption was eliminated immediately. In addition, measures were initiated to prevent their recurrence.

3.2.5.5 Material properties

Most of the materials handled at the plant are subject to the Hazardous Substances Ordinance and the Hazardous Incidents Ordinance. However, by continuously keeping the facilities up to the state of the art and implementing the necessary protection measures for personnel and the environment, the potential hazard has been minimized. This is presented in detail in the relevant safety reports, which have been duly submitted to the corresponding supervisory authorities.

Overall, the material properties can be divided into four hazard groups:

- Fire and explosion hazards
- Health hazards, poisoning hazards
- Chemical burn hazards
- Environmental hazards

Table 12 in the following contains examples from all groups and covers the main substances handled at the plant. In addition, explanations from the area of water legislation are to be added to this table. The substances are classified according to their degree of water hazard. For this reason, most of the substances used in the plant are classified in **W**ater **H**azard **C**lass 1 (WHC 1: slightly hazardous to water), for example ethanol and isopropanol. To a lesser extent, there are also substances classified in WHC 2 (clearly hazardous to water), for example the hydroperoxides. Substances in WHC 3 (highly hazardous to water) are not handled at the Herne plant.

Table 12: Properties of the substances handled at the Herne plant

Hazardous Substances Group	Hazardous Substance Symbol	Signal Word	Substance (occurrence)	Potential Hazards	Precautions
Flammable substances (Cat. 1)		Danger	**Ethylene** (pipeline, ethanol plant) **Propylene** (pipeline, isopropanol plant) **Natural gas** (pipeline, boiler plants) **Diethyl ether** (ether plant, tank farm)	“extremely flammable”; explosive mixtures can form with air.	Keep away from heat / sparks / open flames / hot surfaces. No smoking.
Flammable substances (Cat. 2)		Danger	**Ethanol** (ethanol plant, tank farm) **Isopropanol** (isopropanol plant, tank farm) **Fusel oils** (ethanol, isopropanol, and boiler plants, tank farm) **Cyclohexane** (isopropanol plant)	“highly flammable”; Vapors can form explosive mixtures with air.	Keep away from heat / sparks / open flames / hot surfaces. No smoking.
Flammable substances (Cat. 3)		Caution	**Paramenthane** (peroxide plant, tank farm)	“flammable”; Vapors can form explosive mixtures with air.	Keep away from heat / sparks / open flames / hot surfaces. No smoking.
Substances hazardous to health		Danger	**Diisopropylbenzene hydroperoxide** (peroxide plant, tank farm and drum storage area)	Aspiration hazard, raise awareness	Avoid contact with eyes, skin, and clothes using special protection measures; Do not inhale vapors!
Toxic substances		Danger	**Methanol** (denaturant tank farm)	Toxic by inhalation, skin contact, and if swallowed	Avoid contact with eyes, skin, and clothes using special protection measures; Do not inhale vapors!
Corrosive substances		Danger	**Caustic soda** (ethanol and isopropanol plants, demineralized water system, tank farm) **Hydrochloric acid** (demineralized water system, tank farm) **Phosphoric acid** (ethanol and isopropanol plants, tank farm) **Sulfuric acid** (cooling plants) **Sodium hypochlorite** (cooling plants)	Contact with combustible material may cause fire, may intensify fire	Keep away from clothing / combustible materials / store away from other materials.

Table 12: Properties of the substances handled at the Herne plant

Hazardous Substances Group	Hazardous Substance Symbol	Signal Word	Substance (occurrence)	Potential Hazards	Precautions
Peroxide Type F		Danger	**Diisopropylbenzene hydroperoxide** (peroxide plant, tank farm and drum storage area) **Paramenthane hydroperoxide** (peroxide plant, tank farm and drum storage area)	Can cause a fire, promote an existing fire, and make fighting the fire more difficult	Avoid all contact with flammable substances!
Environmentally hazardous substances		Caution	**Diisopropylbenzene hydroperoxide** (peroxide plant, tank farm and drum storage area) **Fusel oils** (ethanol, isopropanol, and boiler plants, tank farm)	Toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment	Keep container tightly closed; do not allow to enter sewage system or bodies of water!

3.2.5.6 Production-related emissions

Diffuse vapors and gaseous emissions from the plants are minimized using special sealing systems, encapsulated pumps, or pumps with mechanical seals in accordance with the state of the art.

The vapors generated during storage, loading, and filling of the products are extracted and fed into the combustion air of our steam generation plants. With the completion of the extraction system for the product tank farm, the last notable sources of volatile organic compound emissions were also eliminated at the end of 2007.

Finally, flue gases are unavoidably emitted as air pollutants from the natural gas-fired steam generation plants. Their levels are regularly monitored and reported to the Environmental Monitoring Department of the Arnsberg district government as part of the emission statements.

3.2.5.7 Waste

The following main waste fractions are generated at the Herne site:

- For disposal: Used catalysts, oily wastes, sludges from sewer cleaning, and replaced insulation and insulating materials
- For recycling/reuse: Liquid by-products, soil, construction waste, municipal and green waste, and used packaging.

The liquid by-products, known as “fusel oils”, are produced during the synthesis of alcohols and are thermally utilized in the site’s own steam generation plants.

Waste is collected and separated wherever possible so that the average recycling rate is > 97% (see also section 3.2.6.2). The quantity of waste is minimized through the use of reusable bulk containers. Certified waste management companies are employed to dispose of the waste in accordance with the statutory requirements.

3.2.5.8 Energy

The steam required for the chemical processes (so-called high-pressure and medium-pressure steam) is generated in two steam generation plants using primarily natural gas as well as liquid and gaseous by-products. It is used as a heating medium, as a source of energy for production processes, and to drive turbines.
The energy technology of the steam boilers was optimized to increase efficiency and minimize emissions. The waste heat generated in the plants is dissipated via two cooling plants whose water requirements have been minimized by optimizing the cooling water treatment system. Some of the waste heat is fed into the municipal utility's central heating plant located on the plant site and is used to supply the surrounding households.

3.2.5.9 Water and soil protection

The wastewater generated during production is partially pretreated and continuously analyzed before being discharged into the public sewer system. It is then treaded together with municipal wastewater at the wastewater treatment plants belonging to the Emscher Cooperative.

The wastewater from the individual plants is discharged - where necessary - via light liquid separators into the plant's own sewer system. Fluctuations in the pH value are compensated for through the addition of caustic soda. The plant sewer system is inspected and, if necessary, repaired in accordance with the regulations of the Self-Monitoring Ordinance for wastewater. The wastewater is discharged into the public sewer system at a central collection point of the plant. All relevant parameters are continuously monitored at this collection point. If one of the maximum values, some of which we have specified ourselves, is exceeded, a central gate valve is closed and the wastewater is temporarily stored in the wastewater retention basin. It can be subjected to targeted treatment there or returned to the normal wastewater flow once the reason for exceeding the limit value has been eliminated.

The use of fresh water is minimized by recirculating production water. In the production plants, the contamination of wastewater with organic and inorganic components is kept as low as possible through suitable process control and continuous monitoring.

Any product that leaks out is drained off over paved surfaces and collected in catch basins or pits. This prevents the product from entering the soil and contaminating the groundwater.

According to Article 5 of the amended 9th BImSchV, an initial status report (ISR) documenting the condition of the soil and groundwater in the area of the planned modification must be submitted together with the application documents since January 2014 when planning major modifications to a plant that is subject to the Industrial Emissions Directive (IED). This requires relatively extensive analyses of the soil and groundwater. The ISR was submitted to the relevant authority in 2017. During the examination of the initial status of the plant areas mentioned above, no indication of soil or groundwater contamination by the substances currently handled at the plant was found.

A contaminated site, the existence of which has been known for years and which is located in the northern area inside and outside the plant premises, dates from the time when coking plants were in operation at the site and the chemical industry was developing and has been undergoing hydraulic remediation since 1999. This means that groundwater contaminated with organic pollutants is prevented from flowing further north by means of three recovery wells. This measure was developed by an officially recognized expert organization that continues to supervise the well and provides metrological and scientific support. The groundwater extracted - like the other wastewater produced at the plant - is discharged into the internal sewer system for treatment at the Emscher Cooperative (see above).

3.2.5.10 Noise and odor

When selecting machines and equipment, care is taken to ensure that low-noise versions of the units are selected. Where possible, machines and plant components are retrofitted with soundproofing and are encapsulated or enclosed. Noise barriers supplement the noise control measures in the plants. Furthermore, the noise level emanated from the plant site is continuously monitored by four microphones located on the property line of the plant. Employees at the central control station are alerted to unusual noises by the INOMOS measurement system, enabling them to react quickly if any unusual noises arise. In addition, regular noise level measurements are taken from outside our plant grounds during the daily inspection runs performed by our plant fire department. All machines and equipment at our plant have been subjected to sound checks in the past in which specialized companies and their independent experts carry out extensive measurement programs on the site, produce noise level reports from the results, and propose additional noise control measures, if necessary.

During normal operation, the plant does not present an odor nuisance to the surrounding area. In the event of a malfunction that causes an odor nuisance, the emergency response procedures described in section 3.2.5.2 are immediately activated.

3.2.5.11 Storage, loading, and transport

The finished products are stored in tanks that meet the legal requirements (e.g. of the WHG and AwSV). In addition, measures have been implemented to minimize emissions, for example a central gas collection system, sun shields, and reflective paint on the tanks.

Emissions generated while filling the tank with product are extracted and fed into the plant's central waste gas collection system. Overfill protection, drainage surfaces, and catch basins prevent the products from entering the soil when loading.

The use of tanker trucks, rail tank cars, and reusable drums for the liquid products and big bags for the catalysts avoids or reduces corresponding packaging waste when delivering our products to our customers.

To keep the noise nuisance in our neighborhood as low as possible, the loading times have been limited to the workdays between 06:00 AM and 10:00 PM, with loading normally not being done on Saturdays or loading only until 2:00 PM. By selecting suitable shipping company and closely inspecting all vehicles as well as the transport documents, we ensure the safe transport of our products to our customers.

3.2.6 Performance indicators 2017 - 2020

3.2.6.1 Material efficiency/production

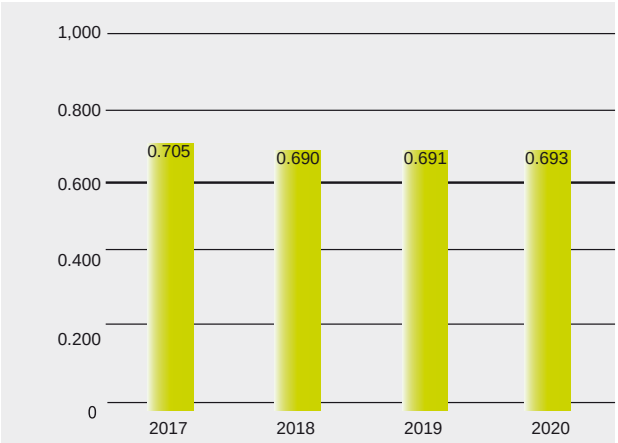


Figure 22

The annual tonnages shown in Fig. 19 (see section 3.2.3) were used to calculate the specific values, i.e. the values per ton of product stated in this section and the following sections.

The specific raw material requirement depends on the corresponding product mix and does not show a clear trend in the four-year period under review (see Fig. 22). The difference between the lowest and highest values is only about 2%. As illustrated in the new environmental program in section 2.3.2, there are still measures being planned to operate the production facilities in the most resource-efficient way possible. The value for material efficiency is less than one because the water required for the reaction to form the alcohols is not taken into account, and only the actual chemical raw materials used are taken into account.

3.2.6.2 Waste

Table 13: Waste quantities

Waste fraction		2017	2018	2019	2020
	Production quantity [1,000 t]	142.6	134.4	104.0	158.3
	Total waste quantity [1,000 t]	3.672	2.913	1.690	4.137
1	Hazardous wastes [1,000 t]	3.314	2.553	1.619	3.806
1a	Material recovery of hazardous wastes [1,000 t]	0.323	0.249	0.174	0.016
1b	Thermal recovery of hazardous wastes [1,000 t]	2.972	2.268	1.423	3.726
1c	Hazardous wastes eliminated [1,000 t]	0.019	0.035	0.022	0.063
2a	Other wastes recovered [1,000 t]	0.358	0.337	0.071	0.134
2b	Other wastes eliminated	0.000	0.023	0.000	0.197

The total waste volumes in Table 13 and the production-related waste volumes in Figure 23 show a sharp increase in waste volumes in 2020. This applies in particular to the generation of liquid still bottoms and reaction residues, see also Table 14. The amounts of these residues increase disproportionately when the plant is running at high capacity, but they are thermally recycled in the plant's steam generation facilities.
In the four-year period under review, the percentage of waste not directly related to production and basically attributable to construction and maintenance measures was only about 3%. In the diagrams of the production-related waste shown in Figs. 23 and 24, the waste soil, construction waste, metal scrap, and household waste-like fractions have been deducted from the total quantity of waste.

There are two main reasons for the high volume of waste produced 2020: First, a very active catalyst was used in the IPA plant that generated a disproportionately large amount of by-products. This effect was reinforced by the extraordinarily high production volume in 2020. Second, wastewater from the catalyst plant had to be disposed of externally.
The disproportionately strong increase in liquid residues also leads to a significant increase in the specific production-related waste volume up to a value of 25.35 kg of waste per t of product (see Fig. 24).

In the past four years, we have been able to recover an average of about 97% of all energy or material waste. Specialized disposal companies are predominantly used for disposal.

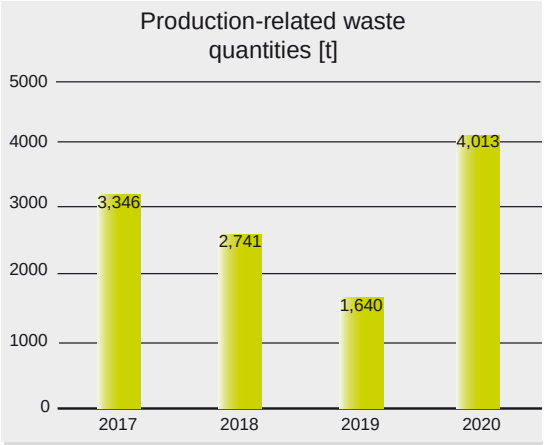


Figure 23

Figure 24

Table 14 below shows the five largest waste fractions for 2020. These accounted for 98% of the total waste generated. Table 14A shows waste fractions by waste type and quantity for 2020.

EWC code	Waste description	Quantity [t]	Portion of waste fraction according to Table 6
07 01 08*	Other still bottoms and reaction residues	3,726	1b
16 10 02	Aqueous liquid wastes other than those mentioned in 16 10 01	181	2b
17 01 07	Mixtures of concrete, bricks, tiles, and ceramics other than those mentioned in 17 01 06	76	2a
16 08 07*	Spent catalysts contaminated with hazardous substances	39	1c
17 06 03*	Other insulation materials consisting of or containing dangerous substances	20	1c
Total		4,042	
Percentage of the total waste volume * Hazardous waste		98%	

Table 14: Waste fractions 2020

Table 14A: Waste fractions by waste type and quantity for 2020.

Waste type acc. to WCO chapter	Waste description	Quantity [t]
07	Wastes from organic chemical processes	3,735
16	Wastes not otherwise specified in the list	237
17	Construction and demolition wastes (including excavated soil from contaminated sites)	106
15	Waste packaging, absorbents, wiping cloths, filter materials, and protective clothing (n.o.s.)	37
20	Municipal wastes (household waste and similar commercial, industrial, and institutional wastes) including separately collected fractions	12
19	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use	7
13	Oil wastes and wastes of liquid fuels (except edible oils, and those in chapters 05, 12, and 19)	4

3.2.6.3 Water

Figure 25 shows the absolute fresh water consumption at the Herne site. Figure 26 shows the specific fresh water consumption per t of finished product:

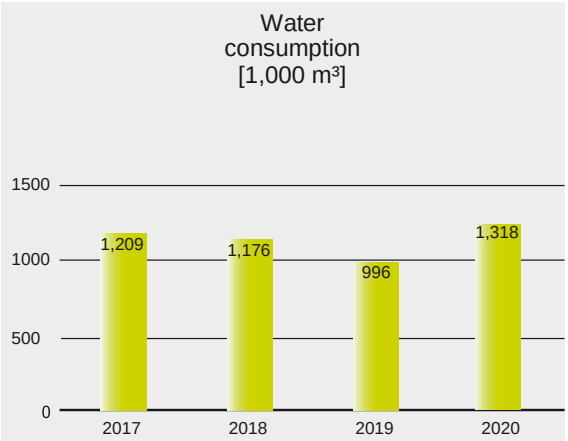


Figure 25

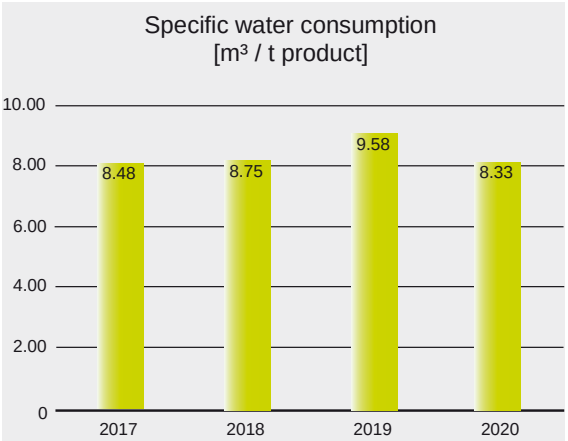


Figure 26

Like the significant increase in production volume in 2020, the volume of fresh water was also significantly higher than in previous years at 1,318,000 m³. With the exception of 2019, the year with the lowest production volume, the specific water consumption is around 8.5 m3 of water per t of product. The large amounts of water used in 2019 also resulted from tests conducted for the purpose of plant optimization in the IPA plant, where large amounts of process water volumes were used.

These trends are consequently reflected in Figures 27 and 28 for wastewater: A significant increase in the absolute wastewater volume, but a specific wastewater volume at 2017 and 2018 levels.

When comparing Figures 25 and 27, it is apparent that the amount of wastewater discharged is approx. 200,000 to 300,000 m3/year less than the fresh water input. A small part of this difference of approx. 200,000 to 300,000 m3/year is used as a reactant for our alcohol production, and a larger part is released into the environment as water vapor via our cooling towers.

The COD value shown in Fig. 29 stands for chemical oxygen demand and is a measure of the amount of oxidizable substances in the wastewater. With the exception of the relatively high value in 2019, the other three years have similar values.

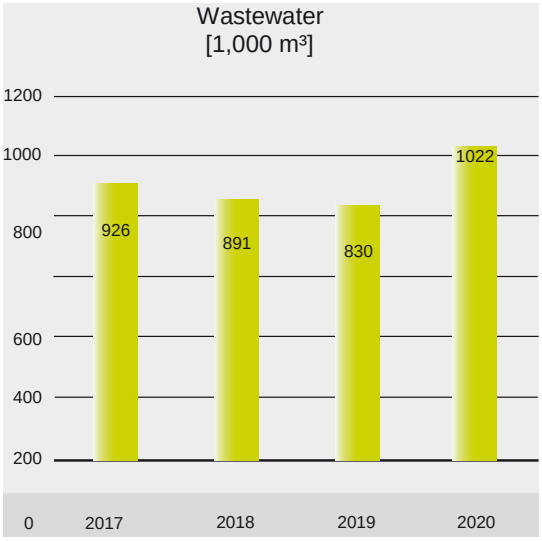


Figure 27

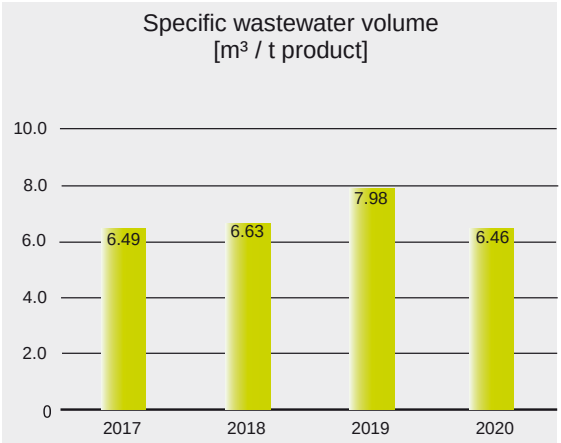


Figure 28

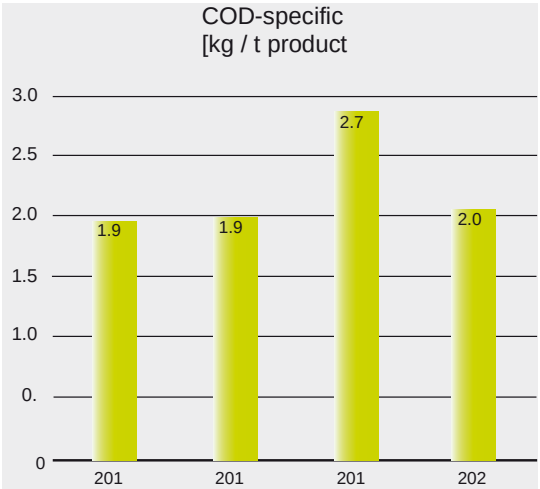


Figure 29

3.2.6.4 Energy

To manufacture our products, we use energy in the form of natural gas and electricity, with natural gas covering by far the largest share (about 94%) of our energy demand (see Fig. 30).

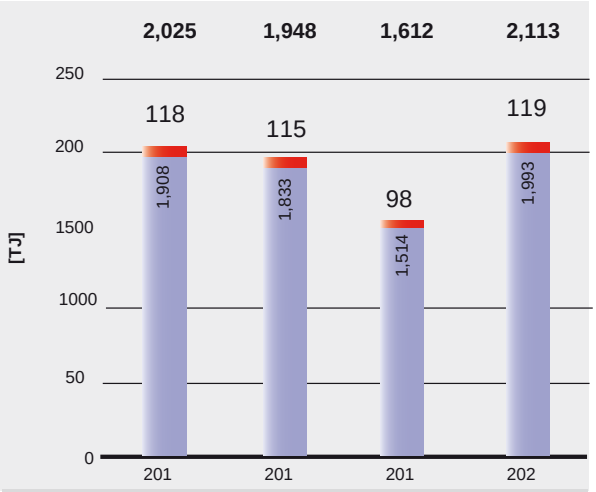


Figure 30: Energy consumption

Neither the natural gas used nor the electric power contain a share of renewable energy.

The energy demand is largely determined by the steam consumption of the production facilities, which in turn depends on the volume of finished products produced. Figure 30 clearly shows a fluctuating energy consumption. This figure looks similar to that for the production volume (Figure 19), both of which show significant increases in 2020.

The specific energy consumption is relatively constant despite highly fluctuating production volumes. However, the diagram also shows that the efficiency of our facilities is lower at low production volumes (2019) than at high production volumes (2020). The high specific energy consumption in 2019 results from a very low plant utilization. The low specific energy consumption in 2020 is favorably influenced by a very high plant utilization.

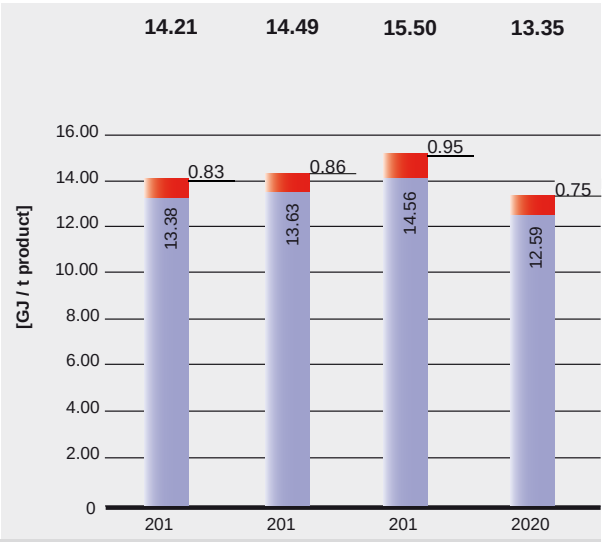


Figure 31: Specific energy consumption

3.2.6.5 Air

The CO_2 emissions are monitored in the framework of CO_2 emissions trading. Fig. 32 indicates a slight deviation from the energy consumption (Fig. 30).

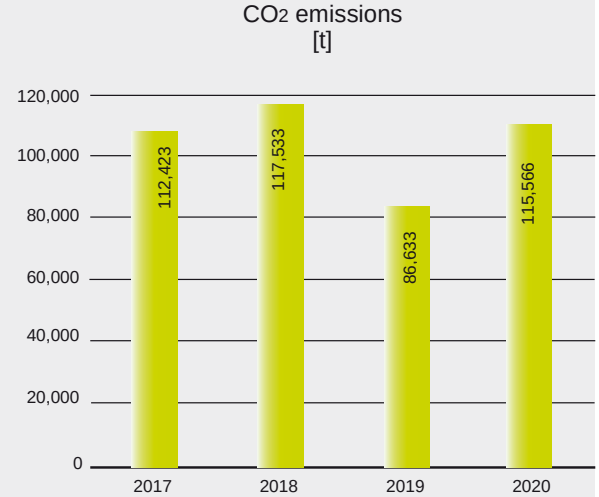


Figure 32

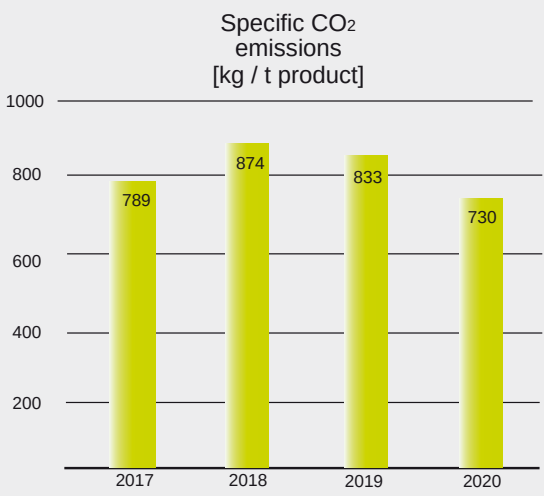


Figure 33

The high value in 2018 was caused by occasionally incorrect quantity measurements on the flare, which means that according to the strict methods of calculation of the CO_2 emissions trading system, approx. 12,500 t more CO_2 was emitted than was actually stated. In 2019, the emission values dropped significantly to 86,663 t, and the specific emissions to 833 kg/t product (Fig. 32 and 33). In 2020, though, there was a significant increase in absolute CO_2 emissions to 115,556 t, but a significant drop in specific emissions to 730 kg CO_2 per t of product. In this case as well, the reason for the drop is the increasing efficiency of our plants as production volumes rise and the consistently good plant operations.

Due to the predominant use of the low-emission fuel natural gas and the use of modern combustion technology, the air pollutants listed in Table 15 “Other emissions” are only produced in comparatively small amounts.

Table 15: Other emissions

Year	2017	2018	2019	2020
NO_2 emissions [t]	69.07	65.33	52.90	70.20
SO_2 emissions [t]	0.43	0.40	0.34	0.44
CO emissions [t]	1.77	1.37	1.11	1.54
Dust emissions [t]	0.10	0.09	0.08	0.09
Emissions of volatile organic compounds (VOCs) [t]	0.21	0.19	0.15	0.23

At the Herne site, various air conditioning systems and units are operated that contain partially halogenated hydrofluorocarbons (HFCs) as refrigerants. These substances have a much higher global warming potential than CO_2 and are therefore particularly in focus. During the mandatory regular maintenance of the equipment by a certified specialist company, minor refrigerant losses are sometimes detected. Ultimately, the HFC emissions measured are converted into CO_2 equivalents. The results are illustrated in Table 16 and show a much lower value for 2020 compared to 2018 and 2019. In comparison to the actual CO_2 emissions, these values are low. Nevertheless, we continue to work on minimizing refrigerant losses.

Table 16: HFC emissions

Year	2017	2018	2019	2020
CO_2 equivalent [t]	0.2	122.4	204.9	14.0

The greenhouse gases N_2O, HFC, NF_3 and SF_6 are not used at the site. CH_4 is produced in technically tight systems and is also only used as a fuel.

3.2.6.6 Biodiversity

Activities at the 16.2 hectare plant site do not affect biodiversity because the sites have been used for industrial purposes for more than 100 years and new industrial areas have not been developed.
A total of 8.4 hectares is categorized as built-up or sealed area.

3.2.6.7 Investments in environmental protection

In 2020, there was a slight decrease in investments to 190,000 euro. The remediation of contaminated sites was continued and the fusel oil tank was completed. A variety of aeration / deaeration equipment on the storage tanks was updated. The compressed air generation / supply system was equipped with an economizer control system for optimization purposes.

The peak in expenditures in 2018 was largely attributable to the expenditures for water protection. The corresponding ongoing inspections and modernization measures on the sewer system and the long-distance raw material pipelines, among other things, were executed as planned.

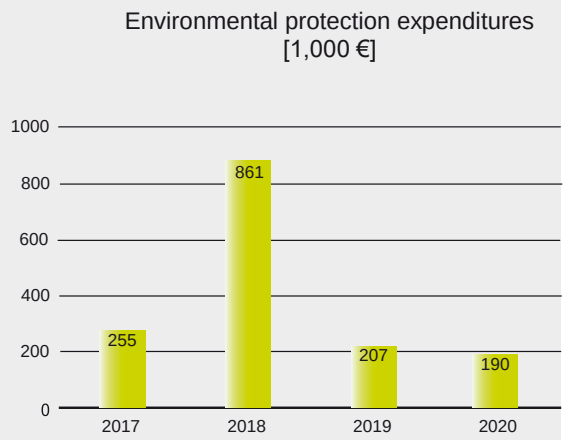


Figure 34

3.2.6.8 Unique aspects of 2020

Filling line for disinfectants

In 2020, a filling line for hand disinfectants for the INEOS Hygienics business unit was installed in a very short time that was used to supply neighboring infrastructure facilities at the very beginning of the pandemic.

3.2.6.9 Essential improvements in the years from 2018 to 2020

Improvements to long-distance raw material pipelines

The long-distance raw material pipelines were equipped with automatic leak detection systems (LDSs) between 2017 and 2019. In the unlikely event of a leak, these systems will enable the fast localization and repair of the leak. Similarly, various sections of the long-distance pipelines were partially renewed between 2017 and 2020 in connection with external measures such as the renaturation of the Resser Bach canal, expansion of the A43 autobahn, and construction of the Former Hassel Coking Plant district park, and various stuffing box expanders and ball joints were removed from in the relevant sections.

Flare: Installation of new pilot burners

At the Herne site, there is an elevated flare to safely burn flammable gases that are produced when shutting down plants, for example. To ignite the flammable gases, there are several pilot burners at the top of the stack that must burn continuously.
The flare at the Herne site was equipped with new pilot burners that require significantly less natural gas. As a result, the annual natural gas consumption for the operation of the flare has been reduced from > 120,000 Nm^3/year to about 50,000 Nm^3/year. A total of 41,000 euro were invested for this purpose in 2019.

Implementation of the INEOS guideline on knowledge-based maintenance

Implementation of the INEOS guideline on knowledge-based maintenance has begun. The probability of substance releases, and therefore of damage to the environment, is reduced by targeted testing that goes well beyond the legal requirements.

Sewer rehabilitation

The plant’s sewer systems were improved and rehabilitated. This significantly reduces the probability of wastewater and cooling water entering the soil and groundwater.

3.2.7 Contact and directions to the site

You can also use the general contact options provided at any time.

INEOS Solvents Germany GmbH Herne plant
Shamrockstraße 88
44623 Herne

Phone: +49 (0) 2323 1477-3000
Environmental phone: +49 (0) 2323 1477-3824
Email: info.solvents@ineos.com

We look forward to your call or visit.

How to find us: If you are coming from the **north**, please follow Autobahn 43 in the direction of Wuppertal. Exit the autobahn at the “Herne-Eickel/Herne-Zentrum (15)” exit. Now turn left in the direction of Herne-Zentrum. After about 250 m, please turn left onto Regenkamp street. After 25 m you will reach the INEOS Solvents Herne plant in the Shamrockstraße.

If you are coming from the **south**, please follow Autobahn 43 in the direction of Münster. Exit the autobahn at the “Herne-Eickel/Herne-Zentrum (15)” exit. Now turn right in the direction of Herne-Zentrum. After about 100 m, please turn left onto Regenkamp street. After 25 m you will reach the INEOS Solvents Herne plant in the Shamrockstraße.

3.3 Marl plant

3.3.1 Description

Our plant in Marl is situated in the Marl Chemical Park and has two production facilities (acetylene plant and butanediol plant) and an acetylene gasometer.
The plant produces acetylene, tetrahydrofuran (THF), formaldehyde, 1,4-butynediol, 1,4-butenediol, and 1,4-butanediol. These products are used to manufacture plastics for the automotive, electrical, textile, and pharmaceutical industries, among others. Acetylene is obtained by cracking liquid gas (butane, propane) in an electric arc followed by separation using various chemical and physical methods.
1,4-butanediol is produced from acetylene, formaldehyde, and hydrogen through reaction with a catalyst followed by hydrogenation and distillation. THF is produced from 1,4-butanediol under the influence of catalytic acid and water splitting. The resulting THF is then purified by distillation.

There are some residential buildings located directly next to the Chemical Park.
The Chemical Park is secured against unauthorized access by a fence and guarded entry gates.

Figure 35: Bird’s eye view of the Marl Chemical Park

Figure 36: Acetylene plant

Figure 37 and 38: Butanediol plant

3.3.2 Organization

Within the framework of the environmental management system, the responsibilities, tasks, and competencies are clearly defined, and not only for environmental protection issues. The management is ultimately responsible for the company and the plant. They ensure the application and efficiency of the environmental management system. Management obtains expert advice regarding their duties from a variety of officers (see also section 3.3.5.1). The officers support the managing director responsible for operations the when performing internal controls.

An operations manager heads the operations of the company. The plant manager in Marl is subordinate together with the Production, Technology / Projects / Engineering, and SHE-Q departments.

The plant manager, through the operations manager, the plant manager, and the operational teams, ensures that the production facilities operate as intended.

The Logistics department is responsible, among other things, for the storage and loading of raw materials and products.

The head of the technical department is responsible for the maintenance, inspection, and repair of the plants.

The SHE-Q department is responsible for coordinating activities in the areas of emission control, wastewater, waste, fire protection, and plant security. It also acts as a representative of the site for authorities and maintains the neighborhood contacts. The SHE-Q department's tasks also include maintaining and monitoring the integrated quality, environmental, energy, and safety management system. Product quality control is performed in the Laboratory department, which is also part of this organizational unit.

The Human Resources department is responsible for selecting and monitoring employee training in coordination with the heads of the individual organizational units.

The INEOS Solvents Marl GmbH is represented by two managing directors. The tasks of the management system including the system manager position are provided by the SHE-Q department at the Marl site. In cooperation with the Operations department, the Technology department deals with the improvement and optimization of the production processes and the plants.

3.3.3 Products and their applications

The following products can be manufactured at the Marl site in the annual quantities specified in Table 17:

Table 17: Products

Production	Annual Quantity
Formaldehyde	approx. 75,000 t
Butanediol group (B1D, B2D, B3D)	approx. 120,000 t
Tetrahydrofuran	approx. 50,000 t
Acetylene	approx. 40,000 t
Crude benzene	approx. 3,300 t
Hydrogen	approx. 7,000 t

Over the past four years from 2017 to 2020, the total production volumes were as shown here:

The annual tonnages shown in Fig. 39 were used to calculate the specific values, i.e. the values per ton of product stated in the following chapters on performance indicators.

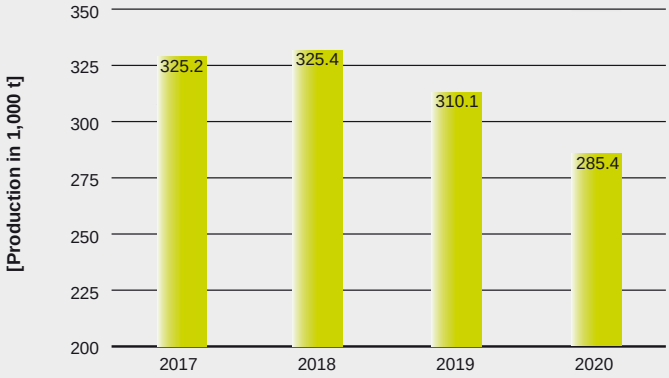


Figure 39: Production volumes

Using liquefied gases (LPG / butanes / propane) as starting materials, acetylene and, as a by-product, technical benzene and hydrogen are produced in an electric arc process. The acetylene is then reacted with formaldehyde, which is also produced at the site, to produce the dihydric alcohol 1,4-butynediol.
The main product 1,4-butanediol is then produced from this through hydrogenation. Tetrahydrofuran is then produced through the addition of sulfuric acid. These main products are produced on a contract basis for the internal customer.

The range of applications for the products of INEOS Solvents Marl GmbH and their downstream products is wide.
The most important area of application is polyester production, i.e. the manufacture of temperature-resistant plastics for automobile production and household goods.
The products are also used, for example, to improve the properties of skin creams or in the building trades to bond PVC films.

3.3.4 Production processes and raw and auxiliary materials

The **acetylene production** process requires large amounts of energy and raw materials. Numerous substances and large amounts of energy (waste heat) are generated as by-products.
In order to implement the concept of environmental protection, resource conservation, and a correspondingly cost-effective production, various processes are applied to utilize by-products (e.g. oil, gasoline, carbon black oil, carbon black, etc.). This is done as described below:

- For the most part in neighboring operations (synthesis gas plant, power plant).
- Wastewater is pre-cleaned in the company's treatment plant (solids filter, hydrocarbon stripping). The hydrocarbons recovered are fed into the process. They are then discharged into the chemical park's wastewater treatment plants.
- Solid waste is sent to a waste management company for recycling or disposal.
- Waste gases - unless they are fed back into the process - are fed into the site's gas collection network and incinerated.
- Waste heat is recovered using heat exchangers (steam and hot water generation).
- Parallel to this, there is a continuous process of improvement (group work, suggestions for improvement, training) to optimize environmental protection and resource conservation.

The acetylene plant is divided into a total of nine plant sections, with the first three sections forming the so-called "hot section", the next five the "cold section", and all auxiliary and ancillary equipment is combined into the ninth section. Each plant section comprises at least one complete process step.
Since the capacity of a single electric arc furnace is limited, the generation of cracked gas, the "dry" cooling of the gas, and the dry soot separation are carried out on four trains. The transition to one train is performed during the oil washing phase. In the rest of the plant, only the cracked gas compression and the caustic soda scrubbing areas have a reserve unit that can be used as a second train.

The **butanediol plant** is integrated into the combined system of the Marl Chemical Park. Raw materials and energy are utilized in a combined structure to ensure as much resources as possible are conserved.
The condensates resulting from the use of HP steam are energetically reused at lower pressure levels or as feed water for the generation of steam. Process water is collected at several points and either returned to the process, used as cleaning water, or disposed of in an environmentally compatible manner. The volume of waste is reduced through technical measures.
The waste streams still generated are collected at suitable locations in cooperation with the operator of the chemical park, Evonik, and stored for collection by a waste management company.

In the two formaldehyde lines, formaldehyde is produced through catalytic oxidation of methanol in the gas phase. The formaldehyde is washed out of the gas mixture with water in absorbers and separated as an aqueous solution. The resulting waste gases are fed into the thermal or catalytic afterburner system. The combustion energy is used to generate steam.
The input materials are obtained as follows:

- Air is extracted from the ambient air via compressors as used as an as oxidant.
  The impact on the environment due to noise is prevented by enclosing the compressors.
- Methanol is available at all times via a pipeline from Evonik's port tank farm. When the methanol tank in the port tank farm is being filled, the vapors are recovered or the residual gas is processed through thermal post-combustion.
- The reaction takes place on a fixed bed catalytic reactor.
- During startup, the reactor is heated electrically.
- The energy from the exothermic reaction is used to generate steam. The heat from the afterburner systems is also used to generate steam.
- The formaldehyde solution obtained is filled into tanks for sale or further processing.

This further processing takes place in the butanediol lines.
Through the addition of acetylene, the formaldehyde is catalytically converted in aqueous solution to 1,4-butynediol. The resulting butynediol is either offered for sale after dehydration and purification or converted to the crude product, e.g. 1,4-butanediol, by a two-stage hydrogenation process.
Hydrogenation is performed in a medium pressure stage on a stirrable nickel catalytic reactor and in a high pressure stage on a fixed-bed catalytic reactor containing nickel.

The additives necessary for further processing of the formaldehyde are obtained as follows:

- Acetylene is provided by the acetylene plant to the butanediol plant via a pipeline. The pipeline is constructed in accordance with TRAC.
- Catalysis for butynediol synthesis is carried out using a stirrable catalyst as the active component. After the reaction, the catalyst is separated by filtration and returned to the reaction stage. A partial flow of the separated catalyst is treated continuously by a catalyst preparation system and then fed back into the process.
- To separate salts from the crude butynediol, the product is purified using anion and cation exchangers. These ion exchangers are regularly regenerated using diluted acids or bases.
- INEOS Solvents Marl GmbH is also supplied with hydrogen by Evonik via a pipeline. The pressures required in the hydrogenation stages (20 bar, 200 bar) are already present in the pipeline or are generated by compressors. The hydrogenation of butynediol is carried out with hydrogen using nickel as a catalyst in the medium-pressure stage. After the reaction, the catalyst is separated by decantation and reused.
- In the high-pressure catalytic hydrogenation system, the reaction takes place on a fixed-bed catalytic reactor containing nickel. The temperature required for the reaction is produced using self-generated steam or using steam from the Evonik network.

The resulting product is then purified by distillation.

A partial flow of the previously obtained 2-butyne-1,4-diol is partially hydrogenated in the reactor integrated into the medium pressure hydrogenation system of the butanediol plant with the aid of hydrogen. The 2-butene-1,4-diol (B2D) obtained is dehydrated first in the distillation columns for B2D and then purified in a second step.

For tetrahydrofuran production, butanediol is catalytically dehydrated through the addition of sulfuric acid. The sulfuric acid required for this process step is purchased. Steam from the steam network is used for heating. After dehydration and purification, the pure product is ready for sale.

To manufacture its products, the production site primarily uses methanol, LPG, oxygen, and other basic chemicals as well as electricity.

Figure 40 below provides an overview of the production scheme at the Marl site:

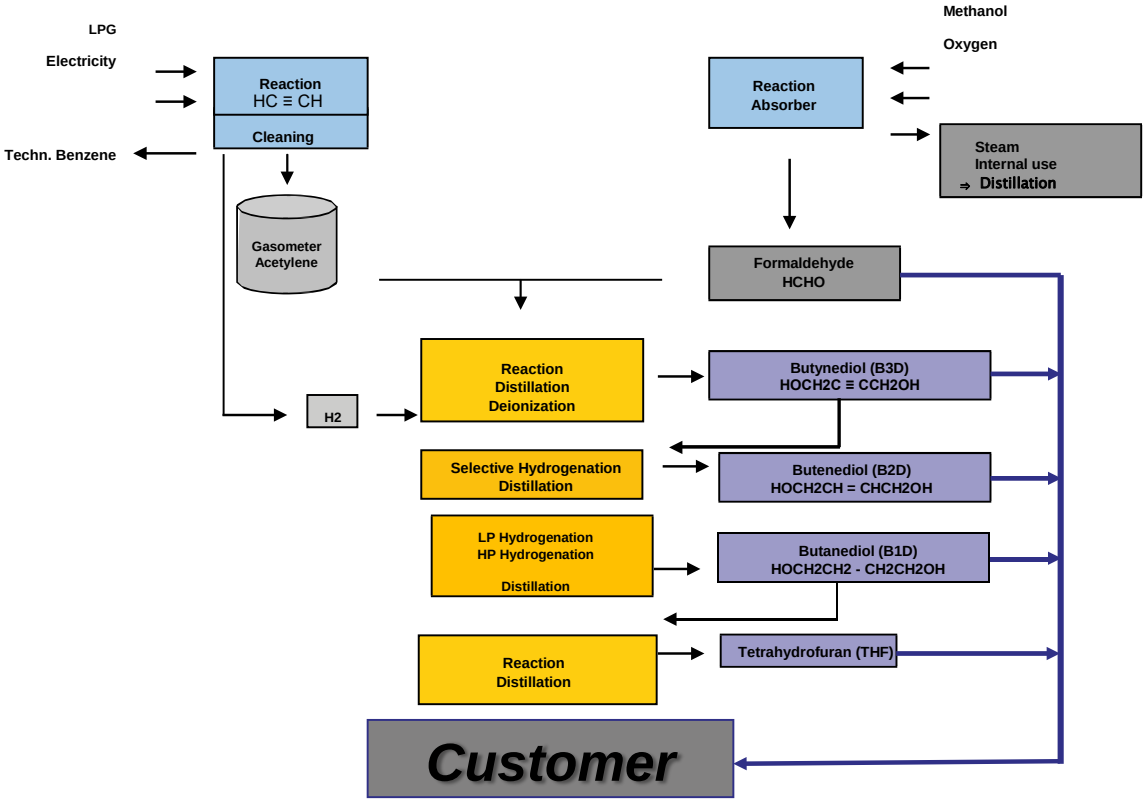


Figure 40: Marl production scheme

The majority of the products manufactured are transported by tanker trucks, ship, or rail tank cars. A very small portion of the products manufactured are filled in drums. The good connection to the waterway (the port in the Marl Chemical Park) ensures that local residents are less affected by truck traffic to and from the plant.

Both plants are supplied with the auxiliary materials nitrogen, hydrogen, and demineralized water via permanently installed pipelines in the Marl Chemical Park. Other important raw materials for the two plants are methanol and liquefied gas, for example. The auxiliary materials include sulfuric acid and caustic soda. The consumption of raw materials and auxiliaries (see Table 18) is constant most of the time due to the largely continuous operation of the plants.

Table 18: Raw and auxiliary materials

Raw/Auxiliary Material	Annual Quantity
Liquefied gas (butane)	approx. 50,000 t
Methanol	approx. 85,000 t
Heavy heating oil	approx. 27,500 t
Propane, octane, caustic soda (25%), propylene, sulfuric acid, demineralized water	100 to 1,000 t each
Various fine and specialty chemicals, catalysts	10 to 100 t each

3.3.5 Environmental protection and safety at the Marl site

3.3.5.1 Company officers

The topic of environmental protection is a top priority at the Marl site. The responsibilities for environmental protection are distributed throughout the entire organization as already presented in section 3.3.2:

- Environmental officers appointed externally by the site for the following legal areas:
  - Immission Control Officer (Art. 53 ff BImSchG)
  - Hazardous Incidents Officer (Art. 58a ff BImSchG)
  - Water Protection Officer (Art. 64 ff WHG)
  - Waste Management Officer (Art. 59 ff KrWG)
- 2 officers for limiting the effects of hazardous incidents (Art. 12(1) StörfallV)
- 1 Dangerous Goods Officer (Art. 1 GbV)
- 1 qualified person (Art. 11 ChemVerbotsV)
- 1 qualified person for working with asbestos according to TRGS 519, Annex 4C/4A/4B
- 1 qualified person according to Annex II REACH
- 1 Safety and Health Coordinator according to Annex B+C of BaustellV
- 1 Fire Safety Officer (No. 5.12.3 IndBauRL NRW)
- 1 Explosion Protection Officer (No. 5.12.3 IndBauRL NRW)
- 1 Occupational Physician (Art. 2 ASiG)
- 2 Occupational safety specialists (Art. 5 ASiG)
- approx. 20 safety officers (Art. 22 SGB VII)

The officers support the management and the site managers within the scope of their legally defined function as operations officer.

- They act in an advisory and proactive capacity and propose specific measures to improve environmental protection and safety standards.
- They monitor and document compliance with environmental protection and safety regulations, permit requirements, voluntary commitments, and internal regulations.
- They report regularly on their activities, in particular on the status of environmental protection and safety, and prepare annual reports. If a need for action is identified, then the persons responsible ensure remedial action is taken.
- The officers are involved in informing all employees about current changes to legislation, environmental impacts, and possible optimization measures.
- When planning projects that affect their area of responsibility, they are involved in good time so that their opinion can be taken into account in upcoming decisions.

To the extent necessary to perform their duties, the officers shall be provided with adequate material and financial resources as well as personnel.

3.3.5.2 Fire protection and technical assistance

Preventive fire protection measures that have already been taken into account during the planning of plants, potential improvements that are subsequently identified during regular fire inspections, as well as the monitoring of our plants (e.g. by continuous measuring equipment such as Ex meters or regular plant tours by the operating personnel) minimize the possible risk of fires in the plants. In addition, there are stationary fire alarm systems as well as the mobile equipment belonging to the plant fire department, for example fire trucks that are equipped with the necessary technology. Fire protection concepts throughout the entire Marl Chemical Park are continuously improved in close coordination with the relevant supervisory authorities.

In addition to these technical measures, effective emergency response procedures are also required to enable the necessary safety measures to be taken quickly in case of danger from the substances processed in the plants. Essential components of our emergency response are:

- A plant fire department appointed acc. to Article 12(1) StörfallV that is responsible for the entire Marl Chemical Park (these firefighters are not only responsible for fire prevention and protection, but also regularly check part of the environmental impact of the site and are immediately called upon to respond to questions and complaints from the neighborhood).
- On-call emergency service (on duty physician/fire chief) consisting of qualified managers who coordinate the necessary measures on site in the event of an emergency and, if necessary, summon any additional help required.
- On-call emergency service in the departments
- Alarm and emergency response plans that define the reporting channels for notifying emergency responders and authorities so that measures to protect the public can be initiated.

The plant fire department at the Marl Chemical Park is a member of TUIS, which is a nationwide, voluntary transport accident information and emergency response system of the German chemical industry that is deployed in the event of transport and storage accidents involving hazardous substances. TUIS supports public fire departments, the police, and other authorities. They can request advice, experts, and special equipment around the clock, 365 days a year.

The effectiveness of the measures described was demonstrated in several exercises involving all relevant departments of the plant as well as the on-call emergency service and the plant fire department.

3.3.5.3 Occupational and plant safety

The topics of occupational safety and plant safety also play an important role in environmentally friendly and sustainable production. As already mentioned in section 3.3.5.1 “Company officers”, all officers have been appointed in accordance with the German Occupational Health and Safety Act (ArbSchG) and Social Code Book VII (SGB VII). These persons and the responsible managers fulfill their tasks with great dedication. The employees act with the necessary care and caution.

Our production facilities for manufacturing chemical products are subject to the Federal Immission Control Act and have been approved by the authorities. The two plants operated by INEOS Solvents Marl GmbH at the Marl Chemical Park also constitute operational areas in accordance with the Hazardous Incident Ordinance. Accordingly, a safety report as well as a general safety concept have been submitted to the authorities.
Alarm and emergency response plans exist for the operations of INEOS Solvents Marl GmbH and for all other operations in the Marl Chemical Park in which measures, training, and exercises are defined in order to be able to react correctly to the consequences of an event. In cooperation with the city of Marl, the fire department and the police, we have jointly defined tasks and responsibilities in case of an emergency and have taken measures to protect the population. These measures can be, for example, suppressing gaseous substances with a spray mist, covering liquid substances with spray foam, or extinguishing fires by the plant fire department. The plant fire department can reach any location in the Marl Chemical Park in less than five minutes. The city of Marl directs the emergency response measures in the affected areas of the city that are outside the chemical park.
It warns the population and is responsible for evacuations, if necessary. In the event of an incident, neighbors are informed of the location of the incident in announcements on Twitter or the Internet and in the local media.

3.3.5.4 Environmentally relevant incidents

During the reporting period, there were two water events according to the State Water Act of North-Rhine Westphalia:

- On 29 July 2018, approximately 20 kg of Cu catalyst was released into the sewer.
- On 27 June 2019, an increase in benzene and styrene levels was detected in the influent at the wastewater treatment plant.
  Due to an unplanned drop in the tank level, approx. 250 kg of process wastewater was released into the sewer.
  Emissions from the wastewater sewer occurred at various locations in the chemical park.

Despite the measures described in sections 3.3.5.1 to 3.3.5.3, though, various other non-notifiable disruptions to the normal operation of the plants occurred during the reporting period, some of which involved local releases of substances. However, none of these events led to a serious hazard in the sense of the Hazardous Incidents Ordinance or to a significant environmental impact because the internal rescue and emergency services intervened promptly and effectively. Support from external emergency response crews was not required.
Internally, the causes of all incidents were identified and the necessary corrective measures were initiated to prevent them in the future.

In all cases, the concerns and worries of the residents were documented and the technical requirements and contexts explained to them. Wherever possible, the cause of the disruption was eliminated immediately. Furthermore, measures were initiated to prevent their recurrence.

3.3.5.5 Material properties

Most of the materials handled at the plant are subject to the Hazardous Substances Ordinance and the Hazardous Incidents Ordinance. However, since the materials are primarily located in closed systems and the facilities are always kept up to the state of the art, and in connection with the necessary protection measures for personnel and the environment, the risk involved in handling these substances is minimized. This is presented in detail in the relevant safety reports, which have been duly submitted to the corresponding supervisory authorities.

Overall, the material properties can be divided into four hazard groups:

- Fire and explosion hazards
- Health hazards, poisoning hazards
- Chemical burn hazards
- Environmental hazards

In addition, substances are classified according to their degree of water hazard. For this reason, most of the substances used in the plant are classified in **W**ater **H**azard **C**lass 1 (WHC 1: slightly hazardous to water), for example tetrahydrofuran, sulfuric acid, and caustic soda. To a lesser extent, there are also substances classified in WHC 2 (clearly hazardous to water), for example formaldehyde. The legal requirements imposed on WHC 3 (highly hazardous to water), for example benzene, methanol, and carbon black oil, have also been implemented in the affected areas.

Table 19: Properties of the substances handled at the Marl plant

Hazardous Substances Group	Hazardous Substance Symbol	Signal Word	Substance (occurrence)	Potential Hazards	Precautions
Flammable substances (Cat. 1)		Danger	**Acetylene** (ACE, B1D plant) **Propene** ACE plant **Butene** ACE plant **Butane** ACE plant **Propane** ACE plant **Natural gas** (B1D plant) **Hydrogen** (ACE, B1D plant)	"extremely flammable"; explosive mixtures can form with air.	Keep away from heat / sparks / open flames / hot surfaces. No smoking.
Flammable substances (Cat. 2)		Danger	**Octane** ACE plant **Heating oil EL** ACE plant **Tetrahydrofuran** (B1D plant)	"highly flammable"; Vapors can form explosive mixtures with air.	Keep away from heat / sparks / open flames / hot surfaces. No smoking.
Substances hazardous to health		Danger	**Heavy heating oil** ACE plant **Dry soot** ACE plant **Nickel** (ACE, B1D plant) **Formaldehyde catalyst** (B1D plant) **Thermal oil** (B1D plant)	Respiratory sensitization; mutagenicity, reproductive toxicity	Avoid contact with eyes, skin, and clothes using special protection measures; Do not inhale vapors!
Toxic substances		Danger	**Benzene** ACE plant **Methanol** (ACE, B1D plant) **N-methylpyrrolidon** ACE plant **Formaldehyde** (B1D plant) **Butynediol solution** (B1D plant)	Toxic by inhalation, skin contact, and if swallowed	Avoid contact with eyes, skin, and clothes using special protection measures; Do not inhale vapors!
Substances hazardous to health		Danger	**1,4 butanediol** (B1D plant) **2-butenediol-1,4** (B1D plant) **1,2-ethanediol** (B1D plant) **High pressure catalyst** (B1D plant)	Hazardous to health if swallowed	Avoid contact with eyes, skin, and clothes using special protection measures; Do not inhale vapors!
Environmentally hazardous substances		Caution	**Butylhydroxytoluene (BHT)** (B1D plant) **Catalyst** (B1D plant)	Very toxic to water organisms; with long-term effects	Keep container tightly closed; do not allow to enter sewage system or bodies of water!

3.3.5.6 Production-related emissions

The acetylene plant produces emission-free.
Due to regulatory requirements, thermal post-combustion of gases recovered from tanks is performed. Due to the use of the low-emission fuel natural gas and the predominantly closed systems, only comparatively small quantities of production-related emissions are released.
Emissions of volatile organic compounds (VOCs) are kept to a minimum through the use of zero-emission or low-emission pumps and sealing systems.

The emission quantities of all plants are regularly reported to the supervisory authorities as part of the emission declarations.

3.3.5.7 Waste

The following main waste fractions are generated at the Marl site:
- For recycling/reuse: Liquid by-products
- For disposal: Used catalysts and replaced insulation and insulating materials.

The liquid by-products, such as the carbon black oil produced during flue gas scrubbing, are recycled in another plant at the chemical park. Other liquid by-products, such as still bottoms, are thermally recycled in the chemical park's power plants.

Waste is collected and separated wherever possible so that the recycling rate is about 99% (see also section 3.3.6.2). Certified waste management companies are employed to dispose of the waste in accordance with the statutory requirements.

3.3.5.8 Energy

The energies primarily required are electricity (acetylene plant) and steam (butanediol plant).
The electric power and steam (so-called high-pressure and medium-pressure steam) required for the chemical processes are obtained from the chemical park's integrated network, which is mainly fed by the chemical park's power plants, which run on coal and natural gas as well as liquid and gaseous by-products. Steam serves as a heating medium for the production processes.
Natural gas is mainly consumed in the butanediol plant to operate the thermal afterburning system. The compressed air consumption of both plants is more or less insignificant in terms of energy consumption.
The waste heat generated in the plants is dissipated via two re-cooling plants whose fresh water requirements have been minimized by optimizing the cooling water treatment system. Steam and hot water are generated from a portion of the waste heat from the INEOS Solvents Marl plants, and excess steam and hot water are fed into the corresponding network of the chemical park. The amount of recooling water consumed is mainly used to the dissipate the heat energy generated in the butanediol plant. It is almost impossible to influence the amount of heat energy generated. The recooling water available is at an unfavorable temperature that is too low. The energy from it cannot be used in an economically viable way at present time.

In the future, the chemical park's coal-fired power plant will be replaced by another gas-fired power plant, which will further reduce the resulting pollutant emissions.

3.3.5.9 Water and soil protection

3.3.5.9.1 Water use

The water supply for the Marl site is ensured by the water network of the chemical park

Circulation water, which is cooled in recooling plants, is used for the most part to cool the production equipment. These recooling plants are owned and operated by Evonik.

3.3.5.9.2 Wastewater

The wastewater generated during production is sampled in a continuous process (ORI water samplers) when it is discharged to the plant's sewage system. Joint treatment with wastewater from the other companies at the site is then performed in the chemical park's wastewater treatment plants.

The wastewater from the individual plants is discharged - where necessary - via light liquid separators into the plant's own sewer system. Fluctuations in the pH value are compensated for through the addition of bases. The in-house sewer system is inspected and, if necessary, repaired in accordance with the regulations of the Self-Monitoring Ordinance for wastewater. The wastewater is discharged into the chemical park's sewer system from a central collection point in the corresponding plant. In the event of malfunctions or when limit values are exceeded, the central gate valves of the corresponding plants are closed and the wastewater is slowly discharged into the chemical park's sewer system following a detailed analysis or, when limit values are exceeded, pumped out and disposed of externally in coordination with the chemical park's wastewater disposal department. If limit values are exceeded, the wastewater disposal department of the chemical park has the option of temporarily storing the contaminated quantity in a wastewater retention basin. It can be subjected to targeted treatment there or returned to the normal wastewater flow once the reason for exceeding the limit value has been eliminated.

The use of fresh water is minimized by recirculating production water. In the production plants, the contamination of wastewater with organic and inorganic components is kept as low as possible through suitable process control.

Any product that leaks out is drained off over paved surfaces and collected in catch basins or pits. This prevents the product from entering the soil and contaminating the groundwater. As clearly shown in sections 3.3.6.7 "Investments in environmental protection" and 2.3.2 "Objective", extensive work has been done in recent years to adapt the corresponding protection equipment to more advanced standards.

Uncontaminated precipitation water is discharged through the wastewater treatment plants into the Lippe River via the storm and cooling water sewer system.

3.3.5.9.3 Soil protection

Precautions have been taken and equipment installed on all areas used to reliably prevent soil and groundwater contamination: Tanks are installed in appropriately sized and sealed drip trays, liquid raw materials and products are loaded and unloaded in specially secured and leak-proof transfer buckets, and pipes carrying product are not laid in the ground but on pipe bridges so that leaks can be detected immediately.

In order to ensure the functionality of the sewer system structures and the corresponding facilities on the lots of both plants, tests are conducted in accordance with the Self-Monitoring Ordinance for Sewers (SüwVO).

According to Article 5 of the amended 9th BImSchV, an initial status report (ISR) documenting the condition of the soil and groundwater in the area of the planned modification must be submitted together with the application documents since January 2014 when planning major modifications to a plant that is subject to the Industrial Emissions Directive (IED). This requires relatively extensive analyses of the soil and groundwater in coordination with the district government of Münster. The ISR for the acetylene plant area is already being written. So far, no indications of soil and groundwater contamination by the substances currently handled at the plant have been found.

3.3.5.9.3.1 Contaminated site situation, butanediol plant

The property on which the butanediol plant is located, for which we have a leasehold from Evonik Real Estate, is divided into two lots:

- Lot 19 008: 39,774.3 m^2
- Lot 19 200: 36,896.0 m^2 Total area: approx. 7.7 ha

The leasehold agreement contains no mention of contaminated sites.
Detailed analyses of the soil are only performed for reconstruction or new construction measures.

3.3.5.9.3.2 Contaminated site situation, acetylene plant

The property on which the acetylene plant is located, for which we have a leasehold from Evonik Real Estate, is divided into two lots:

- Lot 05 006: 13,637 m^2
- Lot 05 202: 6,522.4 m^2 Total area: approx. 2 ha

The leasehold agreement contains no mention of contaminated sites.
Detailed analyses of the soil are only performed for reconstruction or new construction measures.

3.3.5.10 Noise and odor

The two plants of INEOS Solvents Marl are located in the Marl Chemical Park, which in turn is located about one kilometer away from residential areas. An internal noise register was created that documents all sources of noise. For new construction or modification projects, a noise emission forecast is produced in advance with the aid of dispersion calculations. After completion of the projects, noise measurements are taken to verify that noise levels are within the approved limits.

When selecting machines or equipment, care is taken to ensure that the units are as quiet as possible. Where necessary and possible, machines and plant components are retrofitted with soundproofing and are encapsulated or enclosed.

When an event that includes an odor nuisance occurs, our alarm and emergency response plans come into effect. Emission measurements are carried out immediately using the emission measuring vehicle so we can issue a statement on the potential hazards. If it cannot be ruled out that there will be an impact on an area outside the Marl Chemical Park, then we inform the local authorities. The local authorities are in constant contact with us and agree on measures.

3.3.5.11 Storage, loading, and transport

The finished products are stored in tanks that are installed in drip trays to contain any product that may leak in accordance with water regulations. In addition, measures have been taken to minimize emissions. These measures include connection of the acetylene plant to the central gas collection system of the chemical park and the operation of thermal afterburners in the butanediol plant.

Emissions generated while filling the tank with product are extracted and fed into the central waste gas collection system of the chemical park or into the thermal afterburners. Overfill protection, drainage surfaces, and catch basins prevent product from entering the soil when loading.
If no special measures to adequately prevent products from entering into sewers or the soil have been taken, then the filling, decanting, and emptying of containers may only be carried out in the plant drip trays.

The following are transported within the Marl Chemical Park:
- B1D, B2D, CH_2O, and THF in tank containers and tanker trucks as well as rail tank cars
- B1D by pipeline to the port tank
- Waste products in hobbock containers.
- THF / B1D in drums
- Empty 200 l recycling drums are loaded upright but loosely onto trucks with side panels.
- Technical benzene by tank container
- BxD / THF residue per tank container

Off-site transportation, shipping:

- B1D, B2D, CH_2O, and THF in tank containers and tanker trucks as well as rail tank cars
- B1D from the port tank by barge
- B1D / THF / B2D in drums
- B1D in IBCs
- B3D solution in IBCs and drums and solid B3D in bags or drums.
- Waste catalyst in drums
- Waste materials and B3D solution in drums
- B1D / THF / B2D in drums
- B1D in IBCs
- B3D (solid) in 25 kg bags or in 200 l / 60 l drums
- B3D (solution) in IBCs
- Technical benzene by tank container
- BxD / THF residue by tanker truck

The use of tanker trucks, rail tank cars, and reusable recyclable drums for the liquid products and big bags and drums for the solids avoids or reduces corresponding packaging waste when delivering our products to our customers. The packaging materials of our products (e.g. drums) can be properly recycled by our customers at packaging material recyclers (such as Interseroh).

By selecting suitable shipping company and inspecting all vehicles as well as the transport documents, we ensure the safe transport of our products to our customers.

Furthermore, since some of our products are transported by ship from the chemical park’s port, the impact of traffic on local residents is lower.

3.3.6 Performance indicators 2017 - 2020

3.3.6.1 Material efficiency / production

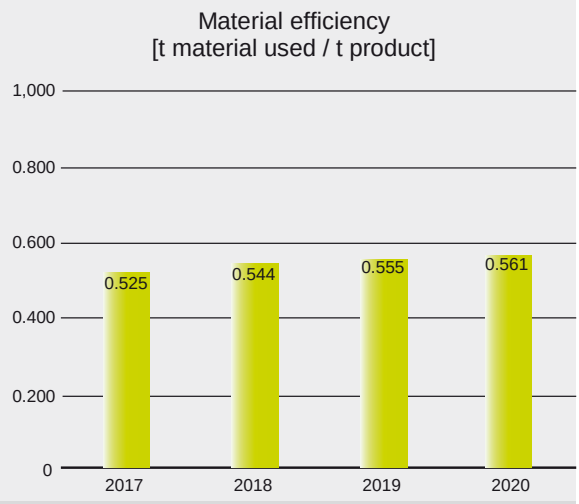


Figure 41

The annual tonnages shown in Fig. 39 (see section 3.3.3) were used to calculate the specific values, i.e. the values per ton of product stated in this section and the following sections.

The specific raw material requirement depends, among other things, on the quantitative proportions in the entire product range and shows a slightly increasing trend in the four-year period under review despite some efforts to increase raw material efficiency (see Fig. 41). In accordance with the new environmental program (see section 2.3.2), further improvement measures are planned for the coming years.

3.3.6.2 Waste

Table 20: Waste quantities

Waste fraction		2017	2018	2019	2020
	Production quantity [1,000 t]	325.2	325.4	310.1	285.4
	Total waste quantity [1,000 t]	45.409	49.179	47.871	47.919
1	Hazardous wastes [1,000 t]	44.562	48.943	47.730	47.758
1a	Material recovery of hazardous wastes [1,000 t]	24.313	27.484	26.160	21.270
1b	Thermal recovery of hazardous wastes [1,000 t]	20.117	21.195	21.402	26.210
1c	Hazardous wastes eliminated [1,000 t]	0.132	0.263	0.167	0.278
2a	Other wastes recovered [1,000 t]	0.203	0.168	0.126	0.138
2b	Other wastes eliminated	0.644	0.069	0.015	0.023

As shown in Table 20, production-related waste volumes have remained at a fairly constant level over the past four years (see Figure 42).

In the past four years, we have been able to recover about 98% to 99% of all energy or material waste. Specialized disposal companies are predominantly used for disposal.

Figure 42

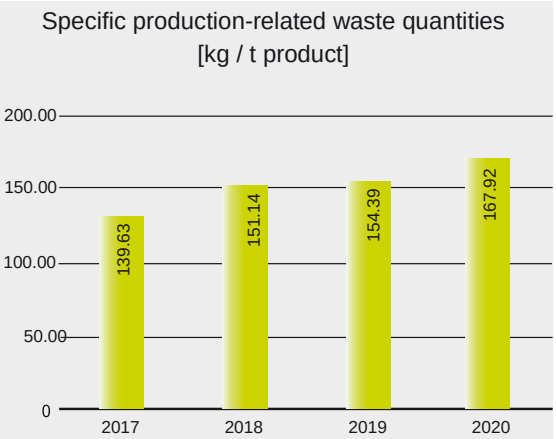


Figure 43

Table 21 below shows the five largest waste fractions for 2020. These accounted for 93% of the total waste generated. Table 21A shows waste fractions by waste type and quantity for 2020.

Table 21: Waste fractions 2020

EWC code	Waste description	Quantity [t]	Portion of waste fraction according to Table 20
13 07 01*	Heating oil and diesel	13,854	1a
07 01 08* 07 02 08*	Other still bottoms and reaction residues	13,479	1b
13 02 05*	Mineral-based non-chlorinated engine, gear, and lubricating oils	7,402	1a
13 07 01*	Heating oil and diesel	5,592	1b
13 07 03*	Other fuels (including mixtures)	4,365	1b
Total		44,692	
Percentage of the total waste volume		93%	

* Hazardous waste

Table 21A: Waste fractions by waste type and quantity for 2020.

Waste type according to WCO chapter	Waste description	Quantity [t]
13	Oil wastes and wastes of liquid fuels (except edible oils, and those in chapters 05, 12, and 19)	33,934
07	Wastes from organic chemical processes	13,537
17	Construction and demolition wastes (including excavated soil from contaminated sites)	370.15
15	Waste packaging, absorbents, wiping cloths, filter materials, and protective clothing (n.o.s.)	47.265
16	Wastes not otherwise specified in the list	28.492
19	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use	1.06
20	Municipal wastes (household waste and similar commercial, industrial, and institutional wastes) including separately collected fractions	0.583
11	Wastes from chemical surface treatment and coating of metals and other materials; non-ferrous hydro-metallurgy	0.1
	Total	47.919

3.3.6.3 Water

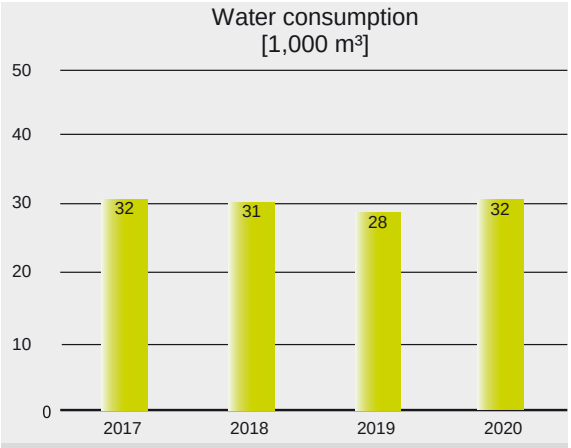


Figure 44

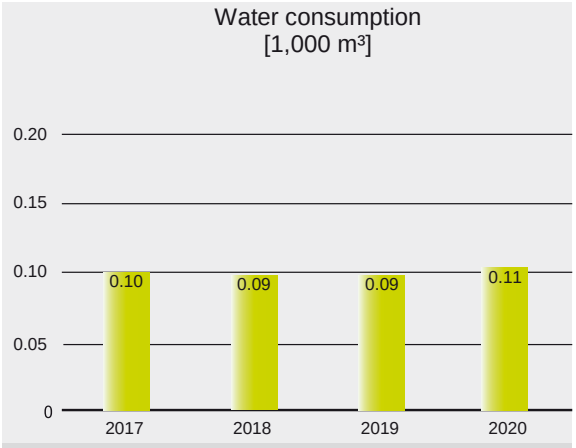


Figure 45

The absolute freshwater consumption has been constant over the four-year period under review (see Figure 44). The specific cooling water consumption increased slightly in 2020, but is at a very low level (see Figure 45).

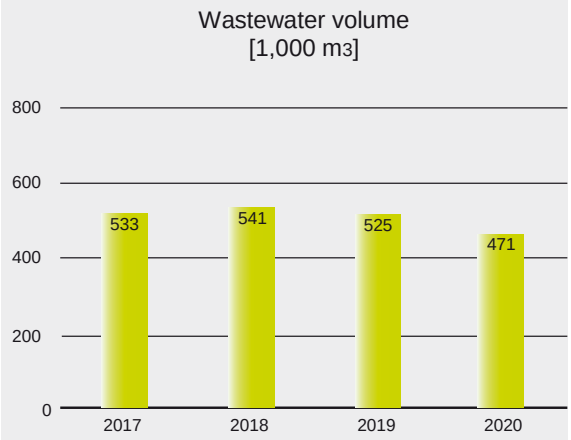


Figure 46

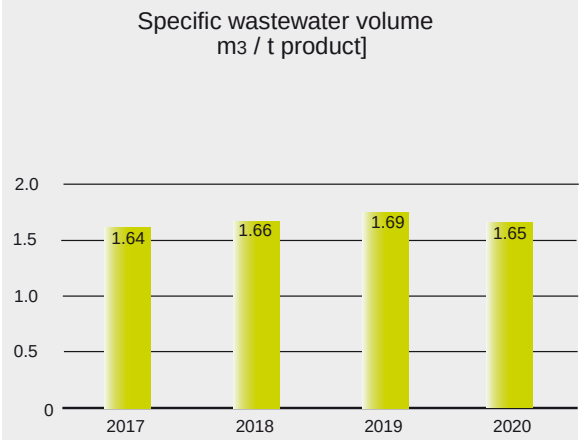


Figure 47

In parallel with the production volumes, the absolute wastewater volumes have decreased from 2018 to 2020 (see Figure 46). As a result, the specific wastewater volumes (see Figure 47) remained at a relatively constant level from 2017 to 2020.

3.3.6.4 Energy

We use the energy sources shown in Fig. 48 to manufacture our products, of which electrical power accounts for the largest share. The second largest energy source is steam purchased from the chemical park. Renewable energies are not used.

The specific energy consumption (see Fig. 49) increased from 2017 to 2020. This depends on the product mix, but also on plant utilization. In some areas, more attention is being paid to the energy-efficient operation of the production facilities. Some savings have already been achieved here, especially in 2020.

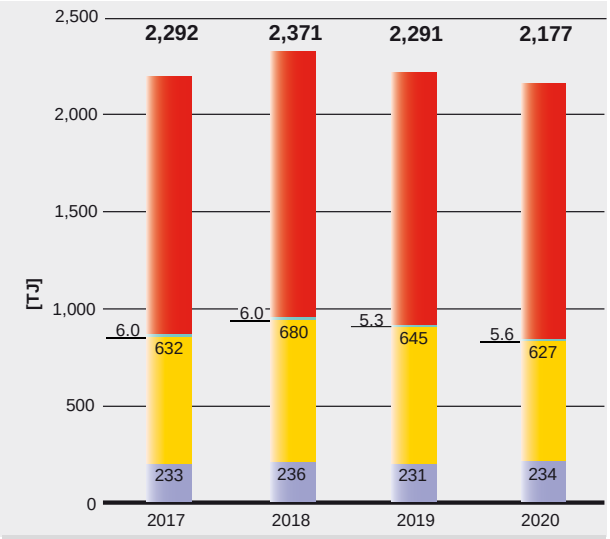


Figure 48: Energy consumption

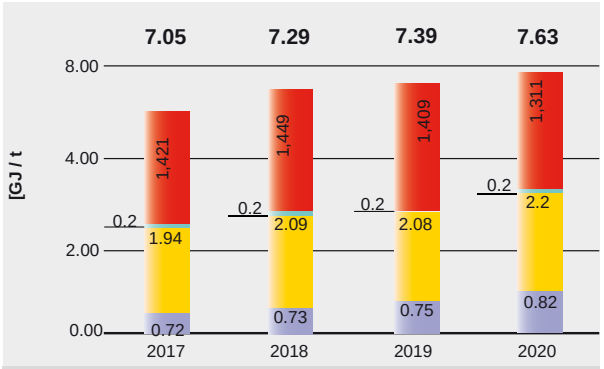


Figure 49: Specific energy consumption

SEUs (Significant Energy Uses) were formed in the plants. This results in the energy performance indicators (EnPIs). The SEUs are as follows:

Area	SEU	
ACE	1	Electric arc reactors
ACE	2	Compressors
ACE	3	MP steam
ACE	4	LP steam
B1D	1	Formox power consumption
B1D	2	B1D distillation
B1D	3	B3D distillation
B1D	4	B2D distillation

In the area of electric arc furnaces, no discernible savings could be achieved in 2020. However, in the last quarter of 2020, after conducting intensive research of the literature, a series of tests was started to optimize the operation of the electric arc furnaces. These tests will be continued in 2021. The goal is to further optimize the load-dependent energy consumption.
Through improved continuous operation with a more constant operation under load made it possible to avoid power peaks in the area of the machines / compressors, resulting in a reduction of the specific power requirement of approx. 4.5% in 2020.

The specific demand for medium-pressure steam of the acetylene plant could be reduced by approx. 3.5% in 2020 compared to 2019.
By optimizing the load-dependent operation, the specific LP steam requirement of the acetylene plant could be reduced by approx. 7.5% from 2019 to 2020.
By decommissioning some stirrers, the electrical power requirement of the butanediol plant was reduced by about 1%. By optimizing the load-dependent operation, it was possible to save around 970 tons of high-pressure steam in the butanediol distillation process and 2850 tons in the butanediol distillation process in 2020.
The butenediol distillation process consumes comparatively little steam. In this case too, though, it was possible to reduce specific consumption by 2.7% in 2020.
Details on the energy consumption are documented in the energy management review.

3.3.6.5 Air

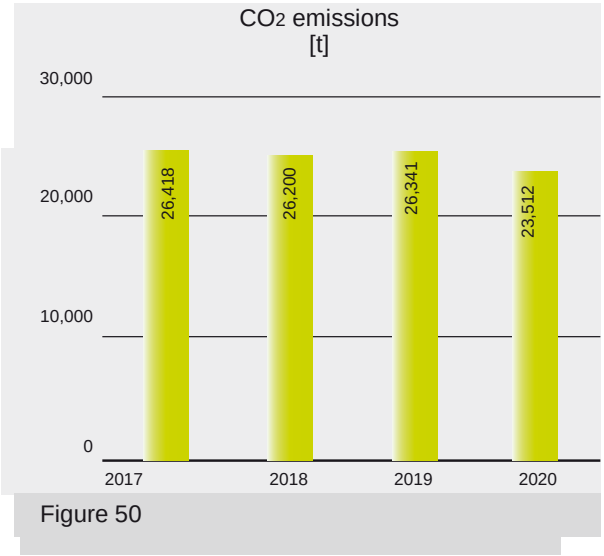


Figure 50

Figures 50 and 51 show the absolute and specific CO_2 emissions.

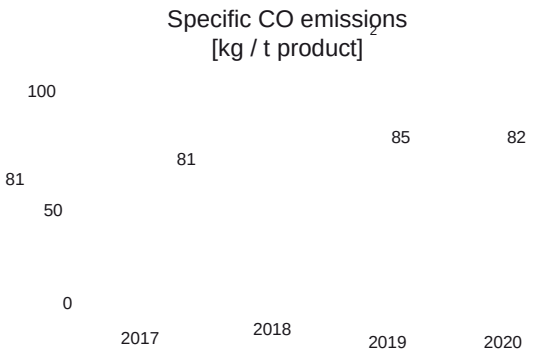


Figure 51

The CO_2 emissions are generated exclusively in the butanediol plant. The large majority of these emissions are generated during the production of formaldehyde. CO_2 emissions are monitored according to the European Greenhouse Gas Emissions Trading Scheme (EU ETS) and verified by an independent test institute. The acetylene plant operates completely emission-free.

Table 22: Other emissions

Year	2017	2018	2019	2020
	[kg]	[kg]	[kg]	[kg]
Non-methane volatile organic compounds (NMVOC)	842	717	865	1427
Carbon monoxide (CO)	1,564	1,516	1,721	1,980
Nitrogen oxides (NOx/NO_2)	11,198	11,164	11,188	11,742
Sulfur oxides (SOx/SO_2)	265	266	266	273
Total dusts	43.1	35.3	38.0	32.5
Fine dusts (PM10)	15.1	12.4	13.3	11.4
Fine dusts (PM2.5)	4.3	3.6	3.8	3.3
Copper and compounds (as Cu)	8.9	7.3	7.8	6.7
Benzene	0.292746	0.008571	0.000148	0.000246

Due to the low-emission fuel natural gas and the fact that most systems are closed systems, the air pollutants listed in Table 22 “Other emissions” are only produced in comparatively small amounts.

At the Marl site, various air conditioning systems and units are operated that contain partially halogenated hydrofluorocarbons (HFCs) as refrigerants. These substances have a much higher global warming potential than CO_2 and are therefore particularly in focus. During the mandatory regular maintenance of the equipment by a certified specialist company, minor refrigerant losses are sometimes detected. The conversion of these HFC emissions into CO_2 equivalents resulted in the values shown in Table 23. The higher value in 2018 resulted from the refilling of an air conditioning system.

Table 23: HFC emissions ACE & BDO

Year	2017	2018	2019	2020
CO_2 equivalent [t]	0.0	42.9	0.0	2.1

The greenhouse gases N_2O, HFC, NF_3 and SF_6 are not used at the site.
CH_4 is produced in technically tight systems and is also only used as a fuel.

3.3.6.6 Biodiversity

Activities at the premises of the INEOS Solvents Marl GmbH do not affect biodiversity because the various sites throughout the chemical park have been used for industrial purposes for more than 100 years.
The two plants operated by INEOS Solvents Marl GmbH in the Marl Chemical Park cover a total area of 9 hectares, most of which is built up.
An initial status report, including an inventory of sealed surfaces, is being prepared for the acetylene plant and should be completed by the end of 2021.

3.3.6.7 Investments in environmental protection

The expenditures for environmental protection measures vary greatly in the years from 2017 to 2020 (see Figure 52).
In 2020, the focus was on environmental protection measures for the construction of the residue incineration plant.
In previous years, for example, tank drip trays were refurbished in accordance with the requirements of the AwSV (Ordinance on Installations for Handling Substances Hazardous to Water). In addition, more energy-efficient equipment, for example pumps and LED lamps, was used. Furthermore, a monitoring system for more energy-efficient operation of the plants was installed in the control stations.

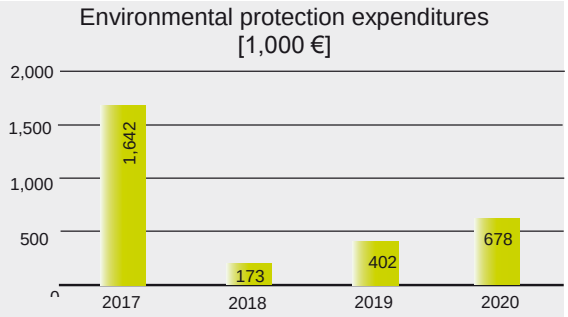


Figure 52

3.3.6.8 Improvements in the years from 2018 to 2020

Reduction of specific energy consumption

In several plant areas, it was possible to reduce the specific energy consumption. This is described in detail in section 3.3.6.4.

Implementation of the INEOS guideline on knowledge-based maintenance

Implementation of the INEOS guideline on knowledge-based maintenance has begun. The probability of substance releases, and therefore of damage to the environment, is reduced by targeted testing that goes well beyond the legal requirements.

New soot incineration plant

Construction of our residue incineration plant started in 2020. The plant will be commissioned in mid-2021. This will make it possible to thermally recycle waste ourselves and generate steam in the process.

3.3.7 Contact and directions to the site

You can also use the general contact options provided at any time.

INEOS Solvents Marl GmbH
Paul-Baumann-Strasse 1
45772 Marl

Phone: +49 (0) 2365 49-6065
Environmental and neighborhood telephone: +49 (0) 2365 49-5555
Email: info.solvents@ineos.com

We look forward to your call or visit.

How to find us: To the south of the chemical park is the A52 autobahn with access to the A43 autobahn.
There is a signpost for the A52 Marl-Zentrum exit with arrows pointing in the direction of the Marl Chemical Park.
Follow the Paul-Baumann-Strasse, you will see a sign for Gate 1.

ARRIVAL BY PUBLIC TRANSPORT

From Recklinghausen:
From Recklinghausen Main station, you can reach the Marl Chemical Park bus stop by taking bus route 223 in the direction of Marl-Mitte.

From Marl-Sinsen:
From Marl-Sinsen station, take bus route 222 in the direction of Gelsenkirchen-Buer to the Herzlia-Center Marl bus stop. From there, you can reach the Marl Chemical Park bus stop by taking bus route 223 in the direction of Recklinghausen.

4 VALIDITY DECLARATION

Declaration of the Environmental Auditor on the Verification and Validation Activities

The undersigned EMAS environmental auditor Dr. Rainer Sommer with registration number DE-V-0285, as an authorized signatory environmental auditor, accredited or licensed for the area NACE Code 20 “Manufacture of Chemicals”, confirms to have verified that the sites

Moers, Römerstrasse 733

Marl, Paul Baumann-Straße 1

Herne, Shamrockstraße 88

Duisburg, Rheindeichstraße 40

as described in the organizations’ Joint Consolidated Environmental Statement 2021

INEOS Solvents Germany GmbH
INEOS Solvents Mari GmbH und
Huntsman Products GmbH

with the registration number DE-120-00025
meets all requirements of the

Regulation (EC) No. 1221/2009

amended in Annex I, II, III by Regulation (EU) 2017 / 1505 and
in Annex IV by Regulation (EU) 2018 / 2026

of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organizations in a community scheme for the

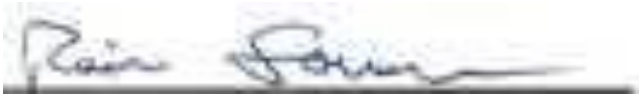
Environmental Management and Audit Scheme (EMAS).

By signing this declaration, it is confirmed that

- the verification and validation have been carried out in full compliance with the requirements of Regulation (EC) No 1221 / 2009.
- the outcome of the verification and validation confirms that there is no evidence of non-compliance with the applicable environmental regulations,
- the data and information in the environmental statement of the sites in Moers, Marl, Herne, and Duisburg provide a reliable, credible, and true picture of all the site’s activities within the scope specified in the environmental statement.

This declaration cannot be equated with an EMAS registration. EMAS registration can only be carried out by a competent body in accordance with Regulation (EC) No 1221/2009. This declaration is not allowed to be used on a stand-alone basis for informing the public.

Großenkneten, 12 Mai 2021



Dr. Rainer Sommer, Environmental Auditor (DE-V-0285)

5 EMAS CERTIFICATES

Lower Rhine Chamber of Commerce and Industry
Duisburg • Wesel • Kleve zu Duisburg

as a joint registration body of the Chambers of Commerce and Industry in North Rhine-Westphalia according to the Environmental Audit Act
- Registration Body -

CERTIFICATE

EMAS
VERIFIED ENVIRONMENTAL MANAGEMENT

Organization
INEOS Solvens Germany GmbH

Site
Moers plant
Römerstraße 733
47443 Moers

Registration No.: DE-120-00025

Date of first registration
23 June 2015

This certificate is valid until
1 June 2024

This organization has established an environmental management system according to Regulation (EC) No. 1221/2009 and EN ISO 14001:2015 (sections 4 to 10) to promote the continual improvement of environmental performance, regularly publishes an environmental statement, has let the environmental management system be verified and the environmental statement be validated by an independent and accredited auditor, is registered under EMAS and therefore entitled to use the EMAS logo.

IHK

Duisburg, 14 June 2021

(Signature)

Dr. Stefan Dietzfelbinger
General Manager

Lower Rhine Chamber of Commerce and Industry
Duisburg • Wesel • Kleve zu Duisburg

as a joint registration body of the Chambers of Commerce and Industry in North Rhine-Westphalia according to the Environmental Audit Act
- Registration Body -

CERTIFICATE

EMAS
VERIFIED ENVIRONMENTAL MANAGEMENT

Organization
INEOS Solvents Germany GmbH

Site
Port of Homberg
Rheindeichstraße 40
47198 Duisburg

Registration No.: DE-120-00025

Date of first registration
23 June 2015

This certificate is valid until
1 June 2024

This organization has established an environmental management system according to Regulation (EC) No. 1221/2009 and EN ISO 14001:2015 (sections 4 to 10) to promote the continual improvement of environmental performance, regularly publishes an environmental statement, has let the environmental management system be verified and the environmental statement be validated by an independent and accredited auditor, is registered under EMAS and therefore entitled to use the EMAS logo.

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Duisburg, 14 June 2021

(Signature)

Dr. Stefan Dietzfelbinger
General Manager

Lower Rhine Chamber of Commerce and Industry
Duisburg • Wesel • Kleve zu Duisburg

as a joint registration body of the Chambers of Commerce and Industry in North Rhine-Westphalia according to the Environmental Audit Act
- Registration Body -

CERTIFICATE

EMAS
VERIFIED ENVIRONMENTAL MANAGEMENT

Organization
INEOS Solvens Germany GmbH

Site
Herne plant
Shamrockstraße 40
44623 Herne

Registration No.: DE-120-00025

Date of first registration
23 June 2015

This certificate is valid until
1 June 2024

This organization has established an environmental management system according to Regulation (EC) No. 1221/2009 and EN ISO 14001:2015 (sections 4 to 10) to promote the continual improvement of environmental performance, regularly publishes an environmental statement, has let the environmental management system be verified and the environmental statement be validated by an independent and accredited auditor, is registered under EMAS and therefore entitled to use the EMAS logo.

IHK

Duisburg, 14 June 2021

(Signature)

Dr. Stefan Dietzfelbinger
General Manager

Lower Rhine Chamber of Commerce and Industry
Duisburg • Wesel • Kleve zu Duisburg
as a joint registration body of the Chambers of Commerce and Industry in North Rhine-Westphalia according to the Environmental Audit Act
- Registration Body -

CERTIFICATE

EMAS
VERIFIED ENVIRONMENTAL MANAGEMENT

Organization
INEOS Solvens Germany GmbH

Site
Marl plant
Paul-Baumann-Straße 1
45772 Marl

Registration No.: DE-120-00025

Date of first registration
2 August 1996

This certificate is valid until
1 June 2024

This organization has established an environmental management system according to Regulation (EC) No. 1221/2009 and EN ISO 14001:2015 (sections 4 to 10) to promote the continual improvement of environmental performance, regularly publishes an environmental statement, has let the environmental management system be verified and the environmental statement be validated by an independent and accredited auditor, is registered under EMAS and therefore entitled to use the EMAS logo.

IHK

Duisburg, 14 June 2021

(Signature)

Dr. Stefan Dietzfelbinger
General Manager

Lower Rhine Chamber of Commerce and Industry
Duisburg • Wesel • Kleve zu Duisburg
as a joint registration body of the Chambers of Commerce and Industry
in North Rhine-Westphalia according to the Environmental Audit Act
- Registration Body -

CERTIFICATE

EMAS
VERIFIED ENVIRONMENTAL MANAGEMENT

Organization
Huntsman Products GmbH

Site
Römerstraße 733
47443 Moers

Registration No.: DE-120-00025

Date of first registration
23 June 2015

This certificate is valid until
1 June 2024

This organization has established an environmental management system according to Regulation (EC) No. 1221/2009 and EN ISO 14001:2015 (sections 4 to 10) to promote the continual improvement of environmental performance, regularly publishes an environmental statement, has let the environmental management system be verified and the environmental statement be validated by an independent and accredited auditor, is registered under EMAS and therefore entitled to use the EMAS logo.

IHK

Duisburg, 14 June 2021

(Signature)

Dr. Stefan Dietzfelbinger
General Manager

6 CORPORATE POLICIES

CORPORATE POLICY

ON OCCUPATIONAL AND PLANT SAFETY, ENERGY EFFICIENCY, HEALTH AND ENVIRONMENTAL PROTECTION AS WELL AS QUALITY AND RISK MANAGEMENT

Our objective is to make the workplaces of our employees safe, minimize risks, and prevent accidents and incidents relating to plant safety. By acting responsibly towards people and the environment, we also want to protect the interests of our customers, suppliers, neighbors, authorities, and all other interest groups as well as future generations. Safety, health, and environmental protection on the one hand and economic success on the other are equally important company goals. In case of doubt, safety, health, and environmental protection take priority..

The quality of our products, services, and internal workflows is subject to continuous improvement. All employees are called upon to work actively on this in their area. All circumstances that could have a negative impact on quality, occupational and plant safety, energy efficiency, health, or environmental protection must be avoided or eliminated.

OUR PRINCIPLES ARE:

Satisfied customers

Customer satisfaction is the basis for the success of our business. Consistently high quality of our products and services is an essential prerequisite for this. We work closely with our customers and always try to fulfill their wishes and meet their expectations. When cooperating internally as well, each of our employees is committed to ensuring the highest quality.

Environmentally friendly products

We only offer products that we can manufacture, use, transport, and dispose of safely and in accordance with the relevant safety and environmental regulations. We conserve resources by using raw materials and energy as sparingly and efficiently as possible.

Compliance with recognized standards

We operate our production facilities and warehouses according to the highest internationally recognized standards relating to safety, health, and environmental protection. We comply with legal requirements and, where economically viable, expand our efforts to exceed the legal requirements. In the event of an incident, we have effective, regularly trained emergency response procedures with detailed alarm and emergency response plans.

Reliable partner

We work to ensure that our suppliers and partner companies comply with the legal requirements relating to safety, health, and environmental protection and recognize our company's own standards. We also require them to be appropriately aware of the risks and to maintain a consistently high level of quality. We therefore only select reliable, qualified suppliers and partner companies whose performance we regularly assess.

Involvement of specialists

The relevant specialists (e.g. company physicians, officers) must be involved at an early stage before any decisions are made that affect risks, quality, energy efficiency, safety, health, or environmental protection. This is the case, for example, for investments, maintenance measures, the introduction of new working materials and workflows, as well as the new construction or conversion of our facilities. Works councils are also involved in good time as part of the codetermination process.

Open communication

We maintain an open and transparent dialog with our customers, suppliers, employees, neighbors, authorities, and the public regarding our activities in the areas of safety, health, and environmental protection.

Personal responsibility

The management is ultimately responsibility for occupational and plant safety, energy efficiency, health and environmental protection, and quality and risk management. It forms the organizational prerequisites for implementing the corporate policy and provides the necessary resources for meeting these prerequisites. It ensures appropriate, demanding objectives and programs are defined regularly and monitors their implementation.

Every employee is required to observe our company policy on occupational and plant safety, energy efficiency, health and environmental protection, and quality and risk management and to intervene immediately in the event of non-compliance. In situations that may endanger people or the environment, work must be stopped immediately. Suitable immediate action must be taken and the instructions of the emergency services must be followed in full.

Zero error tolerance

We expect our employees to avoid accidents as well as safety and environmental incidents by acting with care. We do not accept any misconduct at the workplace. This also applies to our quality standards. For this reason, measures to prevent errors are of the utmost importance. We also carefully analyze every significant error and implement appropriate measures to sustainably eliminate the causes.

Managers as role models

Every manager functions as a role model and is responsible for occupational and plant safety, energy efficiency, health and environmental protection, and quality and risk management in his or her area of responsibility. It is their duty to ensure they have comprehensive knowledge of all relevant rules and regulations and to ensure compliance with them. Managers are also required to issue the necessary instructions, to train awareness of their workforce regarding the topics of occupational and plant safety, energy efficiency, health and environmental protection, and quality and risk management, and to sustainably improve them through suitable training and continuing education measures

Dr. Günther Lohmer — Frank Hirschmann

Managing Directors
INEOS Solvents Germany GmbH
and INEOS Solvents Marl GmbH

INEOS Solvents

Quality, safety and environmental policy

Our top priority is to be our customers' preferred supplier. This requires ensuring and promoting the quality of our product and service to our customers. Our commitment to

Quality, Safety and Environmental Protection

is described in the following principles. They serve as a guideline for the actions of all employees of the Huntsman Products GmbH:

Customer satisfaction
We are dependent on all of our customers at all times. Fulfilling their wishes and meeting their requirements is one of the most important company goals. The customer should be satisfied with us at all times and appreciate us as a reliable business partner.

Standard
The standard for our quality is set by the customer. Through constant communication with our customers, we strive to take their ideas and wishes into account. This endeavor is based on an established compliance management system and is supported by the continuous application of a quality and environmental management system according to DIN EN ISO 9001, DIN EN ISO 14001, and EMAS.

Quality objectives
The quality objective is: a "zero error rate" or "100% correct". Measures to prevent errors are of the utmost importance. The causes of errors must be permanently eliminated.

Environmental protection and safety
The management takes precautions to limit all binding obligations and to limit risks to the environment and safety by adapting the production plant in order to keep up with technical progress. Activities in the area of environmental protection and safety are openly communicated to customers, suppliers, neighbors, and authorities.

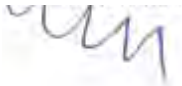
Education and training
Through regular training and continuing education measures, all employees are provided with the necessary knowledge on quality, safety and environmental protection, in particular on the methods of quality and customer assurance. The employees' awareness of these topics will be maintained and increased through appropriate instruction.

Continuous improvement
We strive to continuously improve our products, environmental performance, services, processes, and work environment. All employees have a duty to work towards eliminating circumstances that conflict with our goals.

Moers, 15 March 2021

Huntsman Products GmbH

Herbert Peters, Commercial Director MA EMEA



7 List of abbreviations

AA	Aluminum alcoholates
ASiG	Occupational Safety Act
AVV	Waste Catalogue Ordinance
AwSV	Ordinance on Installations for Handling Substances Hazardous to Water
ISR	Initial status report
BxD	B1D, B2D, B3D
B1D	1,4-butanediol
B2D	2-butenediol-1,4
B3D	1,4-butynediol
BImSchG	Federal Immission Control Act
BImSchV	Federal Emission Control Ordinance
CH2O	Formaldehyde
CO	Carbon monoxide
CO2	Carbon dioxide
COD	Chemical oxygen demand
DIPE	Diisopropyl ether
DIHP	Diisopropylbenzene hydroperoxide
EBV	Railway Operations Manager Ordinance
EFÜ	Remote Emissions Monitoring System
EMAS III	Amended EC Eco Management and Audit Scheme No. 1221/2009
GBV	Dangerous Goods Officer Ordinance
GJ	Gigajoule
ha	Hectare
HFC	Partially halogenated hydrofluorocarbons (refrigerant)
IED	Industrial Emissions Directive
IndBauRL	NRW guideline on building fire protection in industrial construction of the State of NRW
IPA	Isopropyl alcohol, isopropanol
IPC	Isopropyl chloride
ISO	International Organization for Standardization
KrWG	Closed Substance Cycle Act
kg	Kilogram
LINEG	Left Bank of the Lower Rhine Valley Drainage Cooperative
LPG	Liquefied petroleum gas
MEK	Methyl ethyl ketone
MA	Maleic anhydride
NOx	Nitrogen oxides
PMHP	Paramenthane hydroperoxide
PAH	Phthalic anhydride
REACH	Regulation (EC) No. 1907/2006 of the European Parliament and the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation, and Restriction of Chemicals
SBA	Secondary butyl alcohol, secondary butanol
SBC	Secondary butyl chloride
SGB	German Social Code
SHE	Safety, health, environment
SO_2	Sulfur dioxide
StörfallV	Hazardous Incident Ordinance
SüwVO Abw	Self-Monitoring Ordinance for wastewater.
t	Ton(s)
TA	Technical guideline
TEHG	Greenhouse Gas Emissions Trading Act
THF	Tetrahydrofuran
TJ	Terajoule
TRAC	Technical rules for acetylene installations and calcium carbide Stores (has been repealed)
TUIS	Transport accident information and emergency response system of the German chemical industry
DM	Demineralized
DM water	Demineralized water
VOC	Volatile organic compounds
WHC	Water hazard class
WHG	Water Management Act

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