



Environmental Protection in the Aurubis Group
and Updated Aurubis AG Environmental Statement 2018
Hamburg and Lünen Sites

 **Aurubis**
Metals for Progress



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Dear readers,

At the end of 2017, Aurubis AG presented its company strategy for the coming years. With this strategy, we want to expand our position as a leading global provider of non-ferrous metals. The strategy is based on the three areas of Growth, Efficiency, and Responsibility.

All three areas affect our environment, either directly or indirectly: Aurubis' metals play a key role when it comes to renewable energies and e-mobility. An electric car contains up to four times more copper than a vehicle with a conventional combustion engine, and connecting an offshore wind turbine to our energy grid requires up to 30 t of "red gold" – to name just two examples. Other metals that are part of our product portfolio are also crucial for the development of e-mobility. Nickel is necessary to manufacture batteries, for instance. In this way, Aurubis actively contributes to the progress of technologies of the future, which ultimately reduce CO₂ emissions around the world and thus benefit the environment.

Efficiency, on the other hand, means not only optimizing processes and curbing costs. Another significant aspect is the rational and therefore environmentally sound use of scarce resources. Aurubis needs a great deal of energy to manufacture its products. However, we continuously work on reducing the energy required for production. We are already one of the leading producers in the world when it comes to issues of energy efficiency. We often embark on entirely new paths in the process: For instance, the possibilities to improve efficiency at our Hamburg plant have been largely exhausted with the technologies currently available. This is why we are currently implementing a project that contributes to the efficient use of resources beyond the plant boundaries.

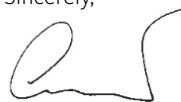
Starting in late summer 2018, we will separate waste heat that is created in a sub-process of copper recovery. This heat will be used to supply the eastern part of the Hamburg district HafenCity with CO₂-free district heating. In the future, this will prevent 20,000 t of CO₂ emissions annually and, at the same time, generate earnings for our company with the marketing of district heating.

We are also implementing this project because we are aware of our responsibility. This is the third pillar of our strategy. With our business activities, we assume responsibility for the sustainable use of all resources and responsibility towards the people who work with us and for us, as well as towards our business partners, shareholders, and everyone else that drives Aurubis' activities forward with us day after day.

This responsibility also includes a conscientious approach to our environment. In this report, we present our environmental activities over the past 12 months in detail. We are proud of what we have achieved thus far, but we will tirelessly continue making our contribution to a better environment into the future as well – because an intact environment is essential for the sustainable existence of our company.

We hope you enjoy reading our Environmental Statement.

Sincerely,



Jürgen Schachler
Executive Board Chairman



Rainer Verhoeven
Chief Financial Officer

Company Profile and Business Model

The Aurubis Group

Aurubis AG is a leading worldwide provider of non-ferrous metals and the largest copper recycler worldwide. The company processes complex metal concentrates, scrap metals, and metal-bearing recycling materials into metals of the highest quality. Its main area of expertise is the processing and optimal utilization of concentrates and recycling raw materials with complex qualities.

Aurubis produces more than 1 million t of copper cathodes annually and from them a variety of copper products such as wire rod, continuous cast shapes, rolled products, and strip, as well as specialty wire and profiles made of copper and copper alloys. Precious metals, selenium, lead, nickel, and a number of other products such as sulfuric acid and iron silicate also belong to the product portfolio.

The company's headquarters, which is also home to key production facilities, is located in Hamburg, Germany. Aurubis has about 6,500 employees, production sites in Europe and the US, and an extensive service and distribution system in Europe, Asia, and North America.

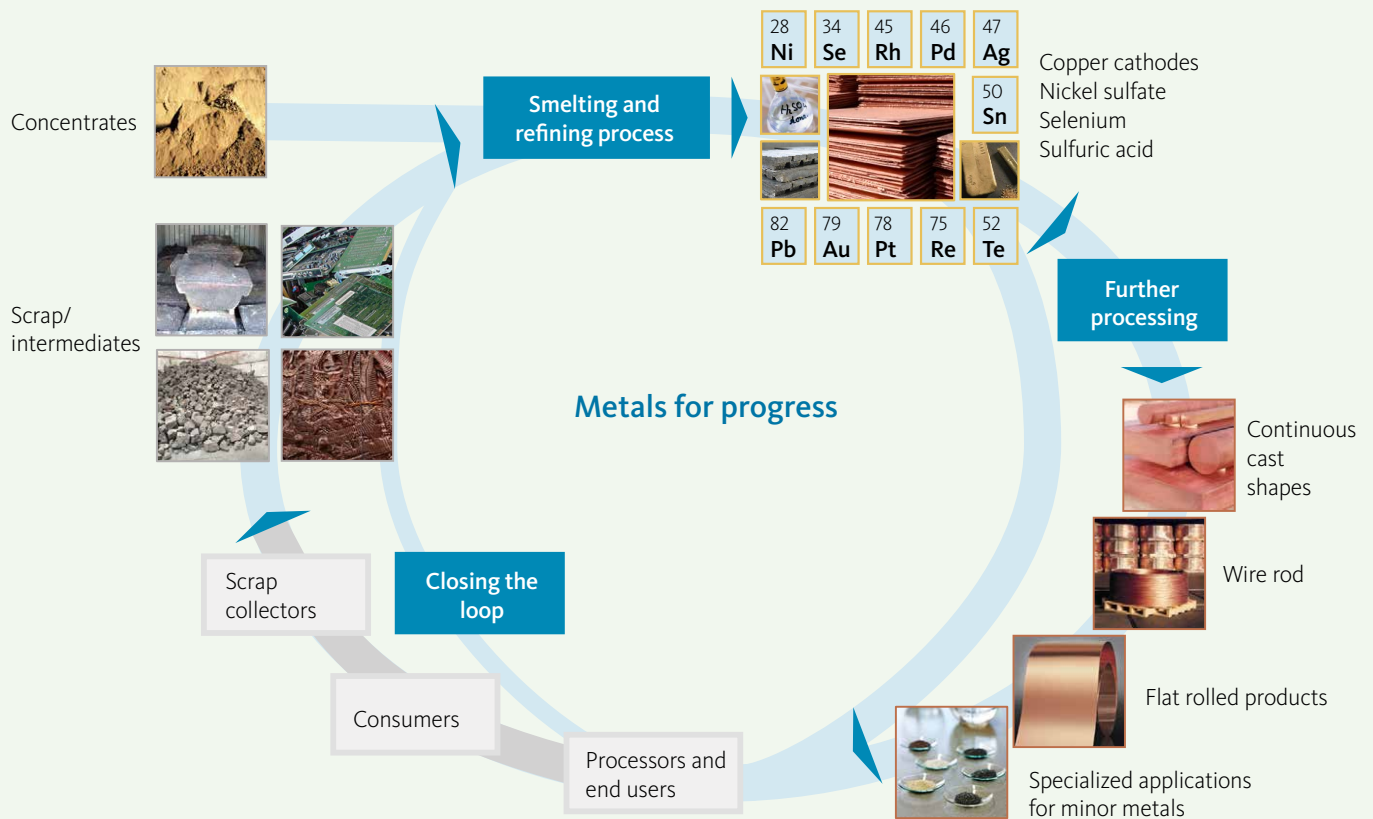
Aurubis AG was founded in 1866 in Hamburg under the name Norddeutsche Affinerie AG. Following numerous changes in the ownership structure, the company went public in 1998. The Annual General Meeting adopted a resolution to change the name to Aurubis on February 26, 2009. Aurubis shares are part of the Prime Standard Segment of the German Stock Exchange and are listed in the MDAX, the Global Challenges Index (GCX), and the STOXX Europe 600.

Business Model and Group Structure

The Aurubis Group's business model links the production of copper and other non-ferrous metals with the processing of copper. The company purchases the necessary raw materials, as it doesn't have its own mines or stakes in mines. Aurubis primarily processes copper concentrates that are mined from ores and sourced on the global market. The processing of purchased intermediates, copper scrap, and other metal-bearing recycling materials plays an important role as well.

The product portfolio mainly comprises standard and specialty products made of copper and copper alloys. These include copper cathodes, the product format traded on the international metal exchanges. They are the starting product for fabricating additional copper products, but they can also be sold directly. Aurubis processes copper into continuous cast copper wire rod, shapes, rolled products, strip, specialty wire, and profiles.

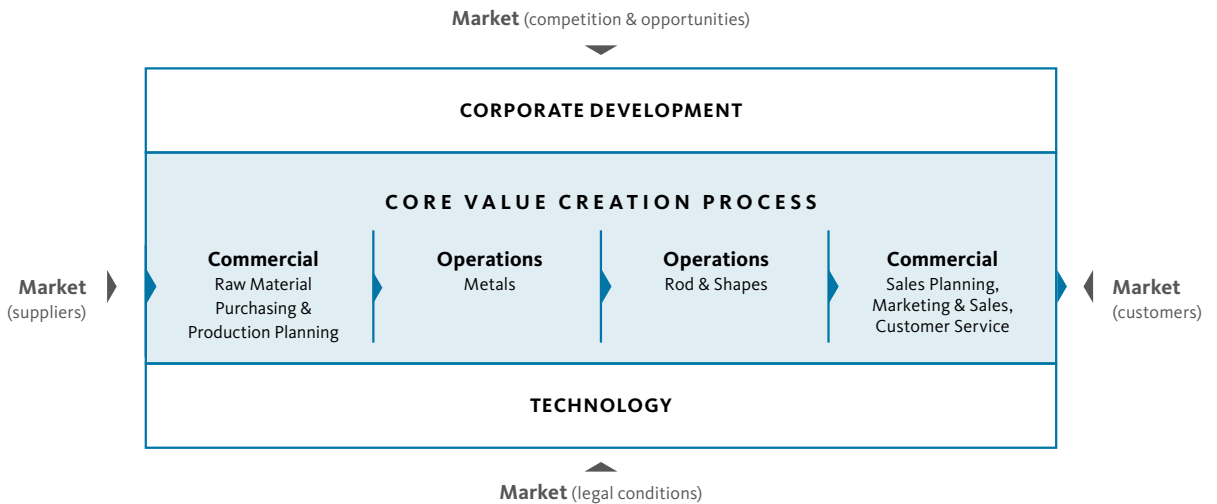
Fig. 1.1: The life cycle of our products





Dr. Thomas Bünger, Head of Operations:
 »It is important to us to make the environmental performance of Aurubis and its products measurable in order to uncover possible optimizations and to advance our modern multi-metal production.«

Fig. 1.2: Our new organizational structure



Corporate Functions

- » Commercial » Corporate Development » Energy & Climate Affairs » External Affairs » Finance
- » Research and Development » Health and Safety » Human Resources » IT » Investor Relations » Communication
- » Legal Affairs/Corporate Governance » Operations » Risk Management » Technology
- » Environmental Protection » Corp. Procurement & Logistics, etc.

Our Environmental Policy – Company Guidelines on Environmental Protection

In order to ensure that our environmental protection standards are safeguarded throughout the Group and continuously optimized, the following principles were established in our company guidelines:

- » The continuous improvement of water pollution control, soil conservation, and immission control are key aims of environmental protection.
- » For reasons of accountability, environmental and climate protection should be developed in such a way as to conserve natural resources and avoid or minimize strain on the environment and our employees.
- » Issues of environmental protection should be taken into account equally in the planning and development of new products and production processes.
- » Processed raw materials and intermediate products should be brought into the economic cycle as completely as possible, and unavoidable waste should be properly recycled or harmlessly disposed of. Raw material suppliers are advised on issues related to environmental protection if needed.
- » Essential precautions to avoid accidents and operational disruptions are in place to prevent or minimize environmental hazards for our employees and neighbors, as well as effects on the environment.
- » Our employees' sense of responsibility in environmental protection should be strengthened and objective, open, and respectful dialogue should take place with them, the relevant authorities, and the public.
- » Our customers are appropriately informed about the features of our products and necessary safety measures and are advised on questions related to product disposal.
- » Contractors working for us must be selected, informed, and advised in such a way as to ensure that laws and our environmental protection standards are observed.

Compliance with legal regulations is the basis and minimum standard of our activities.

Environmental Protection in the Aurubis Group

Strategy

Environmental protection, resource efficiency, and climate protection have been components of our company culture for many years. They are some of the key topics of the Aurubis strategy and are established in our company guidelines. At Aurubis, production is carried out using state-of-the-art, energy-efficient plant technologies with very high environmental standards in order to conserve natural resources and to maintain a clean environment for future generations. We pursue this standard at all of the production sites in the Group and across all of our business processes. We develop innovative and energy-efficient plant technologies in environmental protection that set new benchmarks worldwide and form the basis for establishing best available technologies (BAT) at European level. This allows us to minimize impacts on people and the environment. In the spirit of resource protection, nearly all raw materials are converted into marketable products, and waste is effectively avoided and – wherever possible – recycled.

With our new Aurubis strategy, we have developed a clear compass that directs the path to our Vision 2025. With our mission “Responsibly creating value from raw materials – metals for an innovative world,” we make a significant contribution to society. Metals are necessary for technical progress and a high standard of living. Rising demand worldwide is met with limited resources, however. Metal recycling is therefore an important source of raw materials – especially for a country like Germany that lacks natural resources. It makes an important contribution to supply security and to environmental and resource protection.

With our multi-metal recycling, we are ensuring that the material cycle for copper and other metals is closed. It is becoming more and more important to recycle products

after their life cycle is over. In the process, valuable raw materials are used efficiently, resources are conserved, and environmental pollution is avoided. We at Aurubis have created an internal function for this, as well: Customer Scrap Solutions unites copper product sales and the sourcing of recycling raw materials. In this way, customers become suppliers at the same time.

Aurubis assumes responsibility for environmental and climate protection

Our strategy and our targets are established in the company guidelines and corporate policy on environmental protection; these are binding throughout the Group. The guidelines define areas of activity and responsibility, specify information and reporting requirements, and establish the duties of Corporate Environmental Protection, as well as cooperation with the local environmental protection officers and the managing directors/plant managers. This ensures a uniform approach to environmental protection within the Group and in terms of public image. The Group headquarters support the sites with expertise and technology transfer. All of this makes an important contribution to implementing our new Group strategy in environmental protection. Compliance with legal regulations is the basis and minimum standard of our activities. The regulations that are significant for our production include in particular the German Federal Immission Control Act, the Closed Cycle and Waste Management Act, the Water Management Act, and the European chemical regulation, REACH.

Targets and Challenges

We have set Group-wide targets in environmental protection and defined concrete targets for the individual sites. The effectiveness of these targets and measures is reviewed continuously. Environmental management systems (especially in accordance with ISO 14001 and EMAS)



Dr. Karin Hinrichs-Petersen, Head of Corporate Environmental Protection:

»We ensure our leading position in environmental protection by learning and improving continuously. Together with the sites, we therefore create the basis for environmentally sound production in the Aurubis Group and for future growth processes.««

(From l. to r.): Orhan Cekel, Dr. Karin Hinrichs-Petersen, Dr. Jörn Mühlenfeld, Jan Drzymalla, Daniela Cholakova, Nicole Hennings, Laura Robert (not pictured)

support their implementation. Goals are recorded, deviations are evaluated, and corrective measures are initiated and monitored for their effectiveness. Moreover, energy management systems in accordance with ISO 50001 have been implemented and certified at several sites. An annual external audit offers us the opportunity to have the successful environmental protection measures confirmed by an independent third party and to recognize additional potential for improvement. In the future as well, we will work consistently to become even cleaner, more efficient, and more sustainable.

To prepare ourselves for future developments, we regularly evaluate opportunities and risks that the company faces. When we see opportunities, we use them by implementing projects. One example is the project Future Complex Metallurgy currently under way, which will make an important contribution to the efficient use of resources. Risk management exists to prevent environmental damages,

non-compliance, and unexpected costs. Thus, environmental risks are investigated regularly and minimized by establishing precautionary measures.

Successes

The emission reduction targets set for 2018 were already achieved during the past year and, in some cases, significantly exceeded.

Specific dust emissions for primary and secondary copper production were reduced by 22 % compared to 2012 (target: 10 %). Similarly, SO₂ emissions were reduced by 13 % in the same period under review (target: 8 %). Consequently, when compared internationally, the Group is a forerunner in reducing specific sulfur dioxide emissions.

We have also made significant improvements in water pollution control. We have reduced metal emissions to water in copper production processes from 2.2 to 1.0 g per ton of copper output since 2012. This is a decline of 56 % (target: 10 %).

We were only able to achieve these successes with continuous investments: We have invested over € 560 million in measures to improve environmental protection in copper production since 2000.

As an energy-intensive company, Aurubis feels especially committed to climate protection. We therefore invest in energy-efficient plant technologies at all sites, carry out measures to save additional energy, and implement projects such as the use of waste heat for heating purposes. This long-term involvement has been successful: We have considerably reduced our specific CO₂ emissions at the sites.

The following are examples of measures that have strongly contributed to ongoing improvements in environmental protection:

Fig. 1.3: **Our environmental targets until 2018**

Climate protection

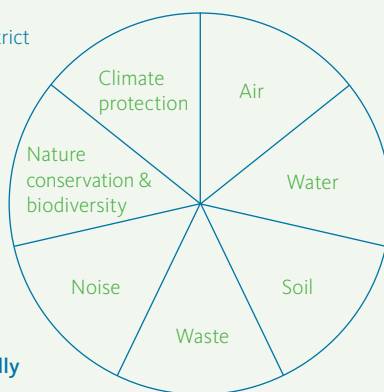
- » **Target: Reducing CO₂ emissions by 100,000 t of CO₂ through energy efficiency projects and heat recovery projects**
- » Example: Use of industrial waste heat for district heating in Hamburg

Nature conservation & biodiversity

- » **Target: Improvement of nature protection at the production sites**
- » Example: Participation in the NABU project UnternehmensNatur in Hamburg

Noise

- » **Target: Reducing noise emissions, especially as part of new technical projects**



Waste

- » **Target: Increasing the recycling rates**
- » Example: Stronger marketing of fayalite in Pirdop (BG)

Air

- » **Target: Reducing dust emissions in copper production by 10 % compared to 2012**
- » Example: Reduction of fugitive emissions in the KRS area in Lünen

Water

- » **Target: Reducing metal emissions to water in copper production by about 10 % compared to 2012**
- » Example: Optimizing the new rainwater treatment system in Lünen

Soil

- » **Target: Reducing input of harmful substances into soil and groundwater**
- » Example: Further paving of plant premises in Lünen

- » Our project to utilize industrial waste heat from the Hamburg plant facilitates an energy-efficient heat supply for HafenCity (see also the “Energy and Climate Protection” section).
- » The rainwater retention facility in Lünen was optimized to reduce consumption of city water further. The treated water is used in the Lünen plant.
- » The adjustment of the slag handling process has started at the Bulgarian site in Pirdop. This project contributes to a further reduction in fugitive emissions.

Dialogue with Interested Parties & Commitment

We have determined and evaluated the interested parties that are relevant for Aurubis: Government authorities, non-governmental organizations, customers, and employees play an important role in particular. Aurubis continued to hold open dialogue with authorities, citizens, and other interested parties across the Group in the past year. This helps us understand the expectations and requirements that those around us place on us and to take them into account in our activities. In addition, we participated in various environmental projects:

Together with the overarching European metal industry association Eurometaux and the European Copper Institute (ECI), for example, we are participating in the testing and development phase of the European Commission's Product Environmental Footprint (PEF), which is currently drawing to a close. The goal of this collaboration is to develop and test the methods for determining the environmental footprint. On this basis, the European Commission is striving to create a single market for “environmentally friendly products” and “environmentally friendly organizations.”

In addition, we are participating with 22 national and international partners in the European research project FORCE – Cities Cooperating for Circular Economy. The goal of the project is to develop new concepts for waste avoidance and treatment for the material streams plastics, biomass, used electrical equipment, and wood. As a multi-metal recycler, Aurubis supports the project with its expertise for the purpose of improving the recycling of strategic metals (e.g., copper, gold, silver, and lead) through the best possible collection and dismantling system for waste electrical and electronic equipment.

In Hamburg, we have been a member of the Environmental Partnership since 2003, and a member of the Partnership for Air Quality and Low-Emission Mobility, which is coordinated by the city of Hamburg. The goal of the latter partnership is to reduce nitrogen dioxide emissions, which are caused by transport in particular. For this purpose, we also participated in the German model project Mobil.Pro.Fit® in collaboration with the environmental organization B.A.U.M. e.V. The goal of the project is to develop a sustainable and climate-friendly mobility concept.

Biodiversity

Aurubis is actively involved in creating and maintaining good conditions for species conservation and biodiversity in its plants and their surroundings. Protecting biodiversity is one of our environmental targets. Wherever possible, we maintain or expand green areas on our plant grounds. For instance, we take part in the Hamburg initiative UnternehmensNatur to promote biodiversity on the plant premises. Due to long-time industrial use, soil contamination typical for industrial areas can appear on our plant premises, which we prevent from mobilizing and spreading with technical measures. If additional areas on our plant premises are used, we choose those that naturally have limited biodiversity.

Governmental authorities also inspect the aspect of biodiversity as part of authorization procedures with environmental compatibility tests. If any impacts on biodiversity were expected, corrective measures were imposed as necessary, which Aurubis then implemented. Furthermore, we conserve the habitats of animals and plants in the areas surrounding our sites with our extensive water treatment, air emission reduction, and waste treatment methods.

Our raw material, copper concentrate – Responsibility in the supply chain

Our raw material for primary copper production, copper concentrate, is mainly extracted on site at mines, where ores with about 0.3% to 3% copper content are concentrated to an average copper content of 22–30% to reduce transport volumes. Our primary concentrate suppliers are the mining companies Vale, Teck, Antofagasta, and Newmont Mining. These global mining companies have committed themselves to a sustainable corporate policy and to releasing environmental reports, which can be found on the companies' websites.

Responsibility in the supply chain is one of the relevant topics of the Aurubis Sustainability Strategy. In addition to the Group-wide guidelines to avoid raw materials for gold manufacturing from conflict zones (Gold Supply Policy), Aurubis introduced a uniform IT-based screening system for business partners in the supply chain in 2013. The screening system is used to review the identity and integrity of Aurubis AG's business partners before entering into contracts. Business Partner Screening is based on a software and relies on multiple steps. The plan is to implement it across the Group. The specifically configured software creates a risk profile after the department making the purchase has entered relevant information. In the case of increased risk, the Compliance and Sustainability Departments carry out an expanded review according to appropriate criteria, using business and risk databases,

among others. Based on the corresponding recommendations, management decides on possible contracts or restrictions. Since close communication with our suppliers is part of our company policy, visits with primarily business objectives take place regularly. At the same time, however, our raw material purchasers also observe the criteria that are relevant for the screening process and/or the corresponding results.

Certificate for Conflict-Free Gold

We already gained initial experience with supplier screening for precious metals in 2013. A review of the sources of precious-metal-bearing and particularly gold-bearing raw materials concluded that Aurubis does not extract any conflict-affected gold-bearing raw materials. The use of the screening program resulted from the Gold Supply Policy, which was developed in the same year. This policy is oriented to the requirements of the Gold Guidance of the London Bullion Market Association (LBMA) and is based on the OECD Due Diligence Guidance for conflict minerals, as well as the provisions of the UN Global Compact. Since 2013, Aurubis' gold production has been continuously certified as conflict-free according to the gold guidance standards of the London Bullion Market Association (LBMA), and the past fiscal year is no exception.

Business Partner Screening is continuously developed and adjusted to changes in requirements.

Environmental Management Organization

The head of the Operations division, Dr. Thomas Bünge, and the Head of Corporate Environmental Protection, Dr. Karin Hinrichs-Petersen, are responsible for the strategic positioning of environmental protection in the Group. Environmental officers oversee the environmental protection duties at the individual sites under the technical supervision of Corporate Environmental Protection management.

With the involvement of employees, Plant Managers, Managing Directors, and the Executive Board, uniform environmental protection standards were developed, established with corporate guidelines, and implemented across the Group as part of the environmental management systems (ISO 14001 or EMAS).

An integrated management system (IMS) was developed for Aurubis AG for the areas of environment, quality, and energy. It was certified in its entirety for the first time in 2017. The IMS utilizes synergies, harmonizes process, and improves environmental, quality, and energy management.

Furthermore, we determine key environmental protection factors, which are uniform within the Group and are reviewed and certified by external auditors annually.

Environmental discussions take place across the Group and employees are trained on environmentally relevant topics regularly.

Emergency plans or alarm and danger prevention plans have been established for emergencies and accidents. These measures ensure that environmental impacts are effectively avoided and that employees and the community are protected. We carry out training sessions and emergency drills regularly, documenting and evaluating the procedures. Emergency plans are developed in coordination with the responsible authorities. The corporate environmental protection guidelines also include the tasks to implement the European chemical regulation, REACH.

Supported by the Aurubis Operating System (AOS) introduced in 2017, production processes are systematically analyzed and continuously optimized with environmental aspects in mind. The environmental management system therefore ensures that, in addition to production targets, environmental protection targets can also be achieved and development opportunities can be utilized.

Fig. 1.4: Corporate Environmental Protection organizational chart

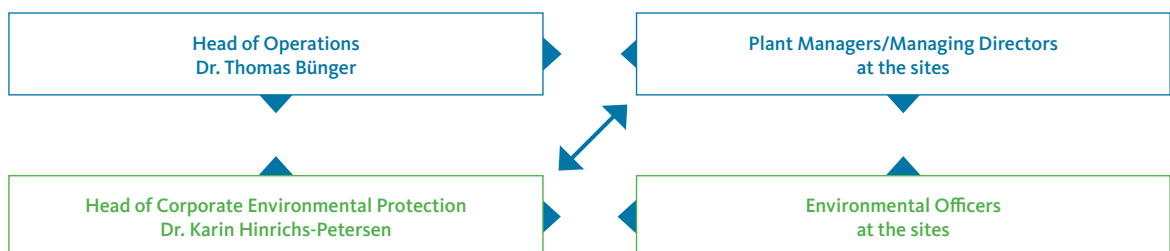


Fig. 1.5: Environmental management in the Aurubis Group

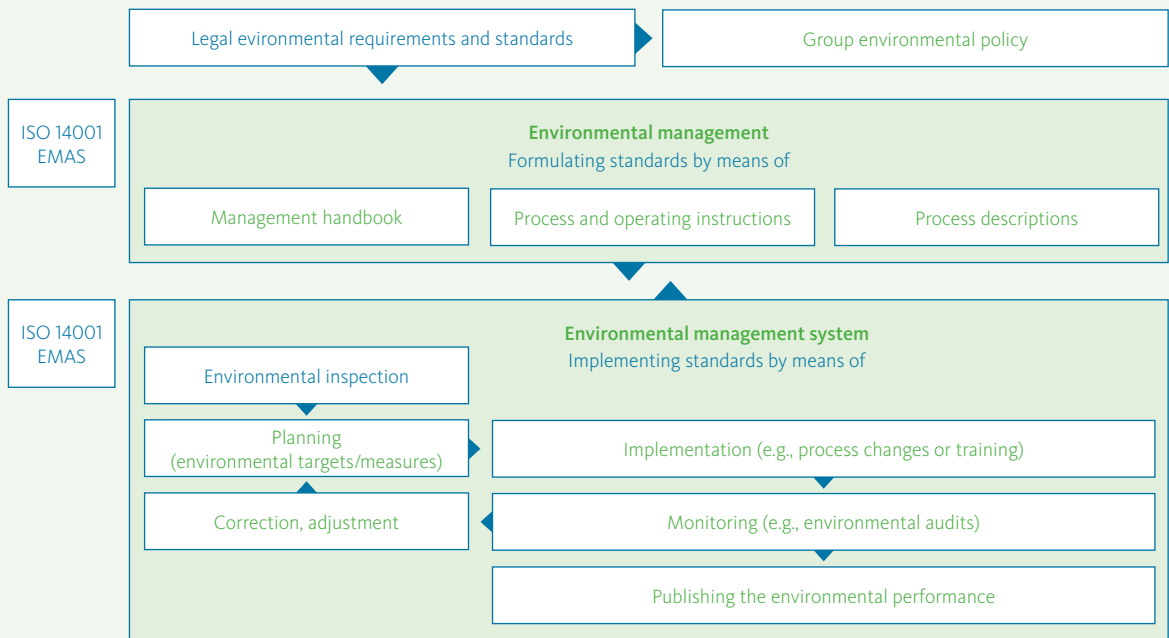


Fig. 1.6: Certifications by site

Standort	EMAS	ISO 14001	ISO 50001	ISO 9001	TS 16949	EfbV
Hamburg, headquarters (DE)	x	x	x	x		
Lünen (DE)	x	x	x	x		x
Pirdop (BG)		x		x		
Olen (BE)		x		x		
Fehrbellin, CABLO (DE)		x	x	x		x
Nersingen, Strass, CABLO (DE)		x	x	x		x
Hamburg, E.R.N. (DE)		x	x	x		x
Buffalo (USA)				x	x	
Pori (FI)		x		x		
Avellino (IT)		x		x		
Zutphen (NL)		x		x	x	
Stolberg (DE)			x	x	x	
Emmerich, Deutsche Giessdraht (DE)		x	x	x		
Stolberg, Schwermetall (DE)	x	x	x	x		
Röthenbach, RETORTE (DE)				x		
Hamburg, Peute Baustoff (DE)				x ¹		

EMAS: system with guidelines for environmental management systems and environmental audits

ISO 14001: standard for environmental management system guidelines

EN ISO 50001: standard for energy management system guidelines

EN ISO 9001: standard for quality management system guidelines

TS 16949: standard for quality management system guidelines for the automotive industry, based on ISO 9001

Efbv: Waste Management Company ordinance (certificate in DE)

¹ For the sale of iron silicate granules used to produce blasting abrasives

Energy & Climate Protection

The individual production steps in the Aurubis value chain are complex and very energy-intensive overall. For us, the effective and efficient use of energy is an issue of ecological and economic responsibility. As a result, all of our sites utilize energy as sparingly as possible. Increasing productivity and efficiency is part of our everyday work at Aurubis. The Energy & Climate Affairs Department oversees the corresponding coordination of the measures across the Group. In order to control energy consumption optimally and identify additional energy savings potential, the main German sites are certified in accordance with DIN EN ISO 50001.

Energy aspects and consumers are determined and assessed to derive a variety of suitable steps that lead to effective energy use and a continuous reduction in energy consumption. Existing measurement systems record energy consumption and verify energy savings.

Energy & Climate Affairs coordinates the Group-wide development of the energy management and monitoring systems. In this way, they provide for a uniform approach where this makes sense and facilitate the exchange of expertise regarding best practice examples, e.g., in the form of an internal energy efficiency network. Furthermore, since 2015 Aurubis has actively taken part in energy efficiency networks as part of an initiative of German government and business, entering into a moderated dialogue on energy efficiency projects and potential with other companies beyond Aurubis' plant and company boundaries.

The development and implementation of the Group-wide energy strategy is the central responsibility of the head of Corporate Energy & Climate Affairs, who reports directly to the Executive Board. In addition to large projects to enhance energy efficiency – such as the steam turbines used to produce electricity from process waste heat at the Hamburg, Lünen, and Pirdop sites – energy-conscious conduct and the participation of all employees are called for in particular. In order to raise awareness of these issues among employees, an Energy Day was organized at the Hamburg plant, for example. Moreover, energy training sessions also take place regularly.

Aurubis holds a leading position in energy efficiency. However, as we increase productivity and efficiency, we are also reaching our technical limits. Efficiency enhancements that have already been achieved don't serve as a blueprint for future development because the more steps that have already been taken in energy efficiency, the more difficult it is to optimize energy demand further. Because there are technological limits to reducing energy consumption and emissions, a continued high level of investment leads to only marginal improvements compared to past years.

Energy consumption is the main source of CO₂ emissions in the Aurubis Group. The biggest CO₂ emitters in the Group are the German sites in Hamburg and Lünen. Currently, Aurubis systematically records the direct CO₂ emissions at the sites, as well as the energy-related indirect emissions, for example, from purchased electricity.



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Fig. 1.7: Aurubis Group CO₂ emissions – estimated

CO₂ emissions in t/t of copper output

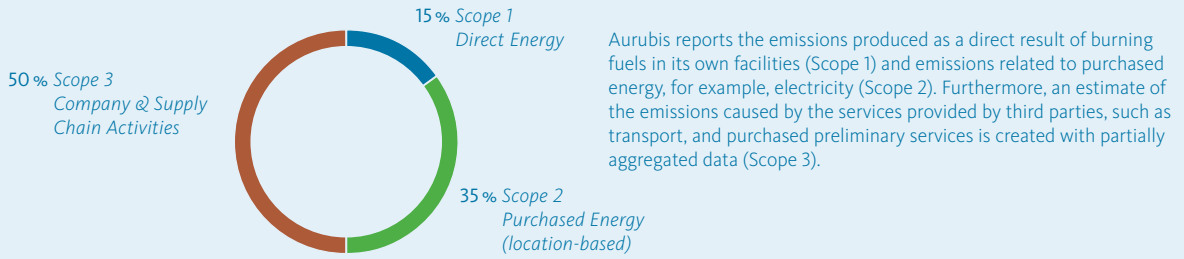
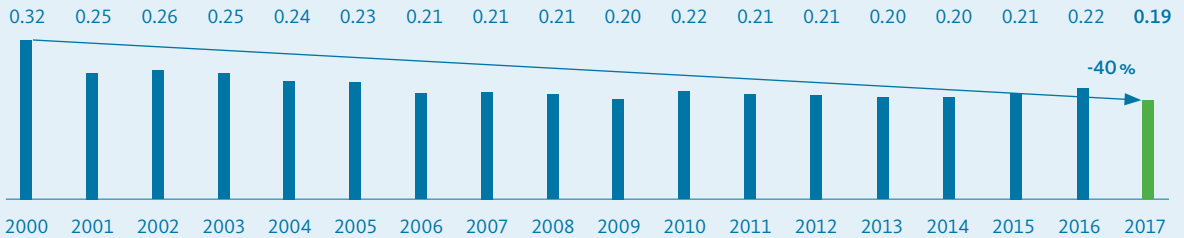


Fig. 1.8: CO₂ emissions from fuels in Aurubis Group copper production

CO₂ emissions in t/t of copper output



Environmental protection already accounts for a large proportion of energy consumption at Aurubis, as the rising use of complex recycling raw materials with comparatively low copper content requires a higher amount of energy. However, since materials other than copper are also recovered, primary energy demand is decreasing steadily when the total input is considered. We therefore work to harmonize environmental protection, resource conservation, and energy efficiency optimally across the raw material spectrum.

We are participating in NEW 4.0 to identify potential for electricity flexibility for our plants. This large-scale project – funded by the German Federal Ministry for Economic Affairs and Energy – brings together more than 50 partners in the German federal states of Hamburg and Schleswig-Holstein. “NEW” stands for “Norddeutsche EnergieWende” (Northern German Energy Revolution) and the “4.0” indicates the threshold to the fourth industrial revolution, i.e., the digitalization of industry, in which the intelligent networking of systems – including with regard to the energy revolution – is playing an increasingly decisive role.



Our Successes

Best Newcomer Germany 2015 and Index Leader MDAX 2016: Aurubis

In 2015 and 2016, Aurubis participated in the Carbon Disclosure Project (CDP) investor initiative. The CDP surveys companies about risks and opportunities related to the climate, as well as CO₂ reduction potential.

CDP awarded Aurubis the distinction of Best Newcomer in Germany in 2015. The sustainability strategy and the transparent presentation of Aurubis' approach to the opportunities and risks of climate change contributed to the good performance. This distinction includes the copper products that contribute to increasing efficiency in applications, as well as the effective production processes, energy management, and investment in energy and CO₂ efficiency optimizations. For Aurubis this award is proof of its innovation capacity and at the same time an incentive to keep up its efforts in CO₂ reduction and energy and resource efficiency.

In 2016, Aurubis was added to the leadership category of the CDP Climate Change Index with a grade of "A-". Aurubis thus achieved the status "Index Leader MDAX" in the 2016 CDP climate reporting and was one of seven leading MDAX companies for that year.

Energy Efficiency Award: award for the Lünen plant

The efficient use of energy is an ecological and economic obligation for Aurubis. At the Lünen site, one of the innovative projects to increase energy efficiency ensures highly efficient and flexible electricity production.

By using waste heat, e.g., converting it into electricity and using residual heat, the recycling center achieves the optimum energy recovery possible. The installation produces about 23 million kWh of electricity (about 14 % of the site's energy needs, or the average energy demand of about 6,500 three-person households). It simultaneously prevents 14,000 t of CO₂.

The energy efficiency initiative of the German Energy Agency classified the project as exemplary and awarded it the label Best Practice in Energy Efficiency in 2015. In addition, thanks to the project, Aurubis was nominated for the international Energy Efficiency Award 2015. This made Aurubis one of the 15 best applicants of the group of about 100.



Our Flagship Project

The city of Hamburg is striving to reduce its CO₂ emissions by 40 % in 2020 compared to 1990 and by 80 % in 2050, as well as to make its district heating supply more climate-compatible in the medium term. The use and inclusion of industrial waste heat as part of the future heating concept in Hamburg is a clear objective of the local government's coalition agreement, the local citizens, and the German federal government.

In February 2017, Aurubis AG and enercity Contracting Nord GmbH signed a contract for the use of industrial waste heat for the energy supply in the Hamburg district HafenCity East in the presence of Hamburg's Environmental Senator Jens Kerstan.



Fig. 1.9: dena distinction (from l. to r.): Michael Niehus (enercity Contracting Nord GmbH), Christian Hein, Andreas Kuhlmann (German Energy Agency, dena), Ulf Gehrckens

In the contract, the partners agree to use industrial waste heat from the Aurubis Hamburg plant to provide energy-efficient district heating to Hafencity East. Aurubis achieves this by extracting heat that is formed when sulfur dioxide – a by-product of copper smelting – is converted to sulfuric acid. This industrial waste heat is nearly free of CO₂, and utilizing it will prevent more than 20,000 t of CO₂ emissions per year.

“We could deliver significantly more district heating for the city of Hamburg and thus cut up to 140,000 t of CO₂ each year,” explained Jürgen Schachler, Aurubis Executive Board Chairman. “However, at the moment, the technical, financial, and contractual foundations haven’t been established yet. We are very interested in a solution and are intensively working on one.” Jürgen Schachler added, “It is important to Aurubis and to me personally that we do everything to ensure that our company works in a way that conserves resources. According to our usual invest-

ment criteria, this project wouldn’t be cost-effective for us.” Nevertheless, the company has decided to pursue heat extraction, he explained. “However, it would be easier for us, and certainly other industrial companies, to opt for industrial heat extraction if corresponding incentives were established,” the Aurubis CEO continued. “In the scope of emissions trading, we require certificates for each ton of CO₂ that we emit, but we don’t receive any compensation when we reduce CO₂ emissions in households in this way.” The district heating agreement is one of ten case examples for the project “Flagships of Energy-Efficient Waste Heat Use” started by the German Energy Agency (dena).



Environmental Protection – Facts and Figures

As in previous years, this year's Environmental Statement is based on internationally recognized guidelines and reporting standards, in particular those pursuant to the Global Reporting Initiative (GRI) and EMAS.

Fig. 1.10: **Capital expenditure for environmental protection in Aurubis Group copper production**

in € million

» Since 2000, more than € 560 million has been invested in environmental protection measures in copper production.

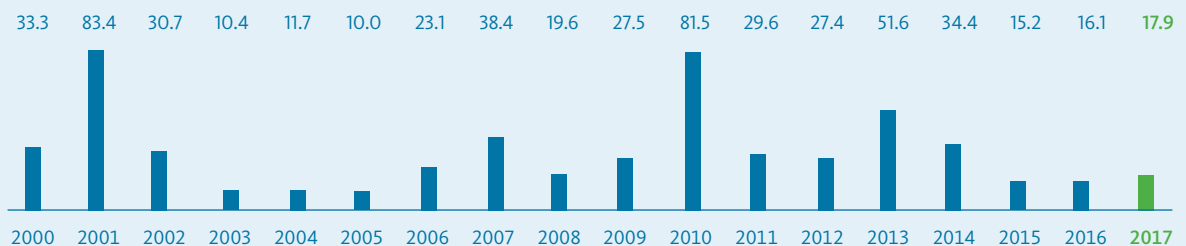
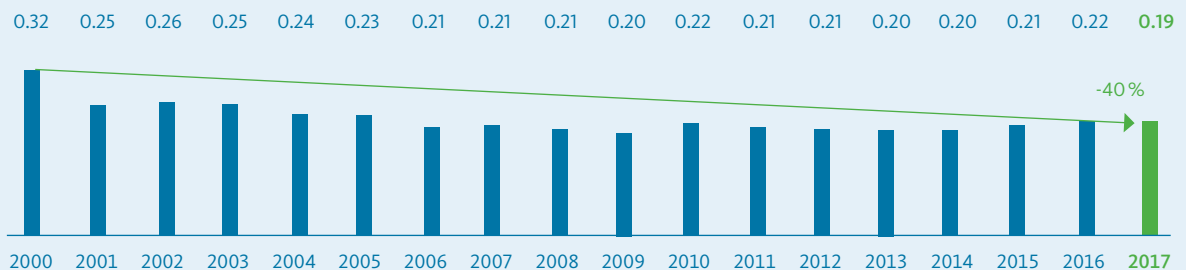


Fig. 1.11: **CO₂ emissions from fuels in Aurubis Group copper production**

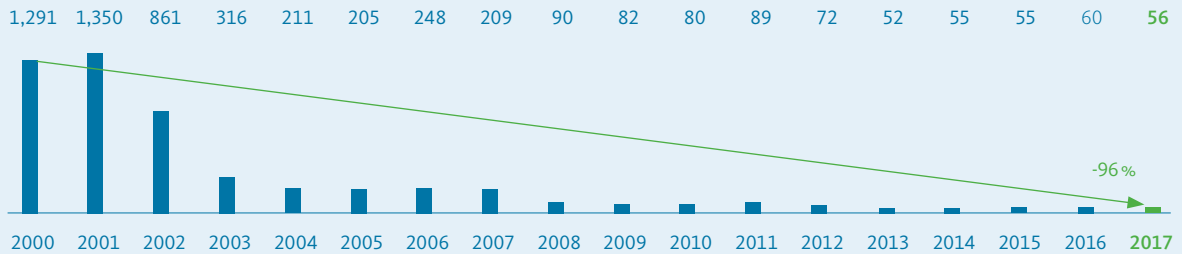
CO₂ emissions in t/t of copper output



At 0.19 t of CO₂ per t of copper output, specific emissions from fuels in copper production are at a low level. Product-related emissions have been reduced by 40% since 2000.

Fig. 1.12: Successful reduction of dust emissions in Aurubis Group copper production

Dust emissions in g/t of copper output



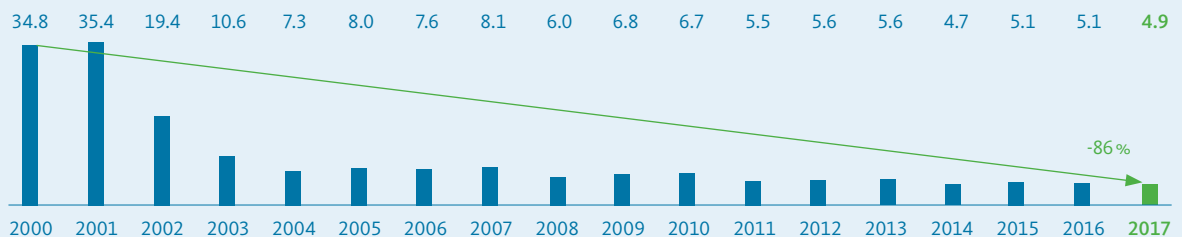
The dust emissions arising during copper production can contain metals and metal compounds. The consistent use of the best available plant techniques has led to a 96% decline in specific dust emissions in primary and secondary copper production since 2000.

One of the main focuses in the 1990s was the use of state-of-the-art filter technologies for all directed emission sources, such as chimneys. Today, projects to reduce fugitive emissions have high priority. For example, fugitive

emissions can arise in the areas of hall openings – such as gates, doors, or ridge turrets – and during material storage and handling. We have already achieved a great deal in reducing directed dust emissions with technical measures and have nearly exhausted the technical possibilities. Further developments related to non-directed emissions pose additional challenges for the future. It will be necessary to develop innovative technologies and break new technical ground.

Fig. 1.13: Specific sulfur dioxide emissions in Aurubis Group primary copper production

SO₂ emissions in kg/t of copper output

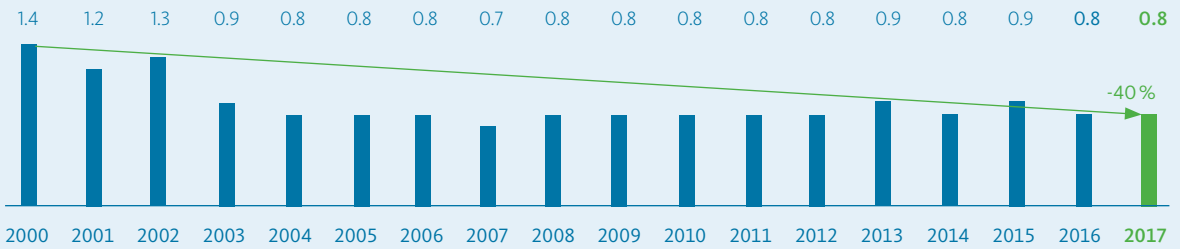


Apart from copper, sulfur is one of the main components of the copper concentrates in use. The gaseous sulfur dioxide produced when concentrates are smelted is converted into sulfuric acid in the sulfuric acid plant using the

modern double catalysis process. When compared internationally, Aurubis is a forerunner in reducing sulfur dioxide emissions: Emissions per ton of copper output have been reduced by 86% since 2000.

Fig. 1.14: Specific potable water consumption in Aurubis Group copper production

Potable water consumption in m³/t of copper output

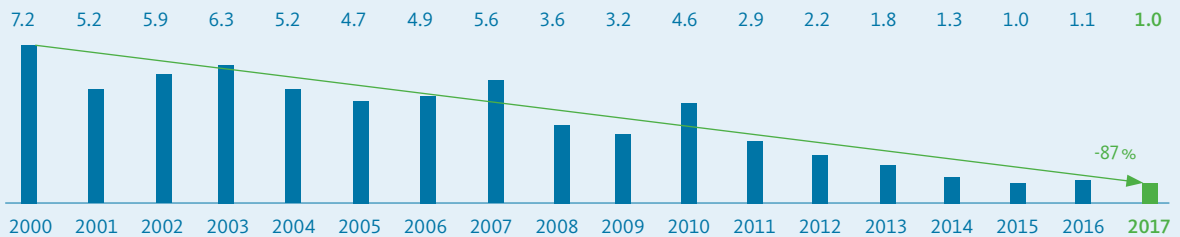


We use water for the production processes and for cooling purposes. The sparing use of water resources is one of our corporate environmental protection targets. Aurubis uses river water wherever possible to conserve the natural

potable water resources. We have reduced our specific potable water consumption in copper production by a total of 40% since 2000. We achieved this reduction with more efficient facilities and the use of rainwater.

Fig. 1.15: Specific metal emissions to water in Aurubis Group copper production

Metal emissions to water in g/t of copper output



Apart from conserving water, treating wastewater and thus avoiding environmental pollution is one of our fundamental responsibilities in industrial environmental protection since water may contain metals after use. We have

reduced metal emissions to water in copper production processes from 7.2 to 1.0 g per t of copper output since 2000. This is a decline of 87%.

Updated Aurubis AG Environmental Statement 2018

Hamburg Site



The largest Aurubis AG production site and the Group headquarters is located on the Elbe island Peute, only about four kilometers, as the crow flies, from Hamburg's city hall.

The plant was constructed in 1908 on an area of about 870,000 m² in Peute, an industrial inland harbor area in the Veddel district. Following reconstruction after World War II, the production facilities were continuously expanded and steadily modernized. Today, Aurubis AG's Hamburg site is one of the world's most state-of-the-art primary and secondary copper smelters and has an authorized production capacity of 450,000 t of copper cathodes each year. A total of 2,381 personnel are employed at the Hamburg site, including around 180 apprentices (as of December 31, 2017).

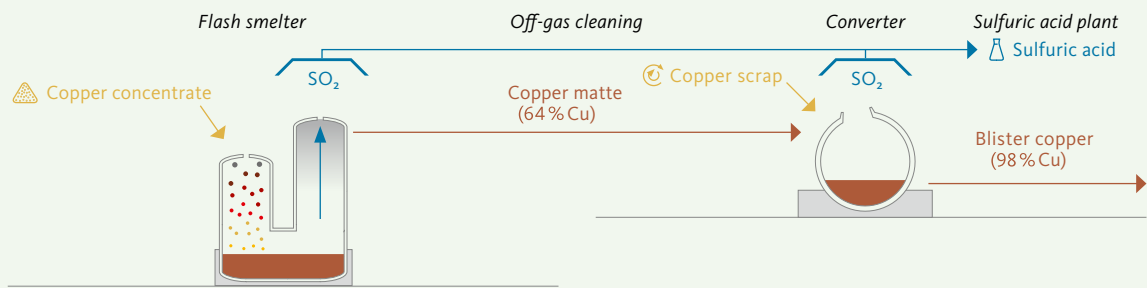
The individual production sectors at Aurubis AG in Hamburg are divided into three plant areas (see Fig. 2.1). Plant North (RWN) is mainly comprised of the administrative building, the workshops, the secondary copper smelter, and precious metal production. Plant South includes the sludge decomposition plant, the cracking acid cleaning facility, the wastewater treatment facility, the concentrate delivery area, the chemical plants, and the casting lines in particular. The primary smelter sector includes the main primary copper production facilities: the RWO, the sulfuric acid production plants, and the tankhouse. This section also houses the rod plant.

Fig. 2.1: The main Aurubis plant in Hamburg – a downtown copper smelter



1 Continuous casting plant 2 Secondary copper smelter/precious metals 3 Rod plant 4 Tankhouse 5 Primary smelter (RWO)

Fig. 2.2: From copper concentrate to cathode



Aurubis is an integrated copper producer that operates copper production and processing facilities at the Hamburg site.

The main raw materials for copper production are copper concentrates (processed copper ores) and recycling materials (including electrical and electronic scrap).

In the primary copper smelter, copper anodes (with a copper content of about 99%) are produced from the primary raw material, copper concentrates, in multi-step pyrometallurgical processes. The metals in recycling materials can be drawn out in each step of the existing processes. The sulfur in the primary and secondary raw materials is oxidized into sulfur dioxide and converted in the downstream double absorption contact acid plant into sulfuric acid and oleum, two marketable products that are primarily used in the fertilizer and chemical industries.

Copper cathodes with a copper content of over 99.99% are produced from the copper anodes in the copper tankhouse using electrochemical methods. The cathodes are used to manufacture copper intermediates (continuous cast rod, copper shapes, and copper powder).

Non-ferrous metals such as copper are not used up but can be recycled as often as desired without a loss of quality, therefore fulfilling an important role in environmental and resource protection. Nearly all raw materials are converted into marketable products at Aurubis Hamburg (see Fig. 2.2).

Intermediates produced in pyrometallurgical and hydrometallurgical copper refining, such as flue dusts and slimes, are further treated in an electrothermal process, primarily in the secondary smelter's electric furnace.

The refining of the matrix metals copper and lead in subsequent pyro- and hydrometallurgical processes (multi-metal production) serves to extract minor metals such as zinc, nickel, antimony, selenium, tellurium, and precious metals in metallic form or as metal compounds.

Internal intermediates and purchased recycling materials rich in precious metals are processed to extract precious metals. In the process, primarily internal and external anode slimes from the copper tankhouse, as well as skimmings rich in precious metals and bullion containing sulfur, are used as input in the top blown rotary converter.

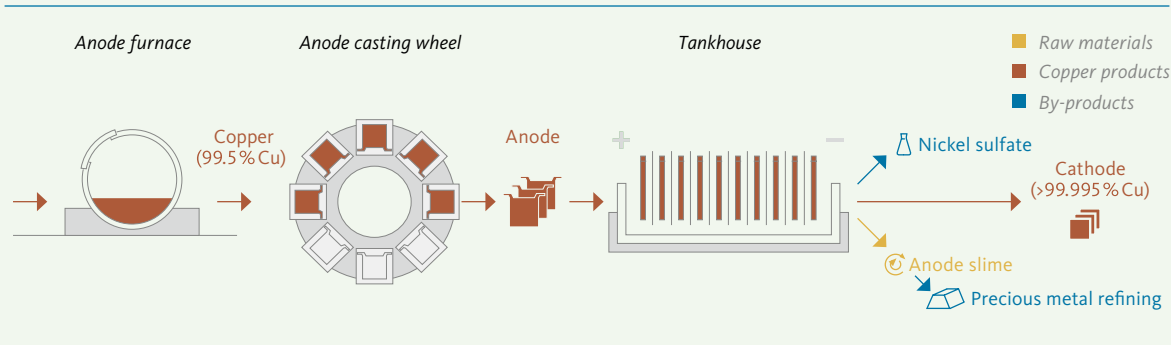
In the precious metal smelter, precious metals (silver, gold, platinum group metals) are separated using hydrometallurgical procedures and then extracted as commercial products.

Pure copper is produced from the various raw materials after the smelting process in the tankhouse. The copper can be traded on the international metal exchanges.

In the central sewage treatment plant (ZABA), process wastewater from different areas at Aurubis is treated chemically and physically.

Precipitation is collected in internal sewer systems and purified chemically and physically in two treatment plants.

Aurubis is currently planning the Group's medium-term development with "Vision 2025." Apart from the main metal, copper, additional metals will be recovered in larger quantities in the future. In this context, the permit for a new project for processing primary and secondary raw materials – Future Complex Metallurgy (FCM) – was applied for at the site in 2017, and has already been granted.



To improve metal recovery from the input materials, and in order to achieve shorter recovery times for valuable metals, the current converter in the existing facilities of the Plant North smelter will be replaced with a submerged lance furnace with subsequent granulation.

As part of the modernization of process technology and infrastructure, extensive measures will be carried out to reduce fugitive emissions and the level of separation will be improved in the case of collected sources. The improvements will be implemented in different areas of Plant North, the primary smelter (RWO), sampling, and precious metal production. The total dust emissions at the Hamburg site will be significantly reduced.

The new FCM facilities should be started up by 2021/2022.

The Integrated Management System (IMS) for the Environment, Quality, and Energy

Aurubis has had an environmental management system at the Hamburg site since 2002, which is certified in accordance with ISO 14001 and EMAS. The environmental management system is part of the integrated management system.

The energy management system at the Hamburg site was implemented in 2005. It had been reviewed within the scope of environmental management until 2013. Because of the increasing significance of certified management systems and the energy policy conditions, it was certified in accordance with DIN EN ISO 50001 for the first time in May 2013.

Quality management in accordance with DIN ISO 9001 has been established in Hamburg since 1996 for the following sub-areas: tankhouse, continuous casting plant,

wire rod plant, contact acid plant (sulfuric acid production), lead plant, analytical laboratories, and sampling. In 2017, the primary smelter (RWO) was also certified in accordance with the norm's specifications.

Targets and Tasks of the Environmental Management System

The environmental management system helps us to control production processes confidently. In particular, targets and measures are defined and their implementation is monitored. The environmental management system includes the documentation of operational processes, external environmental reviews, internal audits, routine recordings, and site inspections. Inventories form the basis for decisions about the type, extent, suitability, and execution of environmental protection measures.

Our environmental management system ensures that the applicable legal requirements are fulfilled with respect to environmental protection. Furthermore, it supports the continuous improvement of our environmental protection efforts with economically reasonable product and process design that takes the environment and occupational safety into account. Saving energy is also part of environmental protection for us.

The systems and organization of the IMS are described extensively and understandably in two handbooks available to employees. The general IMS handbook governs procedures that apply to Aurubis AG, the Hamburg and Lünen sites. The integrated management system handbook for the Hamburg plant describes the site-specific procedures. The management handbooks guarantee that all activities that concern environmental aspects are planned, managed, monitored, and continuously improved with due regard to legal requirements.

The environmental management system EMAS also helps in the implementation of the Aurubis Group sustainability targets, which were newly defined in 2013, at the Hamburg site (see the Sustainability Report at www.aurubis.com).

Environmental Management Organization

As the operator of facilities requiring a permit in accordance with Section 52a Federal Immission Protection Law and Section 53 Recycling Management and Waste Law, the Aurubis AG Executive Board or an appointed member of the Executive Board is responsible for observing environmental protection and radiation protection regulations.

A member of the Environmental Protection Department at the Hamburg site holds the position of Environmental Management Officer. This individual ensures that the requirements for the environmental management system conform to the ISO 14001 and EMAS standards. As part of the environmental management system, the Hamburg Environmental Protection Department tracks changes in legal requirements, reviews their effects on the different areas of our company, and ensures that our facilities are operated in conformity with the law. Because of the high complexity of the legal standards and requirements that have to be applied, the existing legal register has been supplemented by an IT-supported derivation of legal ob-

Fig. 2.4: Plant officers at the Hamburg site

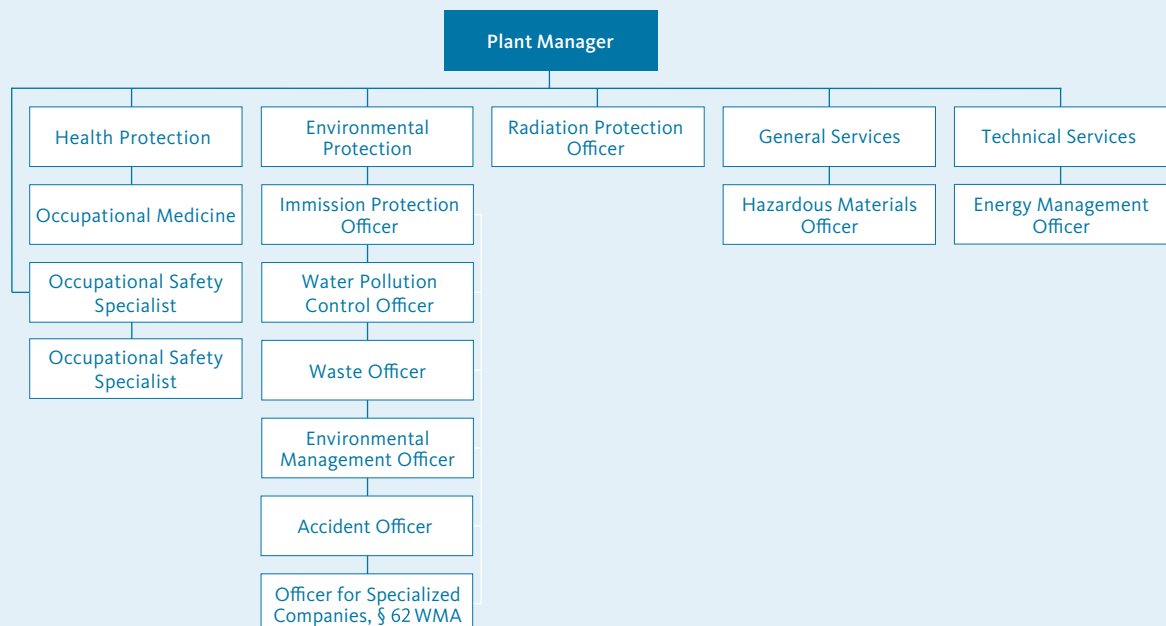
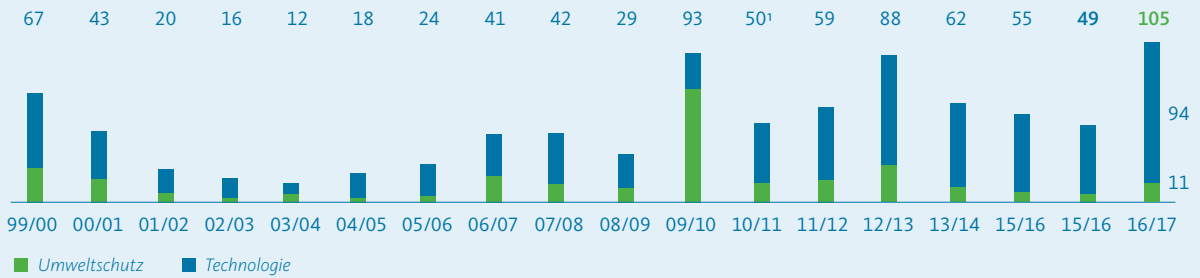


Fig. 2.4: High capital expenditure for environmental protection measures leads to higher operating costs

Capital expenditure at the Hamburg site in € million



ligations that also cover technical inspections of facilities and buildings. The new system can be used to generate facility-specific action recommendations, designate responsibility to individuals, and track implementation.

The Hamburg Environmental Protection Department provides employees with training and information related to environmental protection.

In order to fulfill corporate duties, the company management has appointed officers or specified individuals responsible for the following issues, who work closely with the Environmental Protection Department (see Fig. 2.4):

All environmental protection issues are coordinated, organized, and monitored in the Hamburg Environmental Protection Department to support the different business sectors. The department also serves as a contact for company environmental protection.

Monitoring and Internal Auditing of Environmental Management

The effectiveness of the integrated management system is reviewed with internal audits pursuant to EMAS regulations, ISO 14001, and ISO 50001. ISO 9001 is audited in sub-areas of the plant. The approach for the internal audits is defined in specific process instructions. Internal and external audits take place regularly in compliance with the requirements of the standards.

The external audit involves verifying the description of operating processes and reviewing the environmental data provided.

The plant manager of Aurubis AG, Hamburg, evaluates the fulfillment of the handbook requirements and the current management standards, as well as the validity of business policy, at least once a year in the management review.

The status of follow-up measures from the last management reviews, goals and key figures, changes involving the management system, information about the performance and effectiveness of the management system, summaries of the results of internal audits, the status of preventive and corrective measures, risk assessments, and information about resources and potential improvements form the basis of the management review.

Environmental Aspects and Performance

Following fundamental investments in filtering technologies in the 1980s and 1990s, an additional € 222 million has been invested in environmental protection since 2000. With total investment of more than € 800 million, environmental measures account for 30% of overall capital expenditure on average. Today, only comparatively smaller improvements can be achieved with continued high capital expenditure on environmental protection because a leading international environmental standard has been reached and emission reduction is subject to technological limitations (see Fig. 2.4).

At the same time, the operation of facilities that provide environmental protection (e.g., the operation of filter facilities with fans) incurs substantial costs because they are very energy-intensive.

The best available plant technologies (BAT) are used at Aurubis and the facilities are operated at a very high standard of environmental protection. Through what is known as the Sevilla or BREF process, the BAT are being updated for the non-ferrous industry. The state of the art was updated and the new BAT conclusions were published in 2016. They have to be implemented by 2020. Most of the new requirements are already being observed or exceeded today. Further emission reduction measures beyond this, as a Group and site target, therefore require disproportionately high capital expenditure, but they are still planned and carried out to improve environmental performance continuously. Consequently, corresponding environmental protection projects were initiated in 2017 as well.

The production facilities operated in Hamburg are licensed pursuant to immission protection law. With respect to water pollution control, cleaned rainwater, wastewater, and cooling water are fed in in compliance with existing water law permits.

The permanent 9 t/year reduction that was agreed upon in the sixth emission reduction agreement between the city of Hamburg and Aurubis was also confirmed with the 2017 emissions declaration.

The draft of an additional seventh public agreement with the city of Hamburg that establishes further steps to reduce dust emissions is currently being discussed. A decision about continuing the agreement should be made in 2018.

Air

It is crucial for Aurubis to develop innovative technologies for environmental protection and to enter new technical territory in the process. Almost 80% of the remaining metal emissions from the Hamburg production site come

from fugitive sources, the majority of which stem from hall ventilation facilities.

In 2017, the 5S methodology was introduced at the entire Hamburg plant. 5S serves as an instrument to keep workplaces and their environment safe, clean, and well organized, with the goal of optimizing operating procedures and promoting safe, low-emission work. An implementation check for all production and service areas by an external auditor is planned for 2018.

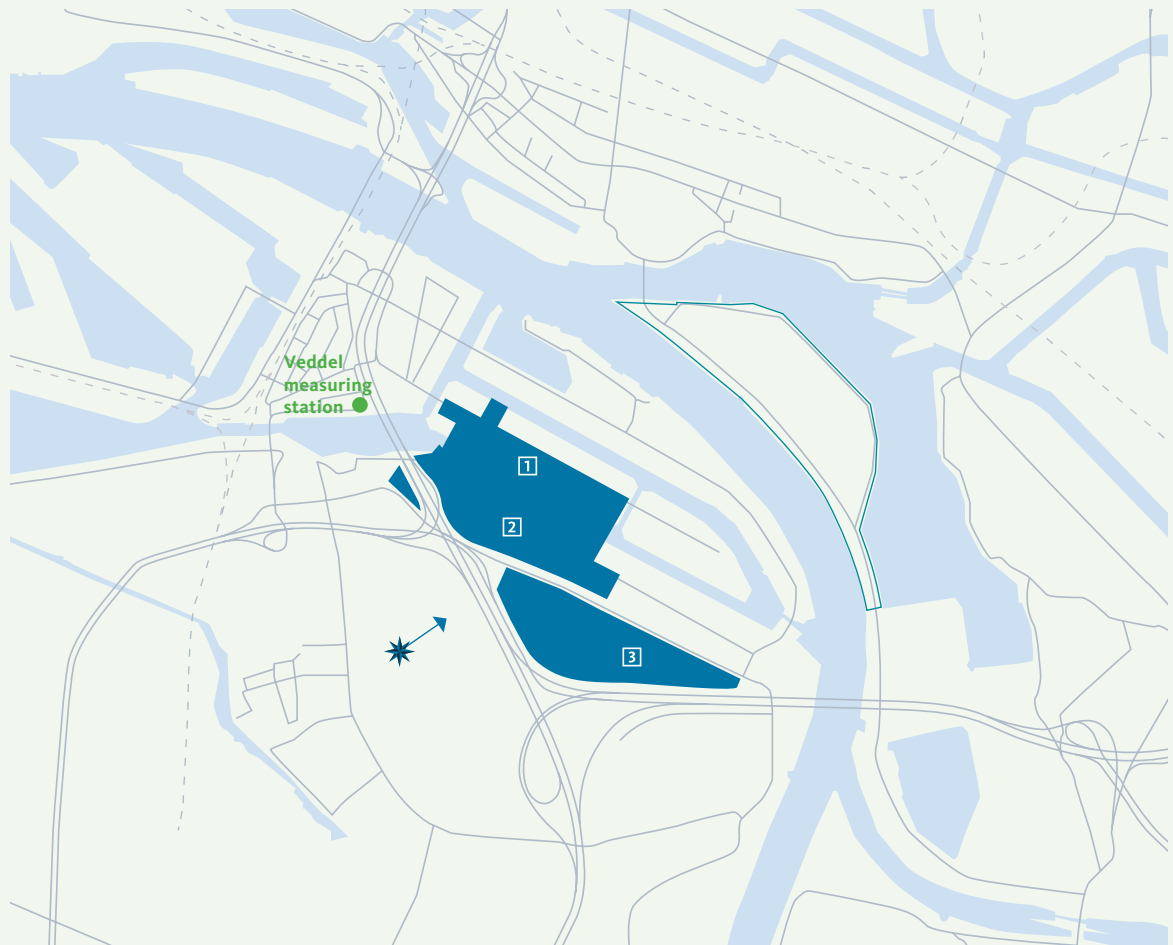
Projects to reduce fugitive emissions have high priority. The success of measures to reduce fugitive emissions is illustrated by the fact that the suspended particulate recordings taken by the Hamburg environmental authority have been kept at a low level. The Veddel measuring station of the Hamburg Air Quality Measurement Network is relevant for the official air quality recordings. It is located in the adjacent neighborhood, about 500 m west of the plant premises.


For years, Aurubis had already been observing the EU target values for arsenic (6 ng/m³) and cadmium (5 ng/m³) that went into effect in 2013.

The investigations carried out by the Aurubis environmental monitoring team on the plant premises confirmed the values from the official recordings (see Fig. 2.5 and 2.6).

All of the statements in this chapter are based on the current Emissions Report, which is issued annually by the Immission Protection Officer. The values outlined on the following pages are made up of a number of individual recordings. Directed emissions are recorded as classified values from continuous measurements made with a system provided by Durag data systems GmbH. Fugitive emissions from hall ventilation facilities, etc. are determined in recording campaigns carried out by both external

Fig. 2.5: Plant premises at the Hamburg site



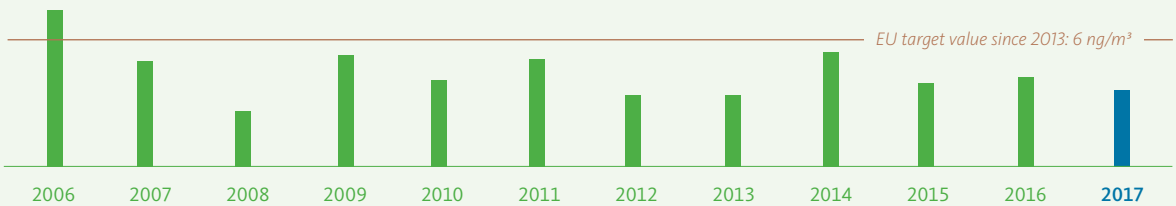
 Prevailing wind direction

1 Plant North **2** Plant South **3** Plant East

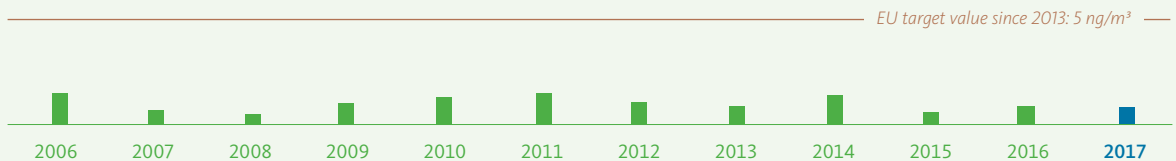
Scale 1: 40.000

Fig. 2.6: Low immission values (suspended particulates) at the Veddel measuring station¹

Arsenic load at Veddel measuring station in ng/m³



Cadmium load at Veddel measuring station in ng/m³



¹1 gram (g) = 1 billion nanograms (ng) ¹Data published by the State Ministry for Urban Development and Environment.

recording institutes and the company's own environmental monitoring team and are projected to find the annual loads. Fugitive emissions due to transshipments in storage areas, etc. are calculated using the corresponding emission factors from the technical literature.

Specific dust emissions have been reduced by 82 % between 1990 and 2017. Emissions remained constant relative to the previous year (see Fig. 2.7).

Copper is the main metallic substance in the dust at the Hamburg production site. Specific copper emissions have been reduced by 78 % since 1990. This low level was maintained, as the changes compared to the previous year were in the expected range (see Fig. 2.8).

Specific lead emissions have been reduced considerably (by 91%) compared to 1990 and are therefore still at a low emission level. The fluctuations observed are due to the use of various concentrates (see Fig. 2.9).

Arsenic is a natural component of copper concentrates. Specific arsenic emissions have been reduced by 90 % since 1990 in various steps of the copper refining process and have been at a low level in the last several years (see Fig. 2.10).

Apart from copper, sulfur is one of the main components of copper concentrates. The gaseous sulfur dioxide produced when ore is smelted is converted into sulfuric acid in the sulfuric acid plant using the modern double catalysis process. The sulfuric acid is mainly used in the chemical industry. Specific sulfur dioxide emissions have been reduced by 57% since 1990 and tend to vary at a low level (see Fig. 2.11).

Fig. 2.7: Dust emissions at the Hamburg site

Dust in g/t of copper output

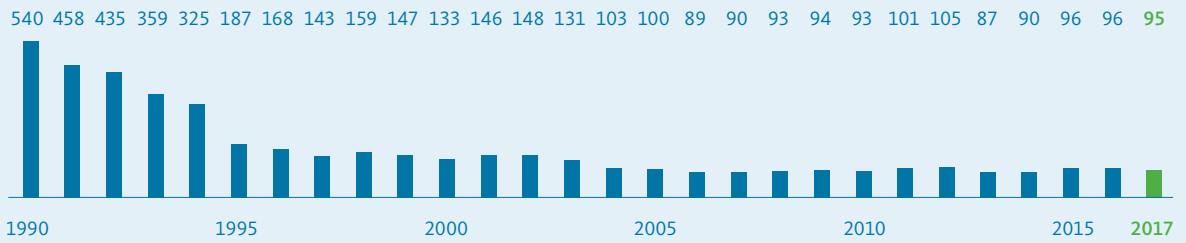


Fig. 2.8: Copper emissions at the Hamburg site

Copper in g/t of copper output

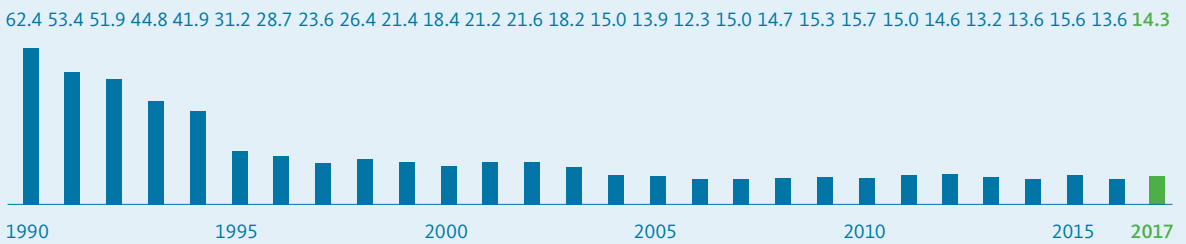


Fig. 2.9: Lead emissions at the Hamburg site

Lead in g/t of copper output

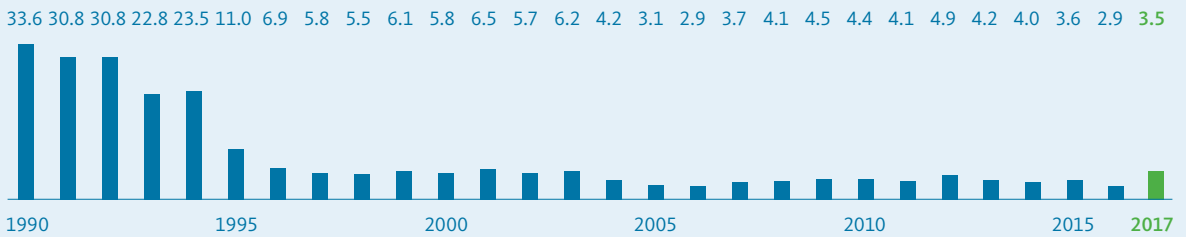


Fig. 2.10: Arsenic emissions at the Hamburg site

Arsenic in g/t of copper output

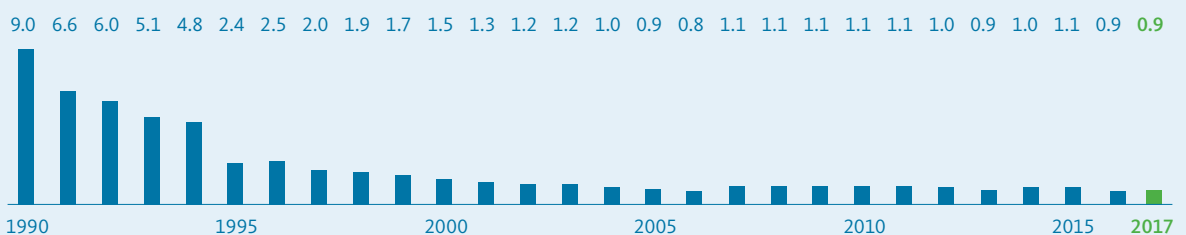
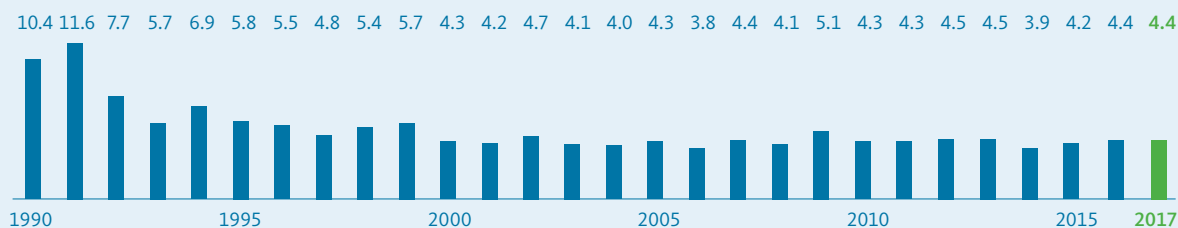


Fig. 2.11: SO₂ emissions at the Hamburg site

SO₂ in kg/t of copper output



The Aurubis Hamburg site continues to be a forerunner in reducing specific sulfur dioxide emissions (see Fig. 2.11).

With an input of 1,700,440 t of material and an annual output of 455,406 t of copper, specific emissions for 2017 are as follows:

Specific emissions related to input material

Type of emission	Input material	Specific emission related to Input material	Specific emission related to Copper output
SO ₂	kg/t	1.2	4.4
Dust	g/t	25.3	95.0
Copper	g/t	3.6	14.3
Lead	g/t	0.8	3.5
Arsenic	g/t	0.2	0.9

Overall, Aurubis strongly adhered to the emission limits established in the Technical Instructions on Air Quality Control (TA Luft) and in the relevant permits for sources of collected and fugitive emissions. The relevant limit values of the TA Luft are featured in chapters 5.2.2, 5.2.4, 5.2.5, 5.2.7, and 5.4.3.3.1 in particular.

Noise

Aurubis constructs and operates its production facilities in accordance with the current noise reduction technology. The noise register developed for the Hamburg site lists all of the relevant noise sources. The local environmental authority has defined noise immission limits for 20 immission areas surrounding the site. These requirements are established in the permits. The impact on the noise situation in the neighborhood is evaluated for all facility modifications and, if necessary, measures are derived and implemented.

There was one noise complaint from the area around the plant in 2017. The possibility of a noise source on the plant premises was ruled out after a thorough inspection.

Water

The wastewater from Aurubis AG's entire Hamburg plant is composed of precipitation, indirect and direct cooling water, condensate, process wastewater, and desludging water. All of the plant's precipitation is collected and cleaned together with other wastewater (e.g., from the anode casting machine in the primary smelter) and discharged into the Elbe River. Precipitation is also used as cooling water in some cases.

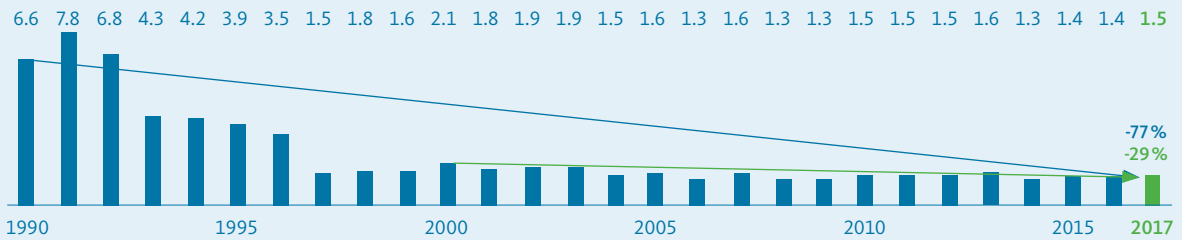
Accumulated process water is cleaned in a separate state-of-the-art wastewater treatment facility. The Hamburg plant has water law permits and observes their requirements. Sanitary water is discharged into the city sewer system.

The proportion of heavy metals discharged by Aurubis in the Elbe's total load is less than 0.1%. Aurubis has reduced the heavy metal load that is discharged with the wastewater into the Elbe by 77 % since 1990 and by 29% since 2000. Today's average emission value of 1.5 g/t of copper products is evidence of Aurubis' continued top position in environmental protection.

Limit values and requirements for discharges into bodies of water are regulated in the German Wastewater Ordinance (AbwV) and in the water law permit. They are monitored by both internal recordings and unannounced recordings by the relevant authorities. The recorded values clearly fall below the regulated limit values.

Fig. 2.12: Metal emissions in water at the Hamburg site

Metal emissions in g/t of copper output



The following diagram shows the total metal emissions of all discharge points (see Fig. 2.12). In 2017, Aurubis already observed the increased requirements stemming from the BAT conclusions, which are supposed to be implemented by 2020.

The company plans to improve cleaning efficiency, modernize the central wastewater treatment plant (ZABA), and improve precipitation management as part of the Future Complex Metallurgy (FCM) project. The goal is a reduction in run-off concentrations above BAT level. A 2017 water ecology inspection confirmed the compatibility of the plant operations with bodies of water. The related change to the existing water law permit was applied for in 2018.

Aurubis operates an extensive monitoring network for cooling water discharge. In the process, the heat emissions, discharge temperature, temperature range, and cooling water quantity are measured and recorded at all discharge points. Furthermore, to improve water quality, the oxygen content is increased in the significant discharge areas with targeted turbulence and is measured at the discharge point.

Through the planned construction of waste heat recovery from the acid coolers of KAWO in order to supply Hafencity East, the average thermal output discharged with cooling water will be reduced by about 18 MW (160 GWh/year). The related permits were issued in 2017 and commissioning is planned for 2018 (see the Energy chapter for more information).

Additional measures to reduce cooling water needs are planned in the scope of the modernization scheduled for secondary copper production (FCM project).

The 42nd German Federal Immission Protection Ordinance on the safe operation of evaporative cooling facilities to prevent the spread of legionella went into effect on August 19, 2017. The new requirements regarding monitoring and modes of operation were passed on to employees in training sessions and were implemented.

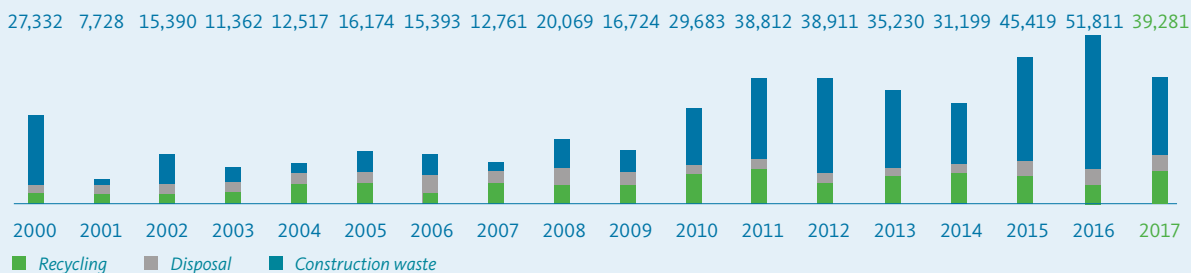
There was no large-scale standstill in the reporting year. The use of water from local bodies of water therefore declined in 2017 by a total of about 5% compared to the previous year, while potable water usage from the Hamburg Water Works also decreased slightly. The treatment of Elbe River water to convert it into fully desalinated water continues to substitute about 300,000 to 400,000 m³ of potable water per year.

Facilities Handling Substances Hazardous to Water

The new Ordinance for Facilities Handling Substances Hazardous to Water (AwSV) went into effect on August 1, 2017. The German Technical Control Board (TÜV) trained the responsible operators and planning and maintenance employees on the new standards. Due to the latest technical plant audit pursuant to the Water Management Act, also carried out in 2017, Aurubis technicians are allowed to work on the AwSV facilities independently.

Fig. 2.13: Disposal methods for waste produced at the Hamburg site

in t per year



Waste

All in all, 127,917 t of waste were accepted and recycled at the Hamburg site in 2017, of which 10,657 t were classified as hazardous waste. A total of 2,671 t of this came from other countries and was registered.

Overall, 11% of the waste accepted was used as a slag former (e.g., spent abrasives, sand, and excavation residues), and 89% was used for metal recovery (dust, slimes, slags, and precious metal-bearing sweeps). At about 114,059 t, the use of metal-bearing secondary raw materials rose slightly compared to the previous year.

In the 2017 calendar year, a total of 39,280 t of waste were generated and directed to waste management at the Hamburg site (see Fig. 2.17). Of this amount, 17,205 t were classified as hazardous waste. The proportion of construction waste in the total waste volume was 61% in 2017 due to low levels of construction and demolition work (2016: 80%). A total of 15,254 t of waste arose from production processes, of which 4,960 t were directed to waste disposal and 10,294 t to external recycling. This corresponds to a recycling rate of 67%.

Most of the waste that is disposed of is slimes from off-gas cleaning, as well as washing fluid and emulsions.

With an annual copper output of 455,406 t, the specific waste level (excluding construction waste) is 33 kg/t of product (2016: 24 kg/t).

A total of 41,897 t of olivine pyroxene rock from the secondary smelter (RWN) and 10,613 t of slag material from the primary smelter (RWO) were not marketed as substitute construction material and were taken to landfills. In the process, large pieces were recycled for use as landfill construction material.

Soil

There are soil impurities typical for industrial areas at the Hamburg plant owing to many years of industrial use. The heavy metal pollution values are so low that no clean-up is required from the authorities' view. The plant premises are mostly paved so that soil impurities cannot mobilize. Furthermore, the groundwater is protected from soil impurities by a water-resistant layer of clay. A sheet pile wall has also been erected in the primary smelter that effectively prevents backwater from flowing beyond the plant premises.

The baseline report for the soil pursuant to the Industrial Emissions Directive was submitted to the Hamburg Authority for Urban Development and Environmental Protection and will be passed during the next commissioning process of a change authorization. The objective of the report is to evaluate the condition of the soil and the groundwater at the site with respect to hazardous substances.

If the site returns to its original state, the baseline report serves as evidence and a standard of comparison and is obligatory for Aurubis in the case of significant facility modifications.

The points of evaluation for the subsequent monitoring program for the soil and groundwater was agreed upon with the responsible monitoring authority. The measures resulting from the inspection program were integrated into the plant monitoring process.

Peregrine falcon nesting box



Biodiversity

Open areas are inspected to see if they can possibly be used in a way that is close to nature. To facilitate green spaces despite the high level of paving on the plant premises, greenery for facades using local plants will be included in future planning. The plan is to plant new trees around the innovation and training center, which is currently under construction. The nature conservation areas NSG Holzhafen and NSG Auenlandschaft Obere Tideelbe are located just a few kilometers east of the plant premises.

By participating in the UnternehmensNatur project, companies are able to find ways to create valuable habitats for animals and plants by designing and maintaining their plant premises in a way that mimics nature, thereby making an important contribution to the preservation and promotion of biodiversity in the city. UnternehmensNatur is a joint project of NABU Hamburg with the Hamburg Chamber of Industry and Commerce and the Hamburg Authority for Urban Development and the Environment (BSU).

Although 88 % of the plant premises are developed or paved (766,000 m² of a total 871,000 m²), it was possible to identify areas that could be rededicated, for example, to butterfly or insect meadows through appropriate changes in use or through greenery and maintenance. It was determined that areas exist on the edges of the plant that have been partially untouched for years and undisturbed due to the fencing-in of the plant.

The implementation of the recommendations made by the NABU experts began in 2017. The plant also has its own tree registry.

The peregrine falcon that has been at Aurubis for a few years has maintained his territory at Aurubis. The nesting aid installed 50 m high on a chimney is still checked regularly and adjusted to the falcon's needs. The falcon hunts pigeons in the plant as prey.

Energy & Climate Protection

We act responsibly towards future generations by economically using raw materials and energy. Our main energy sources are electricity and natural gas. Aurubis AG consumed a total of 1,176 GWh of energy at the Hamburg site in 2017. With an annual copper output of 455,406 t, this amounts to specific energy consumption of 2.6 MWh/t of copper output (2016: 2.6 MWh/t; 2015: 2.71 MWh/t).

Furthermore, landfill gas was used in the production processes instead of natural gas (2017: 2.7 GWh). Aurubis thus uses 100 % of the landfill gas collected in the former Georgswerder landfill.

Specific energy consumption has stagnated at a high level at the Hamburg site in the past several years. An important reason for this is the higher level of multi-metal recycling in the meantime and the commissioning of new facilities, e.g., the anode slime processing plant. This leads to higher total energy consumption at the Hamburg site without a significant increase in the copper volume.

Taking a longer-term view, specific energy consumption as a yardstick for energy-efficient production has been significantly reduced at the Hamburg production site in the last few decades, falling by 44% compared to 1990. It has even been possible to reduce fuel-related specific CO₂ output by 68% since 1990. The reason for this is the strongly reduced use of particularly CO₂-intensive fuels, especially coal.

Fig. 2.14a: Specific energy consumption at the Hamburg site

in MWh/t of copper output

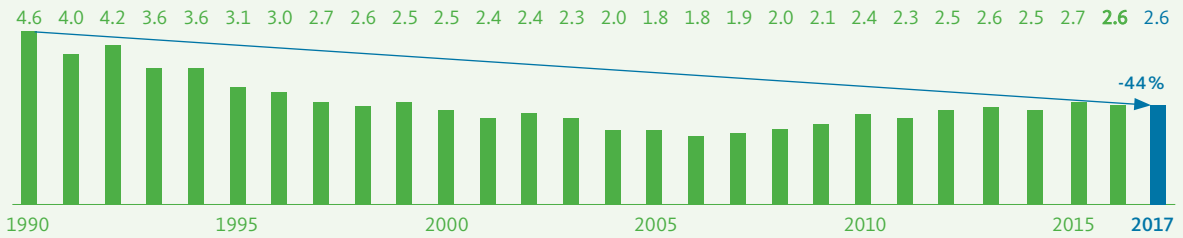
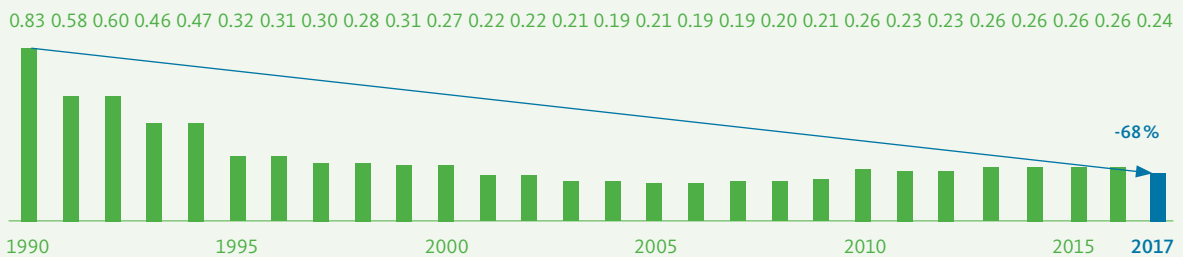


Fig. 2.14b: Specific fuel-related CO₂ emissions at the Hamburg site

in t CO₂/t of copper output



To adjust to the German energy transition and increase consumption flexibility, concepts to use electricity preferentially in phases with a surplus are being developed.

With an output of 455,406 t of copper in the calendar year, specific CO₂ emissions from fuel amounted to 0.24 CO₂/t of product (see Fig. 2.14a and 2.14b). This corresponds to 109,721 t of CO₂.

When it comes to maintenance measures and new investments, engines, and other energy-consuming equipment with as high an energy efficiency class as possible are used.

The calculation is based on CO₂ emission factors from the following sources:

- » for natural gas: GasCalc calculation program, version 2.3.2, distributed by e.on Ruhrgas AG
- » for all other fuels: German Emission Trading Office data, last reviewed on March 30, 2017.

Waste Heat Use

Aurubis strives to use process waste heat to the greatest possible extent. It is used to heat buildings, to facilitate the production processes, and to generate electricity. In 2017, 87% of the steam needed was produced from waste heat and only 13% was produced from fossil fuels, a 50% reduction compared to the previous year.

Copper production from ore concentrates begins in the primary smelter's flash smelter. Its exhaust gases have a temperature of 1,400° C and contain about 35% sulfur dioxide, which is processed into liquid sulfuric acid in a so-called contact acid plant.

The intermediate absorber weighing 250 t is lifted to its final location on the Aurubis plant premises. Virtually CO₂-free heat develops in this cylindrical container and will be used to heat the new HafenCity East district.



The flash smelter's hot exhaust gases are initially cooled in a waste heat boiler, producing 60 bar steam.

Several steam turbines have been installed at the Hamburg site as an effective energy-saving measure. The 60 bar steam is first depressurized to 20 bar in the Interplant turbine, which was commissioned in 2014. The 20 bar steam serves as process steam for various procedures in the plant. The remaining steam volume is depressurized to 3 bar in the first stage of another steam turbine in the thermal power plant. This steam is then available as process and heating steam in the plant and administrative buildings. A total of 8 GWh of electricity was produced from waste heat in 2017, or 1.2% of total electricity consumption (2016: 1.83%). The reason for the slight decline in electricity produced from waste heat was the planned overhaul of one of the turbines, as well as a longer-term breakdown of the other turbine.

A central milestone on the path to more sustainability and better climate protection lies in the shift in heating methods as a key part of the energy transition. This is especially true for a metropolis like Hamburg, which has about 900,000 apartments. The energy needed for providing heating, warm water, and lighting to the city's buildings makes up 40% of the total energy demand and is therefore significantly higher than the energy demand in the transport and industry sectors. Today, the heat supply in Hamburg is dominated by decentralized, gas-fueled heating systems and by a large central district heating network whose thermal output is based on conventional large-sale power plants and heat generation from coal, gas, and waste.

The new development area HafenCity East, which is supplied by enercity Contracting Nord GmbH, is very close to Aurubis AG's Hamburg plant. The energy demand for

new buildings is increasing steadily. Especially in urban areas and metropolises, investors and builders are facing challenges – the energy concepts for individual buildings are becoming more and more complex. In light of this development, eCGN is implementing a forward-looking heating approach using waste heat from Aurubis. Aurubis extracts heat that is formed when sulfur dioxide – a by-product of copper smelting – is converted to sulfuric acid. This industrial waste heat is nearly free of CO₂, and utilizing it will prevent more than 20,000 t of CO₂ emissions per year. About half of this reduction results from the replacement of natural gas used to produce steam on the Aurubis plant premises, while the other half is saved by delivering the waste heat to enercity. In HafenCity East alone, about 4,500 t of CO₂ will be saved each year by the final expansion (target date: 2029). Aurubis will deliver the heat up to its plant boundaries. enercity Contracting Nord GmbH, a 100% enercity holding located in Hamburg, will collect the heat, secure it, and transport it further for use in the area that will benefit from the heat. Aurubis removes the heat from what is known as the contact plant, in which the gaseous sulfur dioxide that accumulates in the process transforms into liquid sulfuric acid. It consists of three lines. About 160 million kilowatt hours (kWh) can be extracted from each individual line annually, for a total of nearly 500 million kWh. The heat from one line is sufficient to supply HafenCity East, which is why only one line will be converted initially.

Use of the waste heat is supposed to start at the beginning of the 2018 heating period. Until then, the contracting parties will carry out the construction work necessary to deliver the district heating for HafenCity East. Aurubis is investing roughly € 21.7 million to convert the facilities and lay the heat pipeline at the plant boundary. enercity Contracting Nord will lay a new heat transport pipeline (district heat line) from the transfer point at the Aurubis

plant to HafenCity. A new power station near the heat line will balance out the industrial heat volume, which fluctuates depending on current operation, for the district heating supply. The investment costs for enercity Contracting Nord's power station and heat transport pipeline amount to around € 21 million.

Aurubis will receive funding for about 30% of the investments from the German Federal Ministry for Economic Affairs and Energy (BMWi) via the Development Loan Corporation (KfW). A similar level of funding is planned for enercity Contracting Nord from the European Regional Development Fund (ERDF) via the funding program of the city of Hamburg's Authority for the Environment and Energy (BUE), as well as the BMWi.

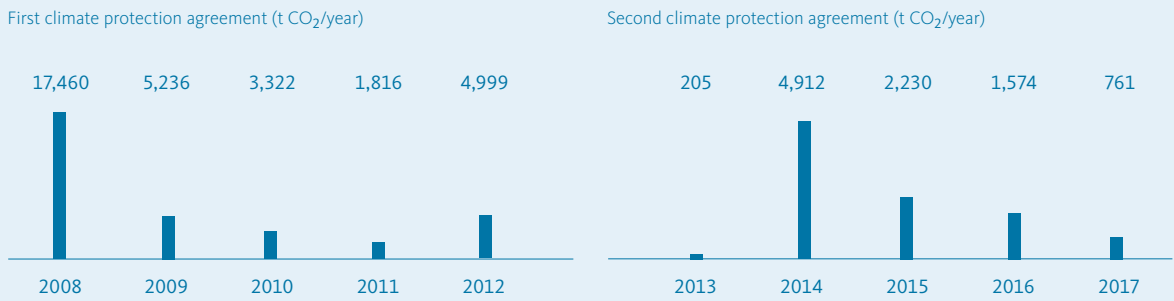
Additional extractable heat with potential savings of up to 120,000 t of CO₂ would be technically available in the remaining two lines of the contact acid plant. The capital expenditure needed to extract the heat and integrate it into the Hamburg district heating system is still so high even with the subsidy that additional discussions must be held with the city and the potential partners in order to gain clarity about the technical and economic implementation.

Additional projects to use waste heat are being planned, e.g., the use of the heat from iron silicate stone and the process gases from secondary copper production.

Fig. 2.15: District heating pipeline route from the Aurubis plant to HafenCity East



Fig. 2.16: Annual CO₂ reduction at the Hamburg site in the context of the Hamburg Climate Protection Concept



Direct CO₂ Emissions – Emission Trading System (ETS)

As an energy-intensive company, the Hamburg site has been required to participate in the European Emission trading System (ETS) since 2013. The direct CO₂ emissions, mainly from natural gas consumption, are verified by TÜV-Nord and reported to the German Emissions Trading Authority (DEHSt).

The reported CO₂ emissions were 166,732 t for 2017. Direct CO₂ emissions have thus been at a relatively constant level since monitoring started in 2005 (average for 2005-2016: 170,000 t). More than 70% were caused by the fuels used, mainly natural gas, while the remainder was caused by the carbon contained in recycling materials and additives.

Indirect CO₂ Emissions

Copper production is an energy-intensive process for which a reliable electricity supply is very important in particular. Aurubis therefore has a long-term cost-based electricity supply contract with the coal power plant Moorburg (a so-called virtual power plant slice). This is one of the most state-of-the-art and efficient power plants of its kind. Electricity production in this power plant nevertheless leads to CO₂ emissions, which are indirect CO₂ emissions for Aurubis, and therefore indirect environmental effects. In 2017, these indirect CO₂ emissions totaled 352,560 t (pursuant to ETS reporting). Overall, 288,816 t of the indirect CO₂ emissions resulted from electricity consumption in the production processes, while 63,744 t resulted from the additional electricity consumption for oxygen production.

The electricity producer already reported these indirect CO₂ emissions to the trading authority. Any costs were passed on via the electricity price. Therefore, these indirect CO₂ emissions are not included in the amount reported by Aurubis to the trading authority.

Climate Protection Agreement with the Hamburg Senate on CO₂ Reduction

In August 2007 the Hamburg Senate approved the Hamburg Climate Protection Concept 2007–2012 and presented it to the public. A major part of the concept was based on the participation of Hamburg industry.

Aurubis AG was one of the first Hamburg companies to participate in this climate protection concept and implemented a number of projects between 2007 and 2012 that cut CO₂ by 32,000 t each year (see Fig. 2.16).

With a pledge to reduce an additional 12,000 t of CO₂, Aurubis is participating in the follow-up agreement for the period from 2013 to 2018.

Aurubis had already achieved a roughly 9,700 t reduction in CO₂ by the end of 2017. Additional reduction potential was identified and relevant measures are being planned and implemented in 2018.

At least another 20,000 t of CO₂ reductions will be achieved as a result of the decision to use hot water extraction to supply heat to the new urban quarter under construction, HafenCity East.

Fig. 2.17: Origin of copper concentrates for the Hamburg site

in percent, fiscal year 2016/17



Audits and Inspections by the Authorities

The production facilities at the Hamburg site are monitored by the authorities as part of inspections and emissions surveillance. The reports on the inspections pursuant to the IED directive have been published online in the city of Hamburg's Transparency Portal since 2016. Inspections were carried out in the following areas in 2017:

- » Primary smelter (RWO)
- » Tankhouse, Plant East
- » Contact acid plant, Plant East
- » Top-blown rotary converter south
- » Precious metal smelter
- » Lead refinery
- » Selenium facility
- » Central wastewater treatment plant

All inspections were carried out without the identification of any defects. Operation in conformity with the respective permits was verified in each case. Depending on the requirements, the inspections included immission control, water pollution prevention, waste management, and plant safety.

Furthermore, the relevant authorities carried out audits as part of permit processes.

Indirect Environmental Aspects

Indirect environmental impacts arise first and foremost from the transport of material and from the mines supplying Aurubis with copper concentrate. These effects are not directly caused by our production processes on site and therefore can't be directly influenced by Aurubis. We cannot directly influence transports of hazardous materials that we have commissioned, either.

We obtain most of the copper concentrate from South America (74%); 14% comes from North America, 5% from the European Union, and small quantities from other countries. The concentrate is transported almost exclusively by sea in bulk carriers via Brunsbüttel. Special ships suitable for inland waterways are used to deliver the concentrate mixtures. They drop off their cargo in the Müggenburger Canal with a crane. In the 2016/17 fiscal year, over 1.2 million t of copper concentrates were delivered to our plant in this way.

Transporting Hazardous Materials

A separate internal Hazardous Materials Officer was appointed for the Hamburg site, and the relevant authorities have been informed.

In the 2016/17 fiscal year, 1,214,998 t of outgoing hazardous materials were registered at the Hamburg site of Aurubis AG. Of the total amount of hazardous materials, approximately 60% are shipped by inland vessel and 20% each by truck and train (see Fig. 2.18).

During the reporting period, there was an incident in the course of a hazardous material transport that was reported to the German Federal Office for Goods Transport. While an intermediate bulk container was being unloaded, a few liters of hydrogen peroxide solution leaked and spilled without causing an environmental impact or health hazard. Other isolated irregularities were corrected immediately before transport in compliance with the relevant regulations on hazardous materials. Internal consultations, monitoring, and training were carried out again in order to maintain this high safety standard.

The commissioning of the individuals responsible under hazardous materials law was reviewed in 2017 and adjusted to company requirements.

Fig. 2.18: Volume of hazardous materials delivered from Hamburg site

Class	Description	2012/13		2013/14		2014/15		2015/16		2016/17	
		incoming	outgoing	incoming	outgoing	incoming	outgoing	incoming	outgoing	incoming	outgoing
1	Explosive materials and objects	0	0	0	0	0	0	0	0	0	0
2	Gases (compressed, liquefied, or dissolved under pressure)	593	1	331	1	410	1	1,225	0	1,668	0
3	Flammable liquid materials	1,804	0	1,679	0	1,607	0	1,651	0	1,585	0
4.1	Flammable solid materials	108	32	78	31	73	29	69	0	63	0
4.2	Materials that can spontaneously combust	0	0	0	0	0	0	0	0	0	0
5.1	Oxidizing materials	2,810	0	768	6	685	6	3,940	0	3,543	0
6.1	Toxic materials	12,069	5,766	11,201	8,215	13,771	7,924	7	0	9,871	0
7	Radioactive materials	0	0	0	0	0	0	0	6	0	0
8	Corrosive materials	18,073	973,203	28,671	980,395	30,536	1,067,003	35,189	839,412	13,416	1,185,455
9	Miscellaneous hazardous materials and objects	5,996	20,492	6,231	26,330	6,598	24,241	1,034	14,096	2,435,404	56,543
Total quantity of all hazardous materials		41,453	999,494	48,959	1,014,978	53,680	1,099,204	43,115	853,514	2,465,450	1,214,998

Commitment to the Environment – Partnership for Air Quality and Low-Emission Mobility

Aurubis is involved in climate protection issues beyond sustainable production.

In 2012 the city of Hamburg, Aurubis, and eleven other companies established the Partnership for Air Quality and Low-Emission Mobility. The objective is to reduce pollution, especially NO_x, resulting from individual transport.

In order to bundle existing ideas and projects in the area of mobility, Aurubis Hamburg participated in the Mobil.Pro.Fit model project in 2016 and was certified as a Mobil.Pro.Fit company in 2017. The mobility management system that was developed was integrated into the existing management system.

Initial measures have already been implemented. The bus connections from the Veddel train station, which lies approximately 2 km from the plant, have been significantly expanded. This project initially ran on a trial basis for half

a year. Both bus lines now operate longer in the evenings, and buses also service shift changes, including on the weekends. The future bus schedule will be decided on in 2018 based on its use so far.

The construction of a city bike station at the plant entrance on Hovestrass, which is scheduled for 2018, will promote bike use for employees in their daily commutes between home and work. The station will connect the plant to Hamburg's city-wide bike borrowing system. Furthermore, there are plans to build bike parking areas with locks at the nearby train and subway stations.

In order to promote e-mobility, efforts are being made to set up charging stations at the employee parking lots on Hovestrass and the Muggenburg Hauptdeich. E-mobility for internal plant traffic is also being emphasized. Recently two hybrid vehicles were acquired to be used in the vehicle pool. For internal transportation, diesel vehicles were replaced with purely electric vans. In January 2018, 11 clean vehicles were in use in the plant.

Emergency Measures and Crisis Management

Because of the type and quantity of materials handled, the Hamburg production site is subject to the expanded obligations of the German Hazardous Incident Ordinance. The safety report for the operating area was adjusted to the requirements of the Hazardous Incident Ordinance amended in 2017 and is regularly reviewed and updated according to legal requirements.

For the first time, the appropriate safety distance was determined by an expert and confirmed in a permit procedure.

Last year the Hamburg environmental authority subjected selected facilities to an inspection. No deviations from their intended operational use or safety deficiencies were found.

There were no incidents or reportable malfunctions within the meaning of the Hazardous Incident Ordinance during the reporting period. Local citizens were not subject to any risks at any time. No direct environmental damages were determined. The results are published on the government agency's website.

The brochure "Safety for Our Neighbors", which was released in February 2013 to inform the public, was expanded and updated in 2017 in cooperation with the Hamburg Chamber of Commerce and 64 local companies that are also subject to the Hazardous Incident Ordinance. The brochure will be distributed to 185,000 households in Hamburg in summer 2018 and will also be available online.

Emergency plans are in place for emergency situations and accidents. Moreover, we have developed an alarm and danger prevention plan in coordination with the responsible authorities, which describes emergency measures for our plant premises. The individual plant divisions also have alarm and danger prevention plans.

The alarm and danger prevention plan will be updated again in 2018 and sent to the relevant authorities. Our Plant Fire Department works around the clock in Hamburg and carries out emergency drills with different plant divisions regularly.

Employees are on call for each plant division and for all of the relevant departments as well. An engineer on duty coordinates required measures as necessary.

Accident Prevention

A separate crisis room has been in place in the Plant Fire Department since January 1, 2017. Fictional scenarios can be planned and executed here in staff exercises with the employees responsible.

The Plant Fire Department carried out a number of drills in 2017, e.g., to test the alarm and danger prevention plan, to test flood protection, and to train employees. The Fire Department added to and expanded their equipment.

The hazardous materials section of the Plant Fire Department, which was first created in 2016, has supervised more than 100 hazardous materials situations, such as the filling of tank wagons, the loading of general cargo in containers, as well as preparatory measures for the transportation of hazardous materials in the facilities of Aurubis AG at the Hamburg site. For this purpose, four employees received qualifications through training as hazardous materials officers.

Aurubis AG Hamburg's Plant Fire Department has been a member of the TUIS, the Transport Accident Information and Assistance System, since 2015. The TUIS, a network of the German chemical industry, supports emergency response personnel across Germany in the case of transport accidents involving chemicals, but also production and warehouse accidents.

Environmental Program

The targets set in the context of the Environmental Statement 2017 were reviewed to determine the extent to which they had been achieved and implemented. Discussions with employees, training, audits, and quality circles served as a basis for discussing and evaluating the environmental protection measures, as well as developing a new environmental protection program for 2018. The results are presented in the following Environmental Program:

Strengthening environmental awareness

Target	Planned measure	Degree of implementation/date
14-day information session for the plant management team on environmental protection as part of regular communication	Routine discussions and review of measures with plant management and the department or production managers	Weekly as part of regular operative communication or as needed, ongoing
Training employees working in all plant areas relevant for environmental protection	Annual training sessions for employees in the primary smelter, secondary smelter, lead plant, precious metal recovery, casting lines, rod plant, ELWO, acid plant, and logistics	Implemented in 2017 Repeated annually
Information and training sessions for department and plant managers on environmentally relevant topics	Conducting environmental quality circles; information session on the legal situation and the correct implementation of regulations; clarifying the consequences of non-compliance.	Training sessions were successfully carried out again; they will continue in 2017 as part of general continuing education on an ongoing basis
	Expanding the legal register by implementing an IT-supported legal and regulatory management system to ensure lawful plant operation with increasing complexity of regulations	Introduced for the legal areas in FM and OHS. Complete system integration in environmental law scheduled for 2019
Plant tours by employees in the Environmental Protection Department	Monitoring plant operations with regard to environmental effects and compliance of Environmental Protection Department with regulations	Information provided to the plant and division management in short reports including implementation controlling
	Process improvement by introducing IT-supported implementation controlling as part of AOS	2018
Strengthening environmental awareness	All employees should be reached through regular training sessions, the distribution of the Environmental Report, and important information on the intranet, i.rubis (e.g., Environmental Policy, IMS handbook with the relevant process instructions).	Completion of the Environmental Report including Environmental Statement ready for printing by August 2018.

Reducing dust emissions

Public contract with the city of Hamburg for the time frame 2011-2016

Target	Planned measure	Degree of implementation/date
Reducing dust emissions by 9 t each year	Various measures from the public contract for the time frame 2011-2016 – see the chapter Environmental Protection Facts and Figures	Verification will follow with the 2016 and 2017 Emissions Declaration.
Remaining work	Improvement of the flow situation in the primary smelter converter hall	Preparatory measures to improve cleanliness in 2017; concept developed in connection with scheduled partial suctioning of ridge turrets, planning started in 2018
	Source extraction for skip loading of ladle linings	Concept options are available, details to be arranged in 2018

Public contract with the city of Hamburg for the time frame 2017-2022

Target	Planned measure	Degree of implementation/date
Additional improvements to reduce fugitive emissions	Suctioning of the ridge turrets in the primary smelter (RWO)	Suctioning of the ridge turrets in the RWO in connection with a flow improvement in the converter hall and improvement measures in the existing auxiliary hood filter system; permit has been issued; commissioning scheduled for 2021
	Program for the cleaning of surfaces and roofs	Tests carried out in 2017, new sweeper commissioned in 2018 with improved cleaning performance (high-pressure jets); renovation of a number of facades/roofs as part of continuous plant modernization, cleaning options taken into consideration during planning

	Improvement of filters	Improvement in filters' cleaning efficiency by using new filter materials and filter fixtures in the areas: Examples: Primary smelter concentrate dryer EBA RWN Rod plant Continuous casting plant Lead refinery Permits have been issued Commissioning planned starting 2019
	Introduction of 5S beyond individual plants/ departments	Plant-wide implementation of 5S in 2018, audit scheduled for May 2018
Additional measures to reduce dust emissions	Suctioning of Plant North DR e-furnace	Permit has been issued, commissioning in 2018
	Constructing an additional closed storage hall in secondary copper production as part of FCM project implementation	Permit has been issued, commissioning in 2021
Efficiency enhancement in reducing gaseous emissions	Optimizing wet gas cleaning in hydrometallurgical precious metal recovery to reduce NO _x emissions	Implementation by 2020 planned

The above, or equally effective, measures should be established in the continuation of the public contract to reduce emissions in 2018. The coordination talks with the authorities started in 2017. Permits under the German Federal Immission Protection Ordinance have been issued for individual measures. The goal is to reduce dust emissions by 5 t per year by 2022.

Air pollution control and permits

Target	Planned measure	Degree of implementation/date
Participation in the Hamburg Senate's Climate Protection Concept	Implementing projects to cut 12,000 t of CO ₂ from 2013 to 2018	Implemented so far: Interplant turbine and conversion of the cracking plant from HD to MD oxygen (degree of implementation 2016: 9,400 t CO ₂); additional projects in the planning stage, particularly waste heat use and acid cooling
Voluntary pledge among Hamburg industrial companies		In 2017 Aurubis achieved 9,700 t of CO ₂ reductions by implementing almost 20 projects
		The extraction of heat from the contact plant for the purpose of district heating will start up in fall 2018, leading to a further reduction of 20,000 t of CO ₂ due to the substitution of fossil fuels for heating apartments

Energy optimization

Target	Planned measure	Degree of implementation/date
Heat extraction for internal use and for district heating in the HafenCity East neighborhood – reducing heat discharge in the Elbe River	Conversion of Line 1 for the extraction of 90 °C hot water; construction of the heat line up to the transfer point on the plant boundary. Review of additional potential for the extraction and delivery of waste heat from Lines 2 and 3 to the city of Hamburg's district heating grid	The necessary permits were issued in 2017. Heat extraction is scheduled to commence in fall 2018. The heating of the tankhouse cells in the Plant East tankhouse, as well as the heating of the copper sulfate crystallization facility, is planned when it comes to internal use
		Discussions with the city of Hamburg on further arrangements for waste heat recovery and heat extraction for district heating, which began in 2017, will continue
Additional measures for waste heat use	Constructing a waste heat boiler in the course of building the new submerged lance furnace in the FCM project as a condition for later use	Permit under the German Federal Immission Protection Ordinance was issued in 2017, implementation by 2022 planned
Measures to adjust to the energy turnaround in Germany	Planning the installation of an electrode steam boiler as an alternative to the gas-fired standby boiler to adjust to more flexible consumption in the scope of the project NEW 4.0	Planning to start in 2018

Water pollution control

Target	Planned measure	Degree of implementation/date
<p>Reducing the authorized heat input via cooling water</p> <ul style="list-style-type: none"> - Max. heating of water by 3 K - Max. discharge temperature 33 °C - Min. concentration of 6 mg/l O₂ in discharged cooling water 	<p>Measurements of heat-relevant parameters, including a data analysis unit (classification unit) to record and assess the heat-relevant data (discharge quantity, temperature increase, discharge temperature, volume measurement, heat input, and oxygen content or oxygen saturation for the discharge point Norderelbe and two points in the Müggenberg Canal) as an hourly average or 6-hour moving average</p>	<p>Measurement program has been in place since March 2011; continuation in 2014. Requirements of the thermal load plan have been implemented since 2013. Water law permit was issued in 2015</p> <p>Installation of measuring buoys in the Elbe and Müggenburg Canal in 2016 to monitor temperature increases in the bodies of water</p> <p>Monitoring continues; limit values are observed</p>
<p>Reduction of heat input via cooling water by 18 MW</p>	<p>Commissioning of waste heat recovery from the KAWO acid coolers</p>	<p>Start of construction 2017 Commissioning 2018</p>
<p>Further reduction of heat input via cooling water by 2-3 MW</p>	<p>Constructing cooling towers as part of the implementation of FCM (replacement for the existing converter) and the modernization of WuK South. The existing once-through cooling systems will therefore also be replaced</p>	<p>Commissioning planned for 2021</p>
<p>Improvement in ZABA cleaning efficiency</p>	<p>Continuous 2-line design; increase in dwell times for metal precipitation and sedimentation; expansion of hydraulic throughput area</p>	<p>License and permit procedure to start in 2018, commissioning in 2021</p>

Partnership for Air Quality and Low-Emission Mobility – Participation in Mobil.Pro.Fit

Target	Planned measure	Degree of implementation/date
Sustainable, efficient, and climate-friendly mobility	Mobil.Pro.Fit program: development of mobility management (Focuses: business trips, vehicle fleet, and the improvement of employee mobility in particular)	Participation in the second round of Mobil.Pro.Fit in 2016
Mobil.Pro.Fit Coordination of action plan with plant management – certification in Q2 2017.	Developing a concept for e-bike/personalized bike leasing	Development of mobility management with the Mobil.Pro.Fit action plan certified in 2017 Implementing a car policy by 2019
	Reviewing the feasibility of a better public transportation connection (additional Hamburg bus routes or shuttle service to Veddel train station)	Start of an evaluation phase in December 2016 with an improved public transportation connection during all shift changes and on the weekend. Transport schedule optimization continues
	Construction of a bike compartment at the Veddel train station	Planning and discussions with the city's transport operators will start in 2018
Promoting e-mobility	Installing charging points (car & e-bike) at the employee parking lots in Plant North and Plant East.	Start of implementation in 2017
	Testing e-mobility for internal traffic	First cars and vans acquired in 2016 – extension and continuation of the pilot phase in 2017, additional electric vehicles will be purchased for the plant as replacements are needed in 2018
Promoting bike use for employee mobility	Building a city bike station on Hovestrass	Discussions with the operating company are underway. Implementation planned for 2018

Promoting biodiversity

Target	Planned measure	Degree of implementation/date
Promoting biodiversity at the Hamburg plant	Sowing butterfly meadows, planting native bushes, installing insect hotels	Plant inspection with NABU in 2016; implementation of recommendations in 2017
		Repeat inspection of open areas with regard to vegetation, e.g., wildflowers
	Planting greenery in suitable places on facades	Pilot in the inner courtyard of Hovestrasse 50 scheduled for 2018
	Planting trees as part of construction of new IAZ	2019

Safety aspects/plant safety

Target	Planned measure	Degree of implementation/date
Support in the case of transport and warehouse accidents with chemicals in public spaces	Participation of the Plant Fire Department in the TUIS system	Initial deployments have been taking place since 2015. Additional technical equipment for accepting hazardous materials was provided in 2017
Ensuring security	Drills for the alarm and danger prevention plan	Conducted annually, most recently in Nov. 2016
		2017 drill to train the company staff in the case of crisis situations, using the example of a tank wagon leak on the plant premises

Continuous improvement of environmental management system

Target	Planned measure	Degree of implementation/date
Introducing an integrated management system (IMS) for Aurubis AG for the environment, quality and energy areas	Introduction of general IMS handbook Introduction of IMS handbook Hamburg Introductory phase – taking advantage of synergies Revising the documents	General IMS handbook & Hamburg handbook adopted (2016) Reorganization, consolidation and revision of process instructions for the environment, quality, and energy Certification of IMS by TÜV Nord in May 2017 New process instructions went into effect in 2017
	Introducing the Aurubis Operating System (AOS). A supporting tool is being implemented that contributes to continuous improvement of production processes with respect to efficiency, environmental protection, and occupational safety	Pilot projects started in 2017, continuous development
Ensuring compliance	Further development of the annotated legal catalogue, including derivation of actions and follow-up on implementation	Continuously, implementation started in 2017, initial training dates will be scheduled in 2018 Continuously, implementation of new legal requirements in 2017 (e.g., StörfallV, AwSV, 42. BImSchV)

Business Partner Screening

Target	Planned measure	Degree of implementation/date
Reinforcing a sustainable approach to raw materials	Developing and implementing a Business Partner Screening process; screening all suppliers and customers under aspects of sustainability, compliance, and tax law, possibly including an in-depth review regarding sustainability and therefore environmental aspects	Concept developed in 2013 and introduced in 2015; developed continuously

**Key figures for Aurubis AG, Hamburg site,
in the 2017 calendar year**

Input	2017	2016
Raw materials		
Copper concentrate	1,287,268 t	1,042,703 t
Copper scrap/refining material	49,125 t	47,928 t
Other Cu-bearing raw materials	112,897 t	137,773 t
PM-bearing raw materials incl. scrap	27,347 t	22,398 t
Lead scrap and waste	26,438 t	24,439 t
Waste for recycling	823 t	579 t
Total TC/RC-earning raw materials	1,503,897 t	1,275,821 t
Auxiliaries		
Sand and additives incl. cyclone sand	182,957 t	135,531 t
Iron as an additive	13,586 t	15,276 t
Total input materials	1,700,440 t	1,426,628 t
Input material/t copper	3.7 t/t Cu	3.2 t/t Cu
Energy		
Electricity consumption	549,957 MWh	522,908 MWh
Additional electricity consumed to produce oxygen	119,594 MWh	118,362 MWh
Natural gas	439,834 MWh	481,446 MWh
Coke	49,513 MWh	52,254 MWh
Other energy sources	17,205 MWh	17,034 MWh
Total energy consumption	1,176,104 MWh	1,192,004 MWh
Energy consumption/t copper	2.58 MWh/t Cu	2.65 MWh/t Cu
Water withdrawal/uptake		
River water	67,277,000 m ³	63,676,000 m ³
Potable water	332,000 m ³	339,000 m ³
Precipitation	514,000 m ³	397,000 m ³
Total water uptake	68,123,000 m³	64,412,000 m³
Water consumption/t copper	150 m³/t Cu	143 m³/t Cu
Area used at the Hamburg site		
Total plant area	871,000 m ²	871,000 m ²
Buildings and paved area	766,000 m ² (equivalent to 88%)	766,000 m ² (equivalent to 88%)

Output	2017	2016
Products		
Copper	455,406 t	450,400 t
Sulfuric acid products as H ₂ SO ₄ (from exhaust gas cleaning)	1,074,468 t	946,224 t
Iron silicate stone (incl. granules)	786,787 t	743,204 t
Silver and gold, selenium	1,866 t	1,804 t
Metal compounds (Ni, As)	3,087 t	2,317 t
Lead	11,349 t	13,123 t
Total products	2,332,962 t	2,157,071 t
Waste		
Recycling	10,294 t	5,992 t
Disposal	4,960 t	4,617 t
Total recycling & disposal	15,254 t	10,609 t
of which hazardous waste	11,652 t	7,812 t
Waste/t copper output	33 kg/t Cu	24 kg/t Cu
Waste/t input material	9 kg/t	7 kg/t
Construction waste (informative)	24,027 t	41,202 t
Total waste	39,281 t	51,811 t
Conversion into products	99.1%	99.3%
Emissions		
Dust	43 t	43 t
Dust/t copper	95 g/t Cu	96 g/t Cu
SO ₂	2,046 t	2,004 t
NO _x /t copper	564 g/t Cu	482 g/t Cu
Direct CO ₂ emissions (ETS, excluding diesel)	166,732 t	166,472 t
of which CO ₂ from fuels	109,721 t	118,954 t
CO ₂ from fuels/t copper	0.24 t/t Cu	0.26 t/t Cu
Direct CO ₂ emissions (diesel for vehicles)	3,865 t	3,498 t
Indirect CO ₂ emissions		
from electricity consumption (ETS)	288,816 t	272,770 t
from additional electricity consumption for oxygen production	63,744 t	63,087 t
Metal discharge in water	684 kg	647 kg
Metal discharge in water/t copper	1.5 g/t Cu	1.4 g/t Cu
Water discharge		
Direct discharge	65,364,198 m ³	61,305,259 m ³
Indirect discharge	50,288 m ³	44,220 m ³
Indirect discharge	65,414,486 m³	61,349,479 m³
Water discharge/t copper	144 m³/t Cu	136 m³/t Cu

Updated Aurubis AG Environmental Statement 2018

Lünen Site



Aurubis AG's recycling center is located in the south of the city of Lünen about one kilometer from the town hall.

The plant was built and commissioned on undeveloped land between the Cologne-Minden railway and the Datteln-Hamm Canal in 1916 as a branch plant of Hüttenwerke Kayser in Berlin. After the loss of the Berlin plants and reconstruction after the end of World War II, the production facilities were continuously expanded and steadily modernized. After the then-Norddeutsche Affinerie AG acquired the majority of Hüttenwerke Kayser shares in 2000, the plant was initially integrated into the company

structure and expanded to become the Group's recycling center. Today Aurubis AG's Lünen site is the largest secondary copper smelter in the world, with a production capacity of 250,000 t of copper cathodes annually.

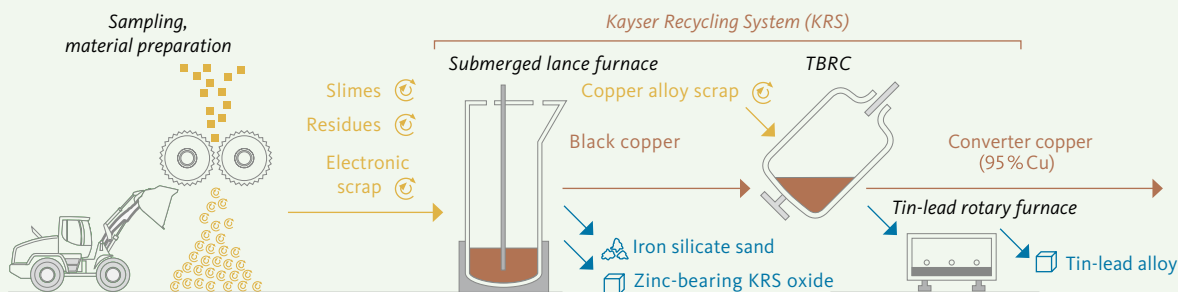
Recycling raw materials are almost exclusively used in the smelting units in Lünen, including traditional recycling raw materials such as copper scrap and other scrap, slimes, and residues, as well as increasing quantities of complex materials, in particular electrical and electronic scrap. The feed materials, which are largely delivered by truck, are first sampled, in some cases crushed and separated in a mate-

Fig. 3.1: Overview of Lünen site facilities



- 1 South plant entrance with noise protection wall
- 2 Rainwater retention facility
- 3 Material preparation
- 4 Sampling
- 5 E-scrap preparation
- 6 Warehouse 4
- 7 KRS
- 8 TBRC
- 9 Leaching plant
- 10 Anode smelter
- 11 Copper tankhouse
- 12 Cathode warehouse
- 13 Kupferstrasse plant entrance
- 14 Administrative building

Fig. 3.2: Multi-metal recycling at the Lünen site



rial preparation plant, and then processed in a multi-step metallurgical process. The copper anodes produced in this way are then refined electrolytically into cathodes, which are the final product at the Lünen site. Additional anode quantities from other Aurubis sites are also processed in the copper tankhouse (see Fig. 3.2).

The core facility for metallurgical processes has been the Kayser Recycling System (KRS) since 2002, which gained a TBRC (top blown rotary converter) in 2011 as part of the KRS-Plus project. The converter copper produced in the TBRC is refined together with copper scrap in the anode furnace and cast into anodes in a casting plant. The anodes are dissolved electrochemically and precipitated as cathodes. Zinc-bearing KRS oxide, iron silicate sand (slag granules), a lead-tin alloy, nickel and copper sulfate, as well as anode slimes, are produced as by-products of “multi-metal recycling.” The anode slimes are processed in the Hamburg site’s precious metal recovery process. The ratio of Cu cathodes to by-products is approximately 1:1; production waste is not generated during the processes.

There are about 600 employees at the Lünen site, around 40 of whom are apprentices.

The Integrated Management System (IMS) for the Environment, Quality, and Energy

An environmental management system exists at the Lünen site as well. It has been certified in accordance with ISO 14001 and EMAS since 1997 and is incorporated in an IMS (integrated management system) in connection with quality management pursuant to ISO 9001. Since 2013, the IMS has also included a certified energy management system pursuant to DIN EN ISO 50001.

Therefore, the management system and handbook and their process and work instructions are related not only

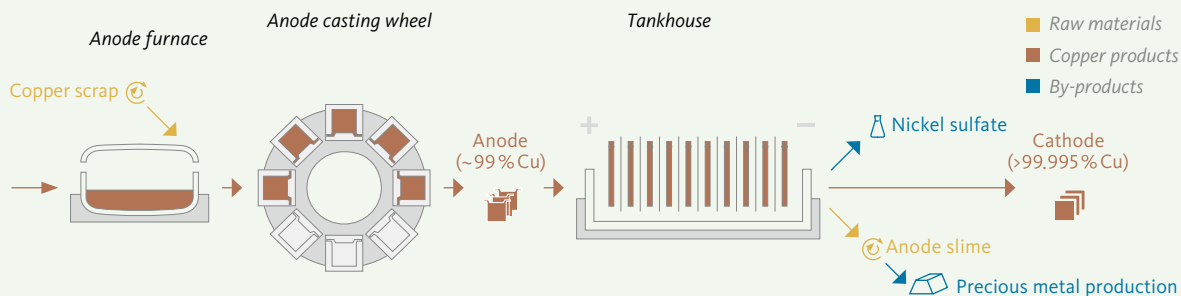
to environmentally relevant issues, including accident prevention and health protection, but also to quality assurance and energy management measures.

The IMS continues to fulfill the requirements of the waste disposal regulation (EfbV) and the law on circulation, withdrawal, and environmentally sound disposal of electrical and electronic devices (German Electrical and Electronic Equipment Act, ElektroG) for the material preparation plant. Since August 2016, the plant is a certified primary treatment facility in accordance with the ElektroG.

The effectiveness of the environmental and energy management system is reviewed with internal audits pursuant to EMAS regulations and ISO 14001/ISO 50001. The approach for the internal audits is defined in specific process instructions. Internal and external audits take place annually in compliance with the EMAS and ISO 14001/ISO 50001 requirements.

The external audit involves verifying the description of operating processes and reviewing the environmental data provided. The results of the company environmental audits and internal audits are compiled in a report and presented to the plant management, as the representative of the Executive Board, for assessment (Management Review). It evaluates how suitable, appropriate, and effective, the management system is and whether the principles for environmental protection, health protection, occupational safety, and energy management are being successfully implemented.

In 2017 the shift to the new system standard ISO 14001:2015 and the consolidation of the IMS for the Hamburg and Lünen sites were completed and successfully audited.



Targets and Tasks of the Environmental Management System

The production processes are securely managed via the environmental management system in Lünen as well as in Hamburg. The targets and measures are defined and their implementation is monitored. The environmental management system includes the documentation of operational processes, internal audits, routine recordings, and site inspections.

The environmental management system ensures that the applicable legal requirements are fulfilled with respect to environmental protection. Furthermore, it supports continuous improvement through product and process design that takes the environment and occupational safety into account. Saving energy is also an essential element of environmental protection. Therefore, the energy management system is also certified according to DIN EN ISO 50001. The energy flows are presented transparently and optimization potential is documented. The systems and organization of the IMS are described extensively and understandably in a handbook available to employees. This management handbook guarantees that all activities that concern environmental aspects and occupational safety issues are planned, managed, monitored, and continuously improved with due regard to legal requirements.

The environmental management system EMAS also helps in the implementation of the Aurubis Group sustainability targets, which are regularly updated, at the Lünen site.

In order to achieve these targets, the IMS is regularly reviewed using a number of key figures, which are usually determined and discussed on a group-wide basis and therefore provide a good estimate of the site's performance. These key figures include, for example, emissions to air and water. In addition, registers for operating

incidents and neighborhood complaints are maintained in Lünen. The registers make performance easier to track, for example, by recording the response to each incident and documenting the solution that was found. The goal is to make as direct contact as possible with those submitting the complaints.

Environmental Management Organization

As the operator of facilities requiring a permit in accordance with Section 52a Federal Immission Protection Law and Section 53 Recycling Management and Waste Law, the Aurubis AG Executive Board or an appointed member of the Executive Board is responsible for observing environmental protection and radiation protection regulations.

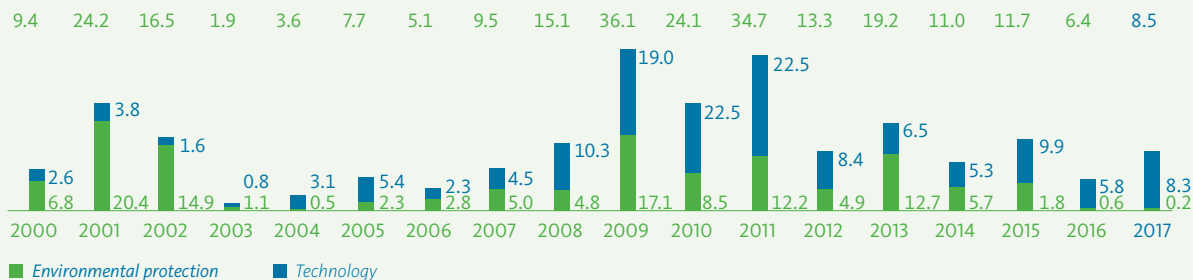
The IMS team consists of the Quality and Energy Management Officer, the Environmental Management Officer, and other delegated individuals and employees. The officer functions for

- » Immission protection and accident prevention
- » Waste management
- » Radiation protection
- » Specialist company under the WHG
- » Hazardous material

are carried out by the employees mentioned above. The same applies to the Occupational Safety Specialist, while the health protection measures that extend beyond this are the responsibility of the company Medical Department. The Lünen site has had its own Medical Department since 2017, which further improves employees' occupational health. The officer function for REACH and CLP (Classification, Labeling, and Packaging) is still carried out centrally for all of Aurubis AG from Hamburg.

Fig. 3.3: Dust in g/t of copper output at the Lünen site

in € million/fiscal year



Environmental Aspects and Performance

Investments in environmental protection also have a high level of significance in Lünen. The Kayser Recycling System (KRS) initially set new precedents with a capital expenditure volume of around € 40 million. Additional capital expenditure followed, especially for reducing fugitive emissions in metallurgical facilities and in the storage and handling of feed materials.

The emission reduction concept agreed on with the authorities for the period from 2005 to 2009 was initially estimated at about € 10 million but was then supplemented with additional capital expenditure of € 25 million with additional measures. Significant projects included the e-scrap warehouse and warehouse 4 for dust-forming KRS input materials, comprehensive paving of storage areas, and the additional KRS filter 5. Furthermore, environmental protection accounted for € 17.5 million of the investment costs of the KRS-Plus project, which has been implemented in the meantime.

Overall, around € 122 million has been invested in environmental protection from 2000 to 2017 (see Fig. 3.3).

Air – Emissions

The emissions from directed sources (chimneys) are monitored with continuous measuring devices in connection with emission data transfer. Dust, sulfur dioxide, nitrogen oxides, hydrogen chloride, hydrogen fluoride, and mercury are measured continuously depending on relevance. Other off-gas and dust components are measured manually.

The TA Luft establishes emission limits for air pollutants. However, the permit requirements of many facilities are even lower than the TA Luft guidelines. The relevant limit values of the TA Luft are featured in chapters 5.2.2, 5.2.4, 5.2.5, 5.2.7, and 5.4.3.3.1 in particular.

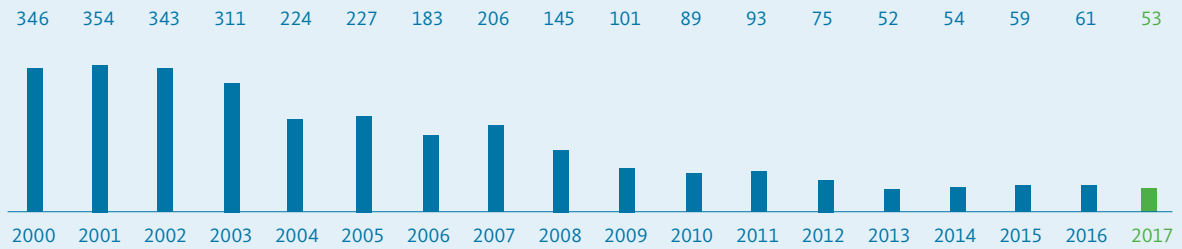
Consequently, the measurements comply with the limit values overall or fall significantly below them in some cases. The same applies to additional substances listed in the permits, e.g., NO_x, HCl, HF, etc.

The long-term goal of the Lünen plant is to achieve a continued reduction in emissions despite the input materials, which are becoming ever more complex. Contributing to the difficulty here is that for many areas, the measured values already lie within the margin of error, which can lead to significant fluctuation ranges for annual values.

Emissions of dust and especially dust components (copper, lead, arsenic, etc.) have been considerably reduced at the Lünen site in the past several years due to reduction measures. The following figures incorporate the fugitive emissions including storage and handling.

Fig. 3.4: Dust emissions at the Lünen site

Dust in g/t of copper output



The dust emissions in 2017 were again at about the same low level of the previous year.

Mercury emissions decreased even further in 2017. In this regard, measures in recent years (additive dosing, early warning devices at the incoming control) have led to a sustained reduction.

The new added filter in the primary smelter (source 2041) stabilized the source's dust emissions at a low level.

On the whole, all values are at the low level of the previous years; the specific emissions are also nearly constant. However, shifts are expected for specific emissions in the coming years. This has already been the case for a long time for emissions per ton of copper output because the Lünen plant works with increasingly complex input materials and the miniaturization of technical devices also has also resulted in an increase in the number of processing steps. This leads to less copper in exchange for more by-products per ton of material input.

Therefore, in the coming years increasing consideration will need to be given to alternative parameters that describe the more complex processes more reliably. As a first step at the Lünen plant, the processed external bleed was included in the input streams since it constitutes a substantial portion of both plant traffic and the metal freights of wet chemistry.

With an annual output of 192,516 t of copper cathodes and a material input of 381,125 t, the following specific quantities result for 2017:

Specific emissions related to input material

Type of emission		Specific emission related to:	
		Input material	Copper output
SO ₂	kg/t	2.7	5.3
Dust	g/t	59.0	116.9
Copper	g/t	3.4	6.7
Lead	g/t	2.5	4.9
Arsenic	g/t	0.1	0.1

Air – Immissions

To measure the immissions of dust precipitation including metallic components, the LANUV (NRW State Agency for Nature, the Environment, and Consumer Protection) operates a network of 12 so-called “Bergerhoff” measurement points in the area surrounding the Lünen plant (see Fig. 3.8).

In the last ten years, there has been a significant reduction in dust emissions, but primarily in dust components. Although individual deposition values of TA Luft are still being exceeded, the deposition involves a complex situation and not immissions that can be directly assigned to an individual emitter. Currently, an immission study that is designed to provide clearer indications of possible mitigation measures is being conducted at the behest of the authorities, Aurubis, and other industrial enterprises in the Kupferstrasse industrial area.

Fig. 3.5: Copper emissions at the Lünen site

Copper in g/t of input material

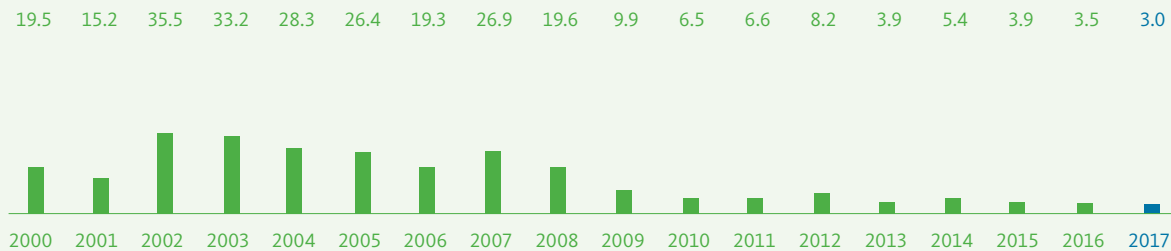


Fig. 3.6: Lead emissions at the Lünen site

Lead in g/t of input material

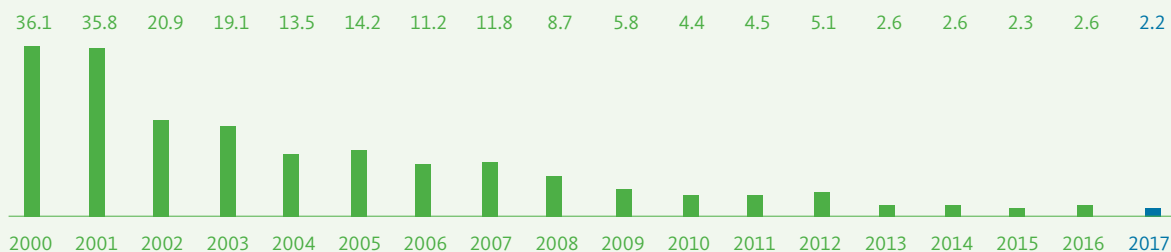
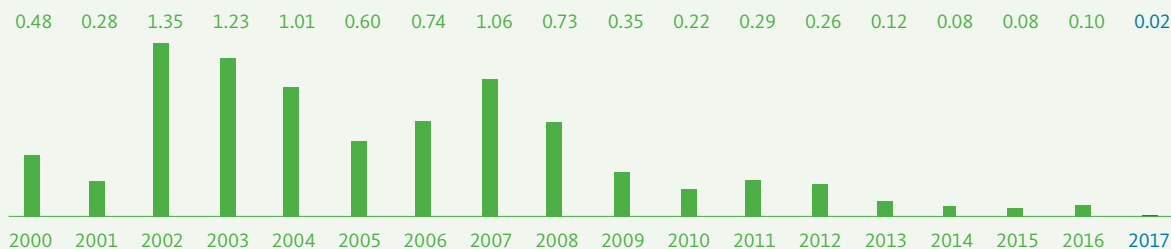


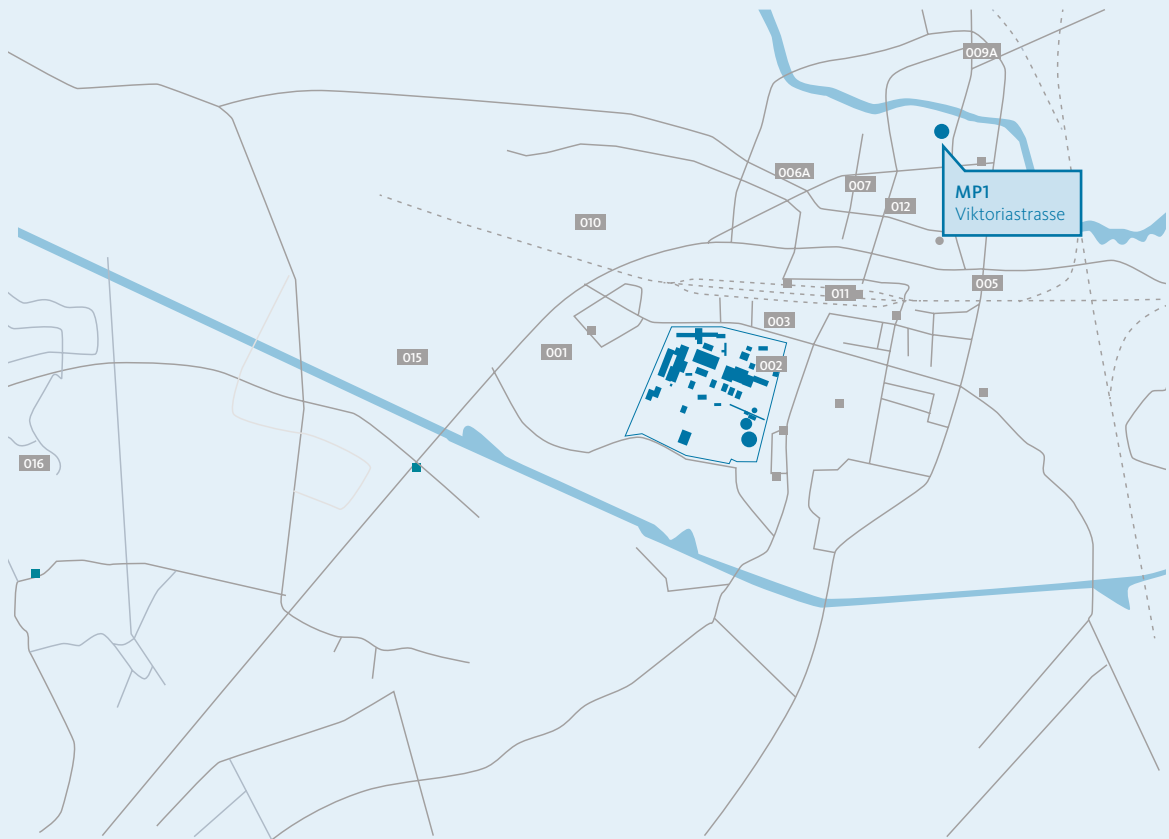
Fig. 3.7: Arsenic emissions at the Lünen site

Arsenic in g/t of input material



Note on the selection of years presented here: Fugitive emissions in particular have been determined or calculated since 2004 in accordance with the methods used at the Hamburg site. The values for 1990, 2002, and 2003 were estimated in a comparable manner, but there are no reliable values for the missing years.

Fig. 3.8: Locations of immission measurement points near the Aurubis plant in Lünen



“Bergerhoff” measurement points in Lünen

- 001 Buchenberg
- 002 Kleine Bergstrasse
- 003 Bergstrasse 48
- 005 Bebelstrasse/Süggelbach

- 006A Rail line/mosque
- 007 Lünen South freight yard
- 009A B 236/Lippebrücke
- 010 Im Wiesengrund
- 011 Builders' association/building yard

- 012 Rail line/Kantstrasse
- 015 Im Engelbrauck/north side
- 016 Im Siepen

Aurubis plant building

Source: LANUV

In addition, a LANUV measurement station for fine dust (PM10) is located on Viktoriastrasse (northeast of the plant). The position corresponds to that of the plant's calculated immission maximum (see Fig. 3.9).

The measurements of air quality for suspended particulates and their content indicate that the levels are significantly and consistently below both the limit values for PM10 and lead, as well as below the EU target values for arsenic, cadmium, and nickel (see Fig. 3.10 – 3.13). The LANUV measurement station at Niederaden is listed for comparison; it serves LANUV as a neutral point measurement station without industrial impact.

Noise

Noise protection measures take high priority in the conception of new facilities in particular. The additional noise pollution in the area in terms of TA Lärm should be marginal, i.e., the levels should be at least 10 db(A) lower than the TA Lärm immission reference values. This requirement was fulfilled in the last few years in all projects, and noise reduction measures were carried out at existing facilities as well.

The measurements carried out in 2012 showed that the reference values relevant for the respective applications were observed at all assessment points predetermined by the authorities. In the areas classified as mixed use areas, this is 60 dB(A) maximum during the day and 45 dB(A) maximum at night.

There was an increase in noise complaints from local residents in 2017. These were mainly attributable to new cleaning vehicles. The vehicles have a perceptible sound similar to a vacuum cleaner, which led in some cases to understandable complaints from local residents several hundred meters away.

Several types of corrective actions were offered in close contact with those affected. For one, the vehicles now operate in most plant areas at the lowest cleaning level; furthermore, the outlets will be equipped with improved filters that will facilitate better noise protection. In the coming years, planned construction projects such as the training center on the edge of the plant, as well as the heightening of the plant fence on the east side, will further reduce noise immissions in the plant environment.

Water

Water is used in the Lünen plant for various cooling purposes, including anode cooling and slag granulation, as feed water for the steam boiler, and increasingly for operating several sweepers, as well as sprinkling driveways, plant/storage surfaces, and input materials. Particularly these latter measures to reduce dust emissions lead to a continuous increase in water consumption.

In order to mitigate this water consumption, a facility for rainwater retention, preparation, and utilization was commissioned in 2014. In the future, a large volume of the plant's internal cooling and process water demand will be covered by the collected rainwater, so discharge volumes and water consumption will decline.

Fig. 3.9: Fine dust immissions (PM₁₀) compared to the plant's calculated immission maximum

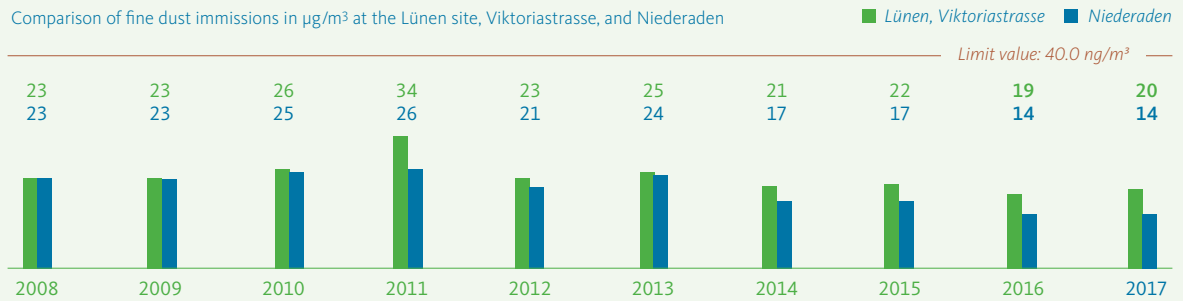


Fig. 3.10: Lead

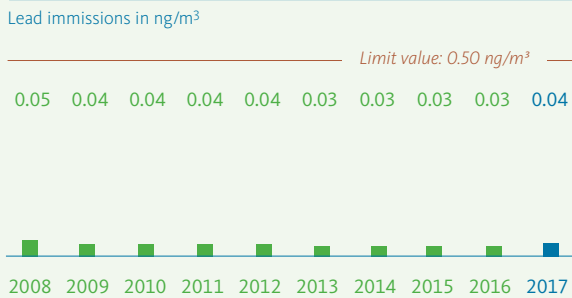


Fig. 3.11: Cadmium

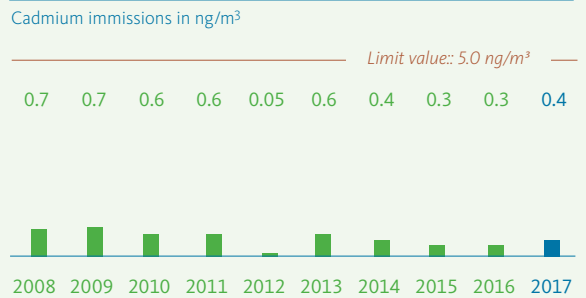


Fig. 3.12: Arsenic

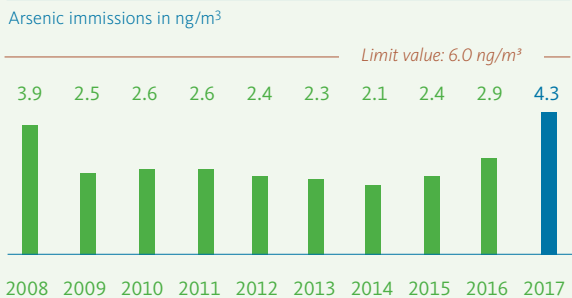
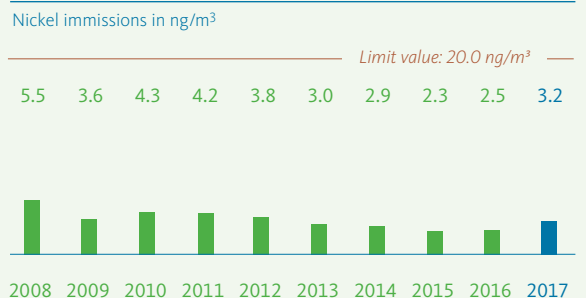
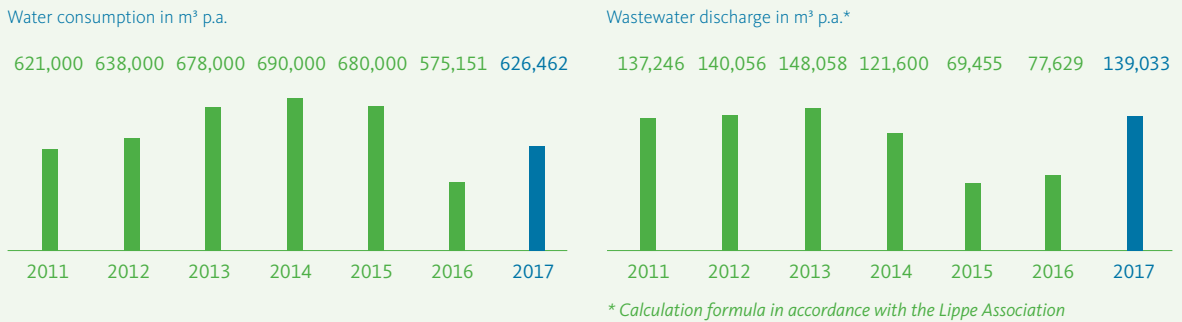


Fig. 3.13: Nickel



The measurements of air quality for suspended particulates and content indicate that the levels are significantly and consistently below both the limit values for PM10 and lead, as well as below the EU target values for arsenic, cadmium, and nickel. The LANUV measurement station at Niederaden is listed for comparison; it serves LANUV as a neutral point measurement station without industrial impact.

Fig. 3.14a: **Water consumption and wastewater discharge at the Lünen site**



In 2017, more than 100,000 m³ of surface water were used for internal purposes once again. Overall, the rainwater-use project has thus significantly surpassed the quantities estimated in the permit. The wastewater discharge is nevertheless still at an unsatisfactorily high level, even though the established deficiencies have been improved and boiler desludging has been reduced (see Fig. 3.14a).

In order to mitigate this water consumption effectively, a facility for rainwater retention, treatment, and utilization was commissioned in 2014. The rainwater on the entire paved area of the plant premises is collected and then treated and used for cooling and process water needs in the plant.

In 2016, more than 100,000 m³ of surface water were used for internal purposes for the first time. The water used in 2017 was also above this volume.

Waste

The waste from the Lünen plant mainly results from packaging from delivered materials, from construction measures, and from spent potlining from the KRS, anode furnaces, etc. The externally marketed contingents of the material preparation plant, e.g., aluminum and separated plastics for continued recycling, are also inevitably among the waste from the site, as they do not lose their waste properties through preparation. In the interim, sorting in the facility has become so homogeneous that for several years it has been possible to deliver all contingents completely as raw material for recycling to the respective industries.

The waste volume increased substantially in 2017 due to numerous construction measures (total: 20,366 t). However, the production-related waste rose as well (9,012 t). This material mainly includes the fractions from the material preparation plant other than non-ferrous fractions, as well as packaging material; the figure therefore reflects

Fig. 3.14b: **Layout of the two rainwater retention basins, central pump station, treatment plant, and service water storage tank 1**

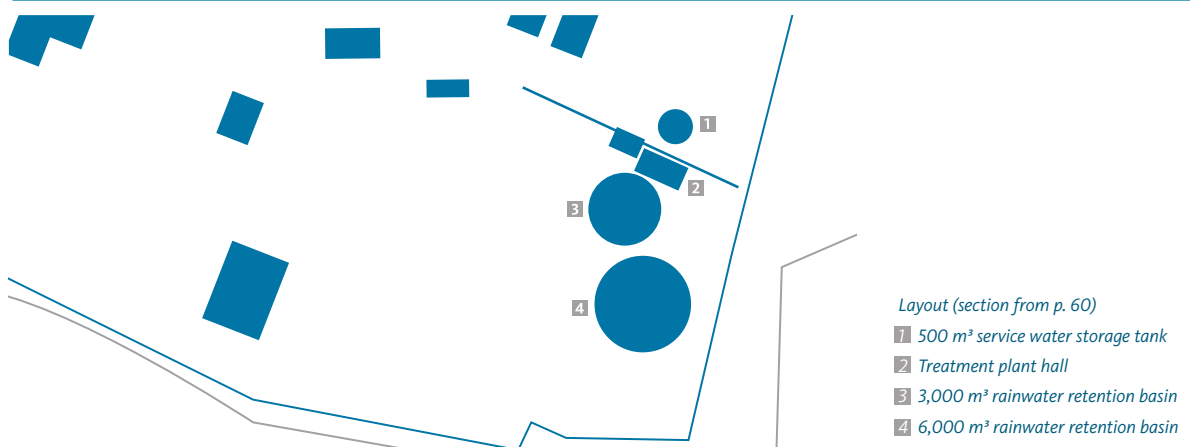


Fig. 3.15: **Waste generated at the Lünen site**

in t p.a.	2012	2013	2014	2015	2016	2017
Packaging and other waste	1,276	1,338	909	794	910	1,745
Construction waste	23,740	23,706	9,914	8,925	4,313	10,988
Spent potlining	264	343	272	201	319	267
Sales products						
Material preparation plant	5,713	6,683	4,849	3,712	5,808	7,366
Total	30,993	32,070	15,944	13,632	11,350	20,366
of which hazardous waste	359	1,513	2,996	276	3,287	367

the changes in the material acceptance and preparation processes first and foremost (enhanced sorting in the plant, better separation, transport to the plant with better repackaging). It can be expected that this will remain at a similar level. In contrast, the total quantity of hazardous waste decreased significantly again (367 t, see Fig. 3.15).

New Material Catalogue for Waste Acceptance

For better communication with suppliers and to ensure worldwide compliance with the requirements of waste management law, the existing material catalogue of the site has been updated, and its information content was improved.

For this purpose, all of the approved waste codes for the Lünen plant were assigned to the material streams possibly containing waste according to the German Federal Immission Control Act (BImSchG) and the maximum metal content derived from them were determined. The result is a new waste acceptance catalogue that has received an official document stamp from the relevant authority and now is being used by Aurubis for customer information.

Soil – Restoration Measures

Since the plant opened in 1916, facilities producing non-ferrous metals have been operated continuously at the site. In conjunction with war damages, this led to soil pollution in the past.

On the basis of comprehensive tests, a restoration plan was developed, which was coordinated with the responsible authorities and has been partly implemented. Because of the sulfate content, it will not be possible in the future to discharge sanitation water via the city sewer system, so direct discharge into a body of water nearby is required.

In late 2014, a restoration agreement was ultimately signed with the Unna District describing the further agenda and the steps planned to restore the soil and groundwater at the Lünen site.

The restoration concept includes encapsulating the contaminated area with the help of a sealing wall, as well as a drainage facility that requires the discharged water to be purified. Part of the sealing wall and some extraction wells have already been completed in the run-up to construction measures.

Furthermore, a groundwater flow model was developed for the site, which was welcomed as helpful by all participants. In 2016 it was refined a few more times, incorporating additional wishes of the Unna District into the monitoring concept. Permit applications are currently being prepared based on the new result and should be submitted by summer 2018.

The oil damage restoration, on the other hand, will be set up soon and should start in 2018 still.

The results of the LANUV (state environmental office) inspections regarding the pollution of leafy vegetables in small gardens in the Kupferstrasse industrial area improved further in the report published in 2017 as well. According to LANUV, there is no acute reason to issue a recommendation that the vegetables not be eaten; this is only in place for one year due to residual concerns.

Another very positive aspect that should be mentioned is that the authorities are clearly distancing themselves from a direct connection between the emissions from Aurubis and the increased heavy metal values in leafy vegetables in the meantime.

Soil – Preventative Measures

Preventative and protective measures have been developed for several decades in order to eliminate future strains on the soil. They are primarily related to the facilities dealing with materials hazardous to water, e.g., the tankhouse and oil storage. Furthermore, the storage spaces for input materials are being designed so that not even traces of deposits or components of input materials hazardous to water can end up in the soil.

Biodiversity

Aurubis AG Lünen's plant premises are adjacent to agricultural land and are just a few kilometers from multiple Natura 2000 nature conservation areas (In den Kämpen, Cappenberger Wälder, and Lippeaue). Respecting and promoting biodiversity is therefore a high priority for us. For example, Aurubis has reviewed larger expansion projects such as the KRS-Plus project with extensive assessments pursuant to the EU Habitats Directive in order to identify possible impacts on biodiversity. In smaller projects in the plant and in the neighborhood, we continue to take active steps to promote and preserve biodiversity, for example by planting greenery on plant surfaces that aren't in use (noise protection wall, landfill for blast furnace slag) and setting up nesting sites on buildings and chimneys.

Energy & Climate Protection

Energy is required first and foremost for the metallurgical processes (primarily heating oil and natural gas), as well as for the tankhouse (electricity). Steam for leaching and electrolysis is mainly produced in the waste heat boilers of the KRS submerged lance furnace and anode furnaces. There are also two auxiliary boilers fueled with light oil or natural gas.

After a longer start-up and test phase, a two-stage condensation turbine was commissioned in 2015. The steam from the process waste heat is initially depressurized from 18.6 bar to 5.15 bar in the first turbine stage. Steam is removed for thermal use and the remaining volume is then depressurized to 0.85 bar in the second turbine stage. The German Federal Office of Economics and Export Control (BAFA) licensed the turbine in accordance with Section 5(2) of the German Act on Combined Heat and Power Generation (KWKG). For this project, Aurubis won the German Energy Agency's (dena) award for Best Practices in Energy Efficiency at the end of 2015.

- » Primary energy input once again at the level of 2014
- » A high throughput of the metallurgically energy-intensive metal zinc, with an increased yield of the product KRS oxide
- » An improvement in the output of valuable metals due to extensive trial phases in the KRS cell furnace
- » An up to 60% higher output volume of minor metal products
- » A considerable increase in the input of energy-intensive, complex raw materials such as shredder materials and residues
- » A decline in usable energy content in electrical and electronic scrap

Fig. 3.16: Energy consumption¹ at the Lünen site

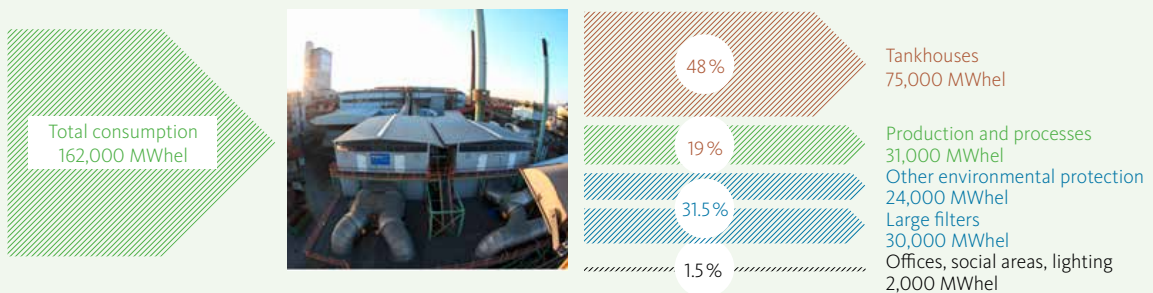
in GWh/year	2012	2013	2014	2015	2016	2017
Heating oil	291	266	266	242	260	257
Coal, coke, etc.	6	13	9	27	24	29
Natural gas	81	77	105	135	106	105
Electricity	154	156	162 ²	161 ²	155 ²	165 ²
Total	532	512	542	565	545	557

¹ Calculated using DEHSt (German Emissions Trading Authority) standards

² Includes internal electricity production from the steam turbine (2017: 17.8 GWh)

The table may include slight deviations in the totals due to rounding.

Fig. 3.17: Environmental protection facilities – including those at the Lünen site – are very energy-intensive



Aurubis uses about 30 % of the electricity for environmental protection measures.

Fig. 3.18: Specific energy consumption in relation to recycling raw material input

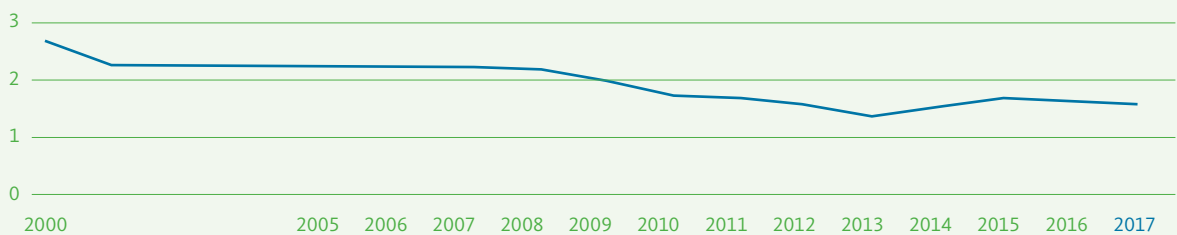


Fig. 3.19: CO₂ emissions at the Lünen site

in t p.a.	2010	2011	2012	2013	2014	2015	2016	2017
Total CO ₂	152,696	166,304	172,870	168,297	172,461	174,549	176,067	186,544
Biogenic CO ₂	653	457	0	568	569	0	480	324
CO ₂ subject to DEV 2020 ¹	152,018	165,847	172,870	164,995	169,134	171,858	173,202	183,839

¹ 2020 Data Collection Regulation for the third emissions trading allocation period

Fig. 3.20: Specific energy consumption at the Lünen site

in MWh/t of copper output

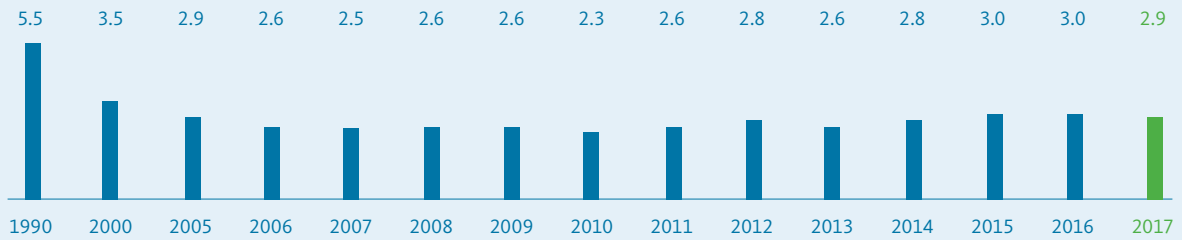
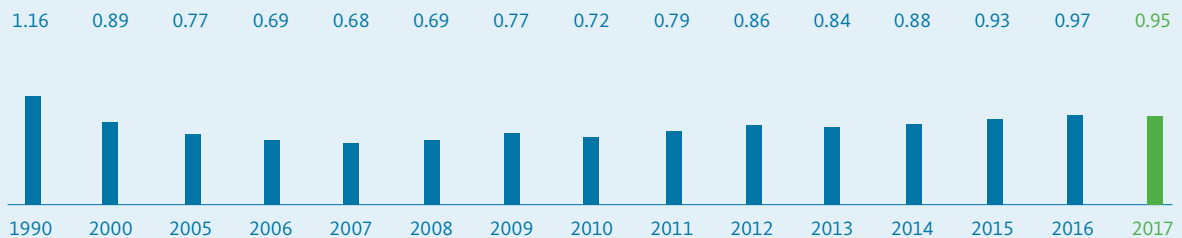


Fig. 3.21: Specific CO₂ emissions at the Lünen site

in t of CO₂/t of copper output



Furthermore, about 50,000 t of electrolyte from the Olen plant has been treated in the Lünen tankhouse and leaching plant since 2014. This leads to a higher demand for heat (with lower potential for internal electricity generation via the turbine at the same time) and electricity. The electricity demand for environmental protection measures remains unchanged at roughly 30% of total electricity demand.

As previously explained, the specific energy demand is also rising significantly in relation to the copper output (copper cathodes). This effect is reinforced because the anode quantity delivered group-wide decreased from 30,000 t to below 7,000 t in the period from 2011 to 2016.

On the left-hand curve (see Fig. 3.18), the graphic shows that the site's absolute energy demand has been relatively constant for ten years. The specific energy KPI in relation to the input of recycling raw materials very concretely illustrates the multi-metal recycling strategy selected for the Lünen site. With the same or, in the last three years, a declining cathode copper output, metal is produced from a high and continuously increasing input of recycling materials. The average copper content in the raw materials is decreasing, while the proportion of minor metals such as zinc, tin, nickel, gold, and silver is increasing distinctly. The shift in the trend shows that the increasingly complex composition of raw materials is becoming more energy-intensive when it comes to processing.

The CO₂ emissions were determined in accordance with DEHSt (German Emissions Trading Authority) standards. The increase in the absolute figures is mainly a result of a higher quantity of complex input materials with low copper contents. This trend, which has been observed for some time now, led to an increase of more than 10,000 t in 2011 due to the implementation of the KRS project. The total CO₂ emissions include biogenic emissions and emissions from mobile production equipment, i.e., the diesel consumption of plant vehicles, which are not considered in emissions trading.

According to the reporting methods of the DEHSt, the raw materials contribute more to the site's CO₂ emissions than the main energy source, SE oil (40% compared to 37%).

Audits and Inspections by the Authorities

The following environmental inspections were carried out by the relevant authorities in 2017:

- » IED inspection of waste acceptance, sampling, and processing in connection with the German Federal Immission Protection Ordinance permits issued by the district government of Arnsberg, November 29, 2017

All inspections were completed successfully. The reports from the IED inspections are publicly available online.

Indirect Environmental Aspects

With the extension of the plant railway and the two-track expansion on the northern plant premises completed in 2011, the anodes delivered to the plant and the cathodes delivered from the plant by train increased distinctly.

Nevertheless, the delivery of most input materials and auxiliary materials with trucks cannot be avoided. The main reason is that the type of delivery is the supplier's choice. About 70% of deliveries arrive through the "Buchenberg" entrance, which is completely located in an industrial area of the Lünen city harbor and is separated from residential areas with an effective noise protection wall.

Emergency Measures and Crisis Management

Because of the type and quantity of materials handled, the Lünen site is subject to what are called the expanded obligations of the German Hazardous Incident Ordinance. Aurubis therefore developed a comprehensive safety report together with external experts and in close coordination with the responsible authority, in which all incident scenarios are addressed and concrete safeguards are derived from them. The safety report is regularly reviewed and updated to account for current developments at all times.

The Lünen plant's incident information is provided to neighbors near the plant and can also be accessed online on the Aurubis homepage at any time.

There were no incidents or malfunctions with significant environmental effects within the meaning of the Hazardous Incident Ordinance at the Lünen plant during the reporting period. In 2017 the site's safety report was revised and a new notification was submitted to the authorities pursuant to the new standards of the Seveso-III Directive. Furthermore, the information for the public regarding the Lünen site has been accessible on the Aurubis homepage to every interested citizen since last year.

Environmental Program

The targets set in the context of the Environmental Statement 2017 were reviewed to determine the extent to which they had been achieved and implemented.

Discussions with employees, training, audits, and quality circles served as a basis for discussing and evaluating the environmental protection measures, as well as for developing a new environmental protection program for 2018. The results are presented in the following Environmental Program:

Air pollution control

Target	Planned measure	Degree of implementation/date
Closing the KRS roof ventilation	Analysis of the emission effects after closing the smelting operations hall and possibly closing the KRS roof ventilation	The detailed engineering plan indicated additional improvement options that are still being incorporated in the project. A central filter on the roof doesn't seem to be the most efficient solution. Instead, suction processes should be accelerated on all working platforms. However, a complete closure still doesn't appear to be necessary.

Water pollution control

Target	Planned measure	Degree of implementation/date
Optimizing wastewater flows	Separate treatment of sanitation water	Details are currently being coordinated for environmental remediation with the responsible authorities. The applications for approval should be submitted this year

Energy optimization

Target	Planned measure	Degree of implementation/date
Increasing energy efficiency	Developing an assessment basis that takes the following aspects into account: <ul style="list-style-type: none"> » Form of energy » Raw material structures » Raw material availability » Price volatility 	The EnPIs have been evaluated as meaningful on the whole. There is no assessment standard for the overall process with regard to energy efficiency
Optimizing the anode smelter cycles and leaching plant	Heat utilization and water quality have to be optimized to enhance performance	Concepts are being developed. Projects are taken into account in the capital expenditure budget

Plant safety

Target	Planned measure	Degree of implementation/date
Adaptation of the requirements to Seveso-III Directive	Public disclosure	The documents are available online, development of a new information concept with flyers, visitor orientations to come
	Preparation of a new hazardous substances register	The report pursuant to the new Hazardous Incident Ordinance was submitted to the authorities. The hazardous substances register should be transferred to a more modern software with an SAP interface in order to improve the quality of evaluations

Environmental management system

Target	Planned measure	Degree of implementation/date
Improved organization	Computerized integrated management system	Document management has been successfully implemented and is currently being used and filled by all plants
	Organization and authorization, assumption of business and operator obligations	The training program for all employees with management responsibility has been introduced as a permanent fixture and supplemented by discussion forums to improve organization

Key figures for Aurubis AG, Lünen site,
in the 2017 calendar year

Input	2017	2016
Input/raw materials		
Recycling raw materials	392,420 t	376,891 t
Blister, etc.	15,138 t	15,979 t
Copper anodes from other Aurubis sites	25,404 t	6,306 t
Total raw materials	432,962 t	395,100 t
Input material/t Cu cathodes	2.24 t/t Cu	2.21 t/t Cu
Auxiliaries		
Oxygen	43 mill. m ³	40 mill. m ³
Rhine sand	15,199 t	12,982 t
Limestone	6,814 t	4,579 t
Energy		
External power sources	147,351 MWh	140,200 MWh
Internal power sources	17,766 MWh	14,855 MWh
Natural gas, oil, coal	391,679 MWh	390,734 MWh
Total energy consumption	556,796 MWh	545,789 MWh
Energy consumption/t Cu cathodes	2.89 MWh	3.05 MWh
Water withdrawal/uptake		
Potable water	626,462 m ³	575,151 m ³
Precipitation	126,302 m ³	139,164 m ³
Total water uptake	795,961 m³	756,461 m³
Water consumption/t Cu cathodes	4.1 m³/t Cu	4.22 m³/t Cu
Area used		
Total plant area (incl. south plant entrance)	316,000 m ²	316,000 m ²
Buildings and paved areas (equivalent to 78%)	247,000 m ² (equivalent to 78%)	247,000 m ² (equivalent to 78%)

Output	2017	2016
Products		
Copper cathodes	192,516 t	179,023 t
KRS oxide	23,022 t	21,118 t
Iron silicate sand	153,294 t	136,599 t
Other (tin composite, nickel sulfate, etc.)	26,289 t	25,001 t
Total products	395,121 t	361,741 t
Waste		
Recycling	9,378 t	7,036 t
Disposal	0 t	0 t
Waste/t copper output	48.71 kg/t Cu	39.31 kg/t Cu
Waste/t input material	46.16 kg/t	28.73 kg/t
Construction waste	10,988 t	4,313 t
Total waste	20,366 t	11,350 t
Emissions		
CO ₂	0.95 t/t Cu cathodes	0.97 t/t Cu cathodes
Dust	116 g/t Cu cathodes	131 g/t Cu cathodes
SO ₂	5.34 kg/t Cu cathodes	4.89 kg/t Cu cathodes
NO _x	1.29 kg/t Cu cathodes	1.93 kg/t Cu cathodes
Water discharge		
Wastewater (indirect discharge)	139,000 m ³	78,000 m ³
Water discharge/t Cu cathodes	0.72 m ³	0.43 m ³

GÜLTIGKEITSERKLÄRUNG

gemäß den Vorgaben der

Verordnung (EG) Nr. 1221/2009 i.d.F. vom 25.11.2009

über die freiwillige Teilnahme von Organisationen an einem Gemeinschaftssystem für Umweltmanagement und Umweltbetriebsprüfung (EMAS)



Die unterzeichnenden Umweltgutachter Dr. Erwin Wolf und Ralph Meß, zugelassen für den Bereich "NACE-Code 24.44", bestätigen, begutachtet zu haben, dass die gesamte Organisation wie in der aktualisierten Umwelterklärung der Organisation

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mit der Registrierungsnummer D-131-00035 angegeben, alle Anforderungen der Verordnung (EG) Nr. 1221/2009 des Europäischen Parlaments und des Rates vom 25. November 2009 über die freiwillige Teilnahme von Organisationen an einem Gemeinschaftssystem für Umweltmanagement und Umweltbetriebsprüfung (EMAS) in der durch die Verordnung (EU) 2017/1505 der Kommission geänderten Fassung erfüllt.

Mit der Unterzeichnung dieser Erklärung wird bestätigt, dass

- die Begutachtung und Validierung in voller Übereinstimmung mit den Anforderungen der Verordnung (EG) Nr. 1221/2009 durchgeführt wurden,
- das Ergebnis der Begutachtung und Validierung bestätigt, dass keine Belege für die Nichteinhaltung der geltenden Umweltvorschriften vorliegen,
- die Daten und Angaben der aktualisierten Umwelterklärung der Standorte ein verlässliches, glaubhaftes und wahrheitsgetreues Bild sämtlicher Tätigkeiten der Standorte innerhalb des in der Umwelterklärung angegebenen Bereichs geben.

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

Hannover, 31.05.2018



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Register-Nr.: DE-131-00035

Ersteintragung am
01. November 2005

Diese Urkunde ist gültig bis
19. Mai 2020.

Diese Organisation wendet zur kontinuierlichen Verbesserung der Umwelleistung ein Umweltmanagementsystem nach der EG-Verordnung Nr. 1221/2009 und EN ISO 14001:2004 Abschnitt 4 an, veröffentlicht regelmäßig eine Umwelterklärung, lässt das Umweltmanagementsystem und die Umwelterklärung von einem zugelassenen, unabhängigen Umweltgutachter begutachten, ist eingetragen im EMAS-Register und ist deshalb berechtigt, das EMAS-Zeichen zu verwenden.

Hamburg, 1. August 2017

HANDELSKAMMER HAMBURG



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Editorial deadline

This report describes calendar year 2017. Current events were included up to the editorial deadline of June 2018.

This Environmental Statement comprises Aurubis AG, which includes the Hamburg and Lünen sites.

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