



# Environmental Protection in the Aurubis Group

and Updated Aurubis AG Environmental Statement 2021  
Hamburg and Lünen Sites



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**DR. HEIKO ARNOLD**

Chief Operating Officer

**Dear readers,**

We live in a world full of complex challenges – whether it's climate change, resource conservation, or the energy transition. As a sustainably oriented multimetal company, we're part of the solutions for these global challenges. We take responsibility for environmental protection. As a fixed component of our Sustainability Strategy, it is enshrined in the corporate strategy and substantiated with concrete targets. We are continuously working on improving and optimizing our processes and facilities – especially with respect to environmental protection – because this is part of our core business.

Aurubis is committed to the European Green Deal and its targets. Our activities contribute to the more efficient use of resources, increased recycling, environmentally friendly production, the fabrication of environmentally compatible products, and the development of a circular economy that is friendly to the climate. Aurubis is reinforcing its recycling capabilities again significantly with the integration of our plants in Beerse and Berango. Because one thing is certain: recycling is crucial for ensuring a sustainable society in the future.

We have set the objective of achieving carbon-neutral production by 2050. In late 2019, we joined the UNGC initiative Business Ambition for 1.5 °C, committing the Group to setting science-based targets to reduce the greenhouse gas CO<sub>2</sub>. By taking part in this initiative, we are contributing to achieving the 1.5 °C target of the Paris Climate Agreement. Our metals are a key component of modern environmental technologies in this regard. Without our products, an energy transition isn't possible.

Aurubis already holds a leading position in energy efficiency. The efficient use of energy is an ecological and economic imperative for us, which we demonstrate in concrete projects. For instance, HafenCity East is the first urban neighborhood near our Hamburg plant to be almost fully supplied with CO<sub>2</sub>-free industrial heat. Using a chemical subprocess of copper production, Aurubis extracts CO<sub>2</sub>-free heat and, together with the energy supplier enercity AG, supplies it to the neighborhood through a roughly 3.7 km long pipeline.

For a long time, our annual investments in environmental protection measures have been in the double-digit million euro range. When it comes to environmental protection, we're one of the world's leading companies in our industry. All of the production sites in the Group implement best available techniques (BAT), but that's not enough for us. We can – and

want to – keep improving. For example, at the Hamburg site, we're investing in innovative, IT-controlled environmental protection technologies and will be able to further reduce emissions with a new ridge turret suctioning system in our smelter operations. This project makes us a forerunner that can serve as a role model to other multimetal producers.

Like I said: environmental protection is part of our company culture that our employees put into practice daily. They make a crucial contribution to helping us achieve our goals and continue improving.

With this Environmental Report, I'd like to warmly welcome you to learn about the environmental protection performance at Aurubis in more detail.

I hope it's an interesting read.

Sincerely,



**DR. HEIKO ARNOLD**  
Chief Operating Officer

## Company profile and business model

### THE AURUBIS GROUP

Aurubis is a company in the basic materials industry that operates worldwide. As an integrated group, we process complex metal concentrates, scrap metals, organic and inorganic metal-bearing recycling raw materials, and industrial residues into metals of the highest purity.

In addition to our main metal, copper, our metal portfolio also includes gold, silver, lead, nickel, tin, zinc, minor metals such as tellurium and selenium, and platinum group metals. Sulfuric acid, iron silicate, and synthetic minerals round off the product portfolio.

The company's headquarters, which is also home to one of our two primary smelters, is located in Hamburg, Germany. Our sites are mainly located in Europe, with larger production sites in Germany, Belgium, Bulgaria, and Spain, as well as cold rolling mills for flat rolled products, slitting centers, and rod plants in Germany and other European countries. Outside Europe, Aurubis also has a production site in the US, and a global sales and service network. Effective May 29, 2020, Aurubis AG acquired the recycling company Metallo with production sites in Beerse (Belgium) and Berango (Spain). Metallo has been fully consolidated into the Aurubis Group since June 1, 2020. Aurubis has approximately 7,200 employees.

Sustainability is a fundamental part of the Aurubis strategy "Responsibly transforming raw materials into value – to provide metals for an innovative world." Following this maxim, the company integrates sustainable conduct and business activities into the corporate culture. This involves a careful approach to natural resources, responsible social and ecological conduct in everyday business, and sensible, healthy growth.

### BUSINESS MODEL AND GROUP STRUCTURE

In our Vision 2025, we established the objective of developing Aurubis from a copper producer to a multimetal group by 2025. Building on our strategy, we are expanding our business model to include this approach. This means that, in addition to copper, other metals will be increasingly recovered from raw materials and intermediate products and then processed into sales products.

We process copper concentrates that are obtained from ores and are offered by mining companies and trading companies on the global market. The necessary raw materials for our two primary smelters in Hamburg and Pirdop are purchased worldwide. Aurubis doesn't hold any stakes in mines and has a globally diversified supplier portfolio. We source a significant portion of our copper concentrates from South American countries such as Peru, Chile, and Brazil. We also purchase raw materials from other countries like Bulgaria, Georgia, and Canada. As a buyer, Aurubis competes with other international primary smelters, particularly in China and Japan. Copper concentrates for the Hamburg site reach us primarily by waterway and are transshipped via the port terminal in Brunsbüttel. There, the different copper concentrates are also pre-mixed in accordance with the requirements of our production process. At the site in Pirdop, Bulgaria, concentrates reach us by land and sea via the port of Burgas.

In addition to copper concentrates, we use copper scrap and various types of organic and inorganic metal-bearing recycling raw materials, industrial residues, and bought-in metallurgical intermediates as feed material. Most of the copper scrap and metal-bearing recycling raw materials for our four secondary smelters in Lünen (Germany), Olen and Beerse (both in Belgium), and Berango (Spain) are sourced in the European and North American markets. Metal trading companies are the main actors on the supply side for recycling materials, though some recycling raw materials also reach us directly from industry through our "closing-the-loop" approach.

In the course of our production processes, we convert copper concentrates and recycling materials into copper cathodes. This is the standardized product format that is traded on the international metal exchanges. Copper cathodes are the starting product for fabricating additional copper products, but they can also be sold directly. Our product portfolio mainly comprises standard and specialty products made of copper and copper alloys. In terms of processing capabilities, we have manufacturing capacities for continuous cast copper wire rod, continuous cast shapes, rolled products, strip, specialty wire, and profiles.

Additional products result from processing the elements that accompany copper in the feed materials, elements that are in some cases purchased on purpose as part of our multimetal approach. In particular, these include different metals such as gold, silver, lead, nickel, tin, zinc, minor metals like tellurium and selenium, and platinum group metals. We also produce iron silicate and synthetic materials. Sulfuric acid forms as a co-product of copper concentrate processing. Sulfuric acid customers are very diverse and include international companies from the chemical, fertilizer, and metal processing industries.

The sales markets for our products are varied and international. Aurubis' direct customers include companies from the copper semis industry, the cable and wire industry, the electrical and electronics sectors, and the chemical industry, as well as suppliers from the renewable energies, construction, and automotive sectors. The focus is on materials such as production waste and residues that accumulate along the copper value chain in production, for example with our customers.

## OUR GROUP STRUCTURE

In fiscal year 2019/20, the Aurubis Group's organizational framework was based on the underlying business model. The Group's structure is made up of two operating segments: Segment Metal Refining & Processing and Segment Flat Rolled Products.

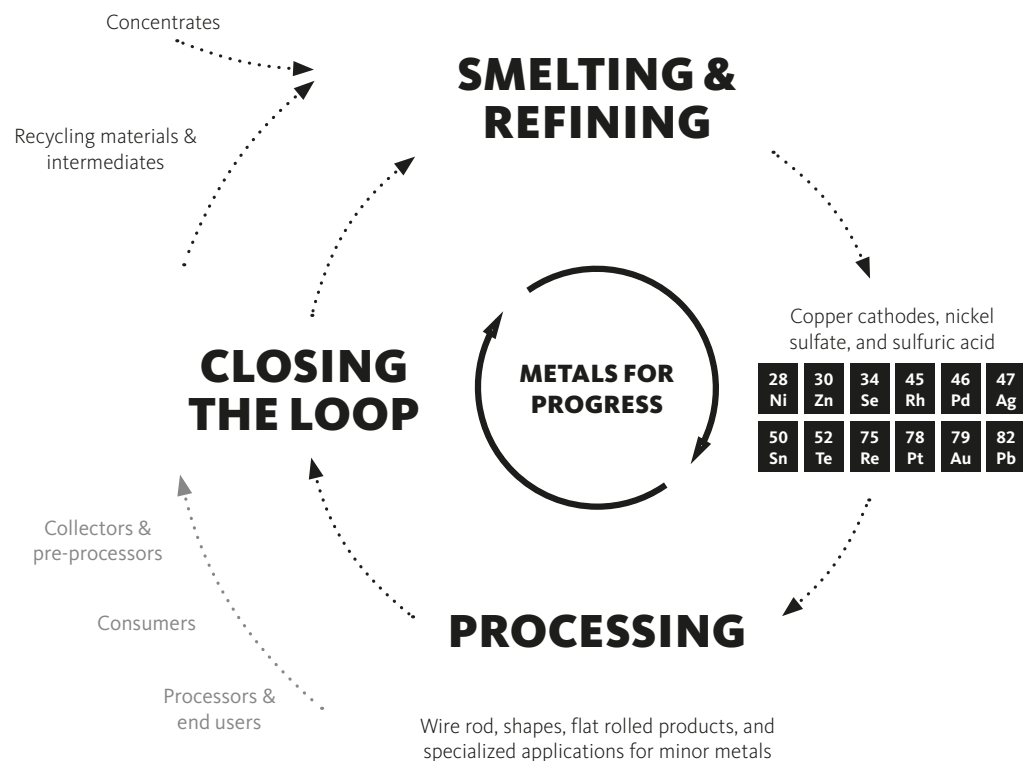
Segment Metal Refining & Processing (MRP) processes complex metal concentrates, copper scrap, organic and inorganic metal-bearing recycling raw materials, and industrial residues into metals of the highest quality. From an organizational perspective, Segment MRP includes the Commercial, Supply Chain Management (SCM), and Operations divisions.

The Commercial division is commissioned by the plants to purchase feed materials and sell products. The SCM division's responsibility to the plants is to carry out production planning, logistics management, and sampling, and to improve the Group-wide metal flows and inventories.

The Operations division is responsible for the ongoing optimization of the integrated smelter network and the production of all basic products and metals, as well as for their further processing into other products, such as continuous cast wire rod and shapes. Among other items, copper cathodes are manufactured at the sites in Hamburg and Lünen (both in Germany), Pirdop (Bulgaria), and Olen and Beerse (both in Belgium). The cathodes produced at the smelters are processed further into wire rod and shapes at the Hamburg (Germany), Olen (Belgium), Emmerich (Germany), and Avellino (Italy) sites. Segment MRP also includes the Metallo Group, the company acquired in 2020 with production sites in Beerse (Belgium) and Berango (Spain).

The second segment, Segment Flat Rolled Products (FRP), processes copper and copper alloys – primarily brass, bronze, and high-performance alloys – into flat rolled products and specialty wire, which it then markets. The main production sites are Stolberg (Germany), Pori (Finland), Zutphen (Netherlands), and Buffalo (US).

Fig. 1.1: The Aurubis AG business model



Furthermore, the segment also includes slitting and service centers in Birmingham (UK), Dolný Kubín (Slovakia), and Mortara (Italy), as well as sales offices worldwide.

There has been an intention to sell Segment FRP since fiscal year 2017/18. Aurubis maintains the intention to sell this segment.

## 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, we have established the following principles as our company guidelines:

- » The continuous improvement of the environmental performance, in particular of water pollution control, soil protection, and immission control, is a key target of the Environmental Protection division.
- » 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.
- » Technical and organizational measures 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. Ongoing improvement in environmental protection is enshrined in our corporate strategy and is one of our key responsibilities.

## Environmental protection in the Aurubis Group

### ENVIRONMENTAL PROTECTION IS PART OF THE COMPANY STRATEGY

For Aurubis, responsible corporate governance is an integral contribution to securing the company's future. The Sustainability Strategy for 2018 to 2023 creates the framework for this. It is a component of the Group strategy and follows the mission "Responsibly transforming raw materials into value – to provide metals for an innovative world."

We are leaders in environmental protection and are continuously improving. Environmentally sound multimetal production from primary raw materials such as iron concentrates and recycling form the foundation for a responsible and demand-oriented metal supply. By doing so, we are safeguarding our sites and creating the basis for forward-looking investments.

As a multimetal group, Aurubis assumes responsibility for protecting the environment and the climate. The efficient use of natural resources and energy as well as the reduction of CO<sub>2</sub> emissions are an important part of the company's ecological and economic responsibility and have been part of our corporate culture for many years. Aurubis views the value chain as a whole and pursues the goal of striking a balance between the economy, the environment, and people.

For all production sites and across all business processes, Aurubis places an emphasis on modern and energy-efficient plant technology that complies with high environmental standards. We also develop innovative and energy-efficient technologies in environmental protection that often set new benchmarks worldwide and form the basis for establishing best available techniques (BAT) at the European level.

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



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 projects.«**

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. It is becoming more and more important to recycle products after their life cycle is over in order to use valuable raw materials efficiently, conserve resources, and avoid environmental pollution. Our core product, copper, has the best conditions for achieving this because it is a metal that can be recycled as often as desired without a loss of quality. This means that copper of the highest purity can be produced from recycling materials again and again. 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. In the spirit of resource protection, nearly all raw materials are converted into marketable products, and waste is effectively avoided and – wherever possible – recycled.

### ACHIEVEMENTS AND SUCCESSES IN ENVIRONMENTAL PROTECTION

After we safely achieved and, in some cases, significantly exceeded the targets we had set in 2013 for the year 2018, we set Group-wide targets in environmental protection and defined concrete targets for the individual sites within the scope of the Sustainability Strategy 2018–2023. The effectiveness of these targets and measures is reviewed continuously.

In 2020, dust emissions per ton of copper output in copper production were reduced by 21% compared to 2012 (target: 15%). This goal was also achieved when the Metallo acquisition is included – with Metallo, a reduction of 19% was achieved. Our goal is to continue maintaining this very low level and to improve it wherever possible.

Similarly, SO<sub>2</sub> emissions in primary copper production were reduced by 4% in the same period under review.

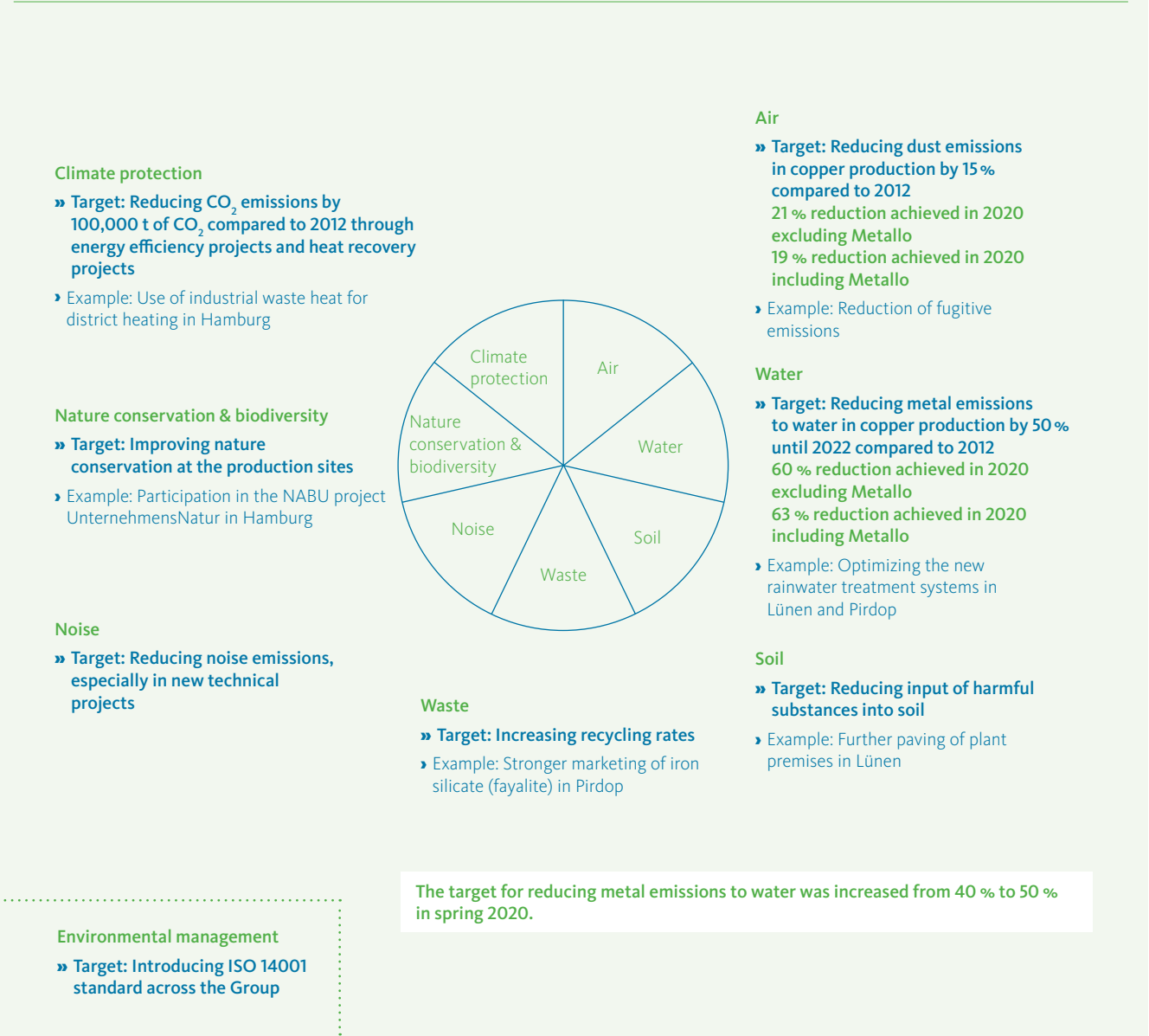


We have also made significant improvements in water pollution control. We have reduced metal emissions to water in copper production processes from 2.2 to 0.9 g per ton of copper output since 2012. This is a decline of 60% (target: 50%). This goal was also achieved when the Metallo acquisition is included – with Metallo, a reduction of 63 % was achieved.

These successes were only possible with continuous investments: we have invested more than € 670 million since 2000 in measures to improve environmental protection throughout the Group.

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 industrial heat for heating purposes. This long-term commitment has been successful: we have considerably reduced our CO<sub>2</sub> emissions per ton of copper at the sites.

Fig. 1.2: Our environmental targets



## PRODUCING WITH NEW, INNOVATIVE ENVIRONMENTAL PROTECTION TECHNOLOGIES



Targeted ventilation openings are being created with the project in Hamburg. The pipes are capable of suctioning off over 1 million m<sup>3</sup>/h of air and filtering it in a modern installation. The renovation is currently taking place while the smelter is in normal operation.

We are a leader in reducing our environmental impact on air, water, and soil in multimetal production. We have a long tradition of developing new and innovative environmental protection technologies.

We want to reach a new milestone at the Hamburg plant, where we will be investing about € 100 million in measures to continue reducing emissions in the primary smelter with our project RDE (Reducing Diffuse Emissions), one of the biggest environmental protection projects since the 1980s. These measures include optimized source extraction, a newly installed procedure for



processing intermediates, and the use of state-of-the-art suctioning and filter technology to trap residual dust emissions. Once our plans are fully implemented, we will reduce fugitive emissions from the primary smelter by more than 70%. All of this contributes to our Sustainability Strategy – and makes the site ready for the future in the long term.

With this project, we prove once again that modern urban development and copper production just a few kilometers from downtown Hamburg can sustainably coexist.

## SOLAR ENERGY FOR COPPER PRODUCTION

Aurubis Bulgaria is executing a project for a 10 MW photovoltaic installation on the plant premises – and will thus become the first industrial consumer in Bulgaria to invest in its own production of green energy on this scale. Commissioning is planned for 2022. “We want to generate 20 % of the electricity that we need from internal renewable sources by 2030,” says Aurubis Bulgaria CEO Tim Kurth, describing the plant’s vision.



## WE WANT TO IMPROVE ENVIRONMENTALLY FRIENDLY PRODUCTION EVEN MORE IN THE YEARS TO COME:

- » Our project to utilize **industrial heat** from the Hamburg plant facilitates an energy-efficient heat supply for the Hafencity East district. At the same time, 12 million m<sup>3</sup> less cooling water and Elbe River water is used each year, as the excess warmth is now used for heating purposes. But there's room for more: the total potential heat volume that could be extracted at Aurubis amounts to up to 500 million kWh per year. We are currently working on an additional expansion of the Industrial Heat project [see "Energy and climate protection"](#).
- » Within the scope of an EU project, Aurubis helped develop the organizational **environmental footprint** for copper production. In this context, rules for determining the environmental footprint were developed and tested. Production at Aurubis has one of the smallest environmental footprints worldwide (see "A comparison – Life cycle assessment for Aurubis copper cathodes").

- » To reduce **sulfur dioxide emissions and fugitive emissions** from the smelting process, a new facility for cooling converter slag was built at the site in Pirdop, Bulgaria, and went into regular operation in early 2020. This project will be expanded in the coming years to optimize cooling of the slags from the flash smelting furnace as well.
- » Furthermore, Aurubis Bulgaria is building a **solar park** on the plant premises, a 10 MW photovoltaic installation – and will thus become the first industrial consumer in Bulgaria to invest in its own production of green energy on this scale. Following the start of construction in 2021, commissioning is planned for 2022.
- » Likewise in Pirdop, Bulgaria, a new **sand filter** was commissioned in the existing treatment facility for industrial wastewater in 2020. This reduces the discharge of undissolved substances into bodies of water.

- » The Beerse site is currently carrying out extensive investigations into a **regenerative thermal oxidizer (RTO)** and a next-generation **afterburner technology** with external off-gas treatment experts. This technology has been in operation at the Berango site since November 2020, so this experience can be incorporated as well. The project reduces the carbon monoxide (CO) emissions in the air. The technologies are being investigated in 2020/21.
- » To **reduce noise and CO<sub>2</sub> emissions**, a new facility for loading ships, the Cu-Port, was constructed at the site in Olen, Belgium. Transport that was previously performed by truck is now carried out in an energy-efficient and environmentally friendly manner by waterway. This prevents a total of about 20,000 truck transports per year and thus over 230 t of CO<sub>2</sub> emissions annually.
- » The Avellino site was certified in accordance with **EMAS** for the first time at the end of 2018. In addition to the Hamburg, Lünen, and Stolberg Schwermetall sites, Avellino is now the fourth site in the Group that has an EMAS certificate in addition to the ISO 14001 certificate.
- » To promote **biodiversity**, a pilot project to add greenery to facades on the plant premises was concluded at the Hamburg site. The Pirdop site is taking the initiative to restore certain areas by planting grasses, bushes, and trees. Defunct landfill areas on the premises are renaturated while they are closed.
- » **Soil material** that was removed from the Retorte site during environmental remediation was recycled at the Hamburg site. The soil material was mainly composed of sand and was used as an additive to form slag for recovering selenium at the end of the copper refining process.



Ship loading facility (Cu-Port) at the Olen site

## DIALOGUE WITH INTERESTED PARTIES AND COMMITMENT

We have determined and evaluated the interested parties that are relevant for Aurubis: governmental 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.

Since 2013 we have participated in the EU projects Organizational Environmental Footprint and Product Environmental Footprint, which seek to achieve an environmental balance in organizations and products. The goal of this collaboration is to develop, test, and possibly implement the methods for determining the environmental footprint. In 2018, the pilot phase successfully concluded after the results were accepted by the official supervisory bodies. We will take part in the next phase of the Environmental Footprint and contribute our experience in this area.

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., which has led to different measures for low-emission mobility. For instance, bike boxes with locks were provided for employees at nearby train stations and a bike rental station was set up in front of a plant entrance.

## OUR PARTICIPATION IN THE HORIZON 2020 PROJECT FORCE

### Conclusion of FORCE project: successful project presentation at the closing event

Recycling valuable metals and optimally recovering them with an environmentally sound approach is particularly important to us. As a result, we were one of 22 national and international partners participating in the European research project “FORCE – Cities Cooperating for Circular Economy.” The project took place within the scope of Horizon 2020, the overarching European Union research and innovation program.

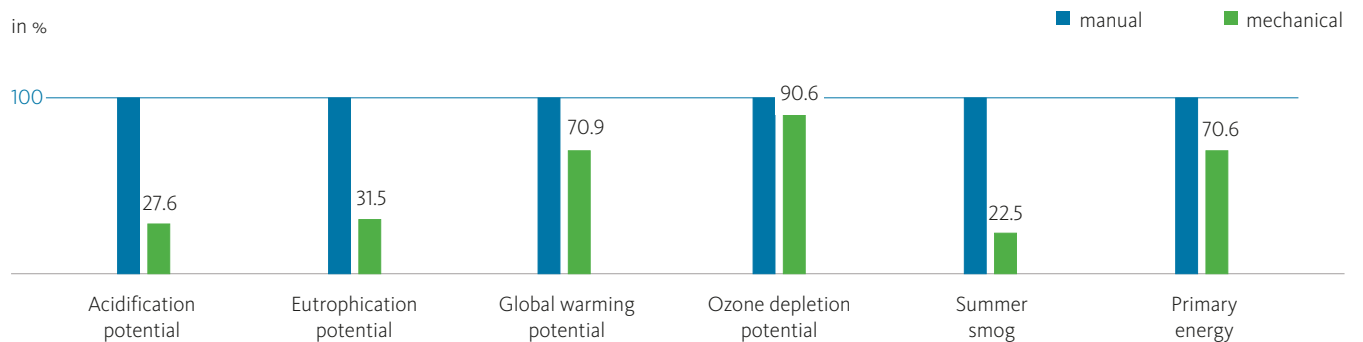
The goal of the project was to develop new concepts for waste avoidance and treatment for the material streams for plastics, biomass, used electrical equipment, and wood. By participating in the project, Aurubis positioned itself as a pioneer in multimetal recycling and contributed to the development of this issue within the context of a closed circular economy. This foundation paves the way for improving the collection and dismantling system for waste electrical and electronic equipment, and thus the recycling of strategic metals (e.g. copper, gold, silver, and lead).

The project, which Aurubis participated in with the city of Hamburg’s waste management service and other project partners,



has now officially concluded. At the official closing event, which took place virtually at the end of January 2021, Aurubis COO Heiko Arnold emphasized how important functional metal recycling is for recovering key raw materials and highlighted the significance of the FORCE project in this context. Afterward, Laura Robert, employee in Corporate Environmental Protection and Aurubis project manager, presented the results achieved in the project.

**Fig. 1.3: Results of the ecological assessment: Comparison of impact categories in manual dismantling and mechanical shredding**



The European cities of Copenhagen, Genoa, Lisbon, and Hamburg took part in FORCE, which dealt with different aspects of the circular economy and addressed possibilities for boosting recycling.

In the course of the project, Aurubis actively collaborated with different project partners in Hamburg, for instance the Senate Chancellery and the waste management service of the city of Hamburg, HafenCity University, and the Hamburg College of Applied Sciences (HAW), and created momentum for sustainability initiatives in science and business. In cooperation with Hamburg's waste disposal service, Aurubis compared two similar batches of electrical and electronic scrap from household devices in the project. One batch was manually pre-dismantled to obtain purer material contingents, while the other was mechanically shredded, sorted, and processed. The result showed that mechanical dismantling is substantially more cost-efficient, though manual pre-dismantling provides opportunities for an improved environmental footprint from a purely ecological standpoint (based on the eco-balance that was drawn up [see Fig. 1.3](#)).

"However, in order to take advantage of these opportunities in a cost-efficient manner, manual pre-dismantling has to be significantly simplified to make it more efficient," Laura Robert said. In this regard, the project team sees the possibility of new approaches in product design first and foremost. For instance, a number of special screws are still built into devices and require specific tools, and certain materials are combined that can't be separated from each other, or only with a great deal of effort.

Participating in FORCE, which extended over four years, provided Aurubis with valuable insights as well. Insights into individual product groups were especially eye-opening, for example the composition of these devices, how the metals in them are distributed, and how product design impacts recycling. Furthermore, by participating in the project, Aurubis was able to position itself as a pioneer in multimetal recycling and contribute to the development of this issue within the context of a closed circular economy.



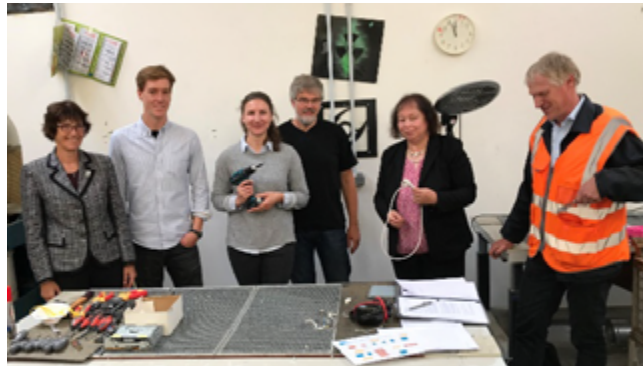
The unprocessed electrical and electronic devices prior to handling ...



... during the dismantling process ...



... and dismantled into individual parts in wire mesh crates



Start of the manual dismantling of the electrical and electronic devices in the workshop of the subsidiary (Stilbruch Hamburg-Altona) of Hamburg's municipal waste management service with their own cooperation partners: Aurubis representatives, Hamburg's municipal waste management service, and software developer Consist ITU



Aerial photo of the material preparation, crushing, and separation plant (MV-ZS facility) in Lünen



Releasing the electrical and electronic devices onto the feed conveyor of the MV-ZS facility

## ENVIRONMENTAL MANAGEMENT ORGANIZATION

Chief Operating Officer Dr. Heiko Arnold and 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 in a corporate policy, and implemented across the Group as part of the environmental management system (ISO 14001 or EMAS). This Environmental Statement is part of the EMAS registration and comprises Aurubis AG, which includes the Hamburg and Lünen sites. Moreover, energy management systems in accordance with ISO 50001 have been implemented and certified at several sites. The annual external audit in the scope of the certifications offers us the opportunity to have the successful environmental protection measures confirmed by an independent third party and to recognize additional potential for improvement.

The Corporate Environmental Protection Policy defines areas of activity and responsibility, specifies information and reporting requirements, and establishes 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 supports 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 Protection Act, the Closed Cycle and Waste Management Act, the Water Management Act, and the European chemical regulation, REACH. The results of internal and external assessments confirm that the legal regulations and guidelines from the permits were adhered to.

In 2017, an integrated management system (IMS) was developed for Aurubis AG for the areas of environment, energy, quality management, and occupational health and safety, with the first three areas certified that same year. The IMS utilizes synergies, harmonizes processes, and improves management in these areas.

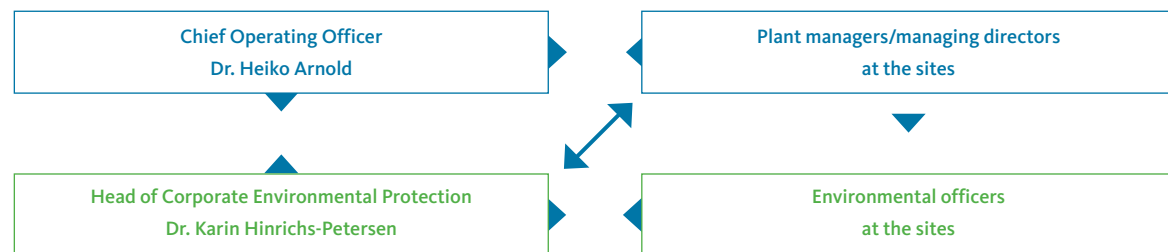
Furthermore, we determine key environmental protection factors, which are uniform within the Group and are reviewed and certified by external auditors annually.

In the future, there are plans to introduce a software program Group-wide to monitor and update environmental KPIs and to simplify compliance with all laws and standards. At the Hamburg site, the software is already in use for certain sub-areas. The plan is to gradually expand the roll-out to the individual sites.

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

Emergency plans and 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.

**Fig. 1.4: Aurubis Environmental Protection organizational chart**



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.

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. Risk

management exists to prevent environmental damages, non-compliance, and unexpected costs. Thus, environmental risks are investigated regularly and minimized by establishing precautionary measures. For this purpose, we regularly carry out environmental risk assessments at every production site through an external expert. Topics of the assessments include emissions to air and water, water management, and handling hazardous substances, but also the challenges that climate change poses. In the past year, we expanded the assessment to include the additional topics of biodiversity, nature conservation, and water availability.

**Fig. 1.5: Environmental management in the Aurubis Group**

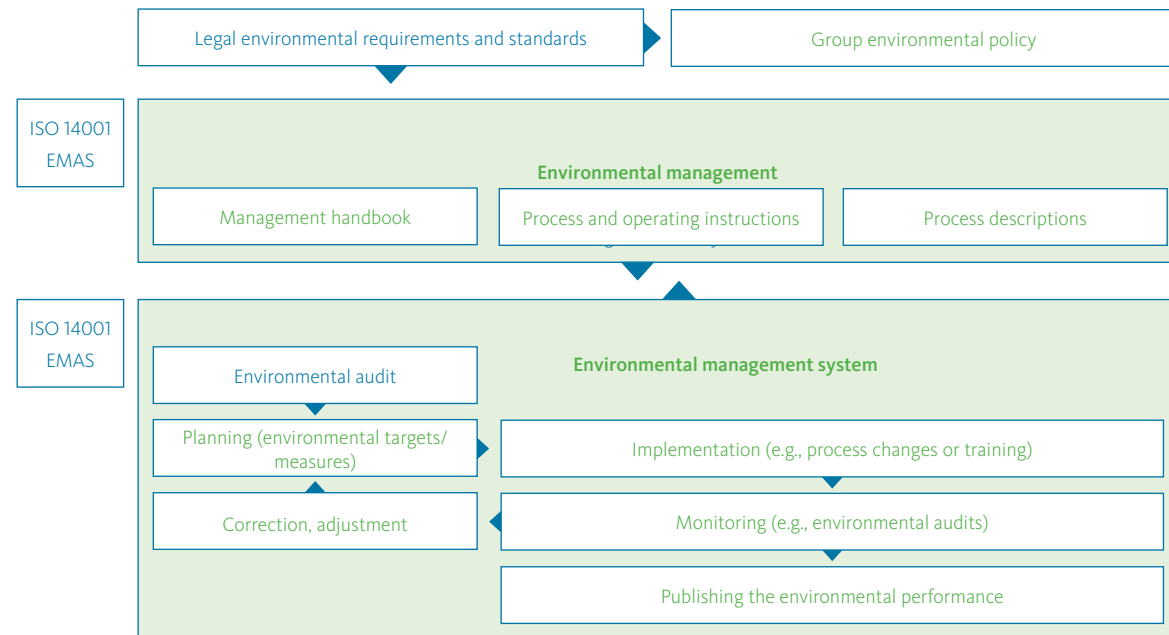


Fig. 1.6: Site certifications

Site	EMAS	ISO 14001	ISO 50001	ISO 45001	ISO 9001	IATF 16949	EfbV
Hamburg, headquarters (DE)	x	x	x	x	x		
Lünen (DE)	x	x	x	x	x		x
Pirdop (BG)		x		x	x		
Olen (BE)		x	x		x		
Beerse, Metallo (BE)		x			x		
Berango, Metallo (ES)		x		x	x		
Emmerich, Deutsche Giessdraht (DE)		x	x		x		
Avellino (IT)	x	x		x	x		
Fehrbellin, CABLO (DE)		x	x		x		x
Hamburg, E.R.N. (DE)		x	x		x		x
Röthenbach, RETORTE (DE)					x		
Hamburg, Peute Baustoff (DE)					x <sup>1</sup>		
Buffalo (US)					x	x	
Zutphen (NL)		x			x	x	
Pori (FI)		x	x	x	x		
Stolberg (DE)			x		x	x	
Stolberg, Schwermetall (DE) <sup>2</sup>	x	x	x	x	x		

<sup>1</sup> For the sale of iron silicate granules used to produce blasting abrasives.

<sup>2</sup> Not majority-owned by Aurubis (50 % stake).

#### Explanation

**EMAS:** system of specifications for environmental management systems and environmental audits

**ISO 14001:** standard for environmental management systems

**ISO 50001:** standard for energy management systems

**ISO 45001:** standard for occupational safety management systems

**ISO 9001:** standard for quality management systems

**IATF 16949:** standard for quality management systems in the automotive industry, based on ISO 9001

**EfbV:** Ordinance on Specialized Waste Management Companies (German certificate)

## Energy and climate protection

### OUR CLIMATE, OUR CONTRIBUTION

With the Green Deal, the EU has an ambitious target for 2050: a resilient economy and society that achieves carbon neutrality through high innovative strength and competitiveness. With our affirmation of the Science-Based Targets initiative, we demonstrate that this aligns with our targets. We have committed to setting science-based CO<sub>2</sub> reduction targets, contributing to the 1.5 °C goal of the Paris Climate Agreement. And we want to become carbon-neutral well before 2050.

At all of the relevant production sites, we have been successfully implementing CO<sub>2</sub> reduction projects through different energy efficiency measures for several years. Furthermore, we are working on making our electricity uptake more flexible so that we can react to fluctuating electricity availability and use more renewable energies. Shifting the electricity supply to renewable energies, utilizing hydrogen as a reducing agent in the copper process, and investing in new facilities: this is what the future holds. We also provide solutions outside of our plants, solutions that save energy and thus CO<sub>2</sub> – such as the Industrial Heat project.

### MANAGEMENT APPROACH

The individual production steps in the Aurubis value chain are complex and very energy-intensive overall. Accordingly, the effective and efficient use of energy is an issue of ecological and economic responsibility. The use of energy is the main source of CO<sub>2</sub> emissions in the Group. Taking the entire value chain into consideration, over half of the CO<sub>2</sub> emissions are upstream and downstream, i.e., they originate from our suppliers, customers, and service providers (Scope 3 emissions). Most of the Scope 3 emissions originate from the activities of the mining companies from which we source ore concentrates.



At the same time, the products we manufacture contribute to reducing CO<sub>2</sub> emissions because they play an important role in renewable energies, energy efficiency applications, and electric vehicles. Electric cars contain nearly four times more copper than vehicles with conventional combustion engines, and building and connecting an offshore wind turbine to the energy grid requires up to 30 t of copper. Our metals contribute to CO<sub>2</sub> reduction in our society thanks to their use in electric vehicles and in the expansion of renewable energies.

Identifying climate-related opportunities and risks and deriving related measures are two issues that link our risk management and our energy and climate strategy. When doing this, we consider (pending) legal requirements, technological developments, and compliance-related, reputational, and physical risks.

The development and implementation of the Group-wide energy and climate strategy and the corresponding coordination of the targets and measures are the central responsibility of the head of Corporate Energy & Climate Affairs, who reports directly to the Executive Board. The corporate department also coordinates the development of the energy management and monitoring systems across the Group, providing for a uniform approach and facilitating the exchange of expertise regarding best practice examples – for instance in the form of an energy efficiency network for the German Aurubis sites' energy management officers and a regular international Aurubis workshop. Topics include completed and planned energy efficiency projects, results of energy audits, the current legal situation, and aid programs and implementation assistance related to new requirements.

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 capital expenditure leads to only marginal improvements compared to past years.

In order to control energy consumption optimally using energy performance KPIs and identify additional energy savings potential with the goal of continuous improvement, the main German sites are certified in accordance with DIN EN ISO 50001:2018. The plan is to introduce an energy management system in accordance with DIN EN ISO 50001 at all Aurubis sites by fiscal year 2021/22.

## ENERGY EFFICIENCY AND REDUCING THE USE OF FOSSIL FUELS

To prevent CO<sub>2</sub> emissions, we primarily focus on energy efficiency measures. 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.



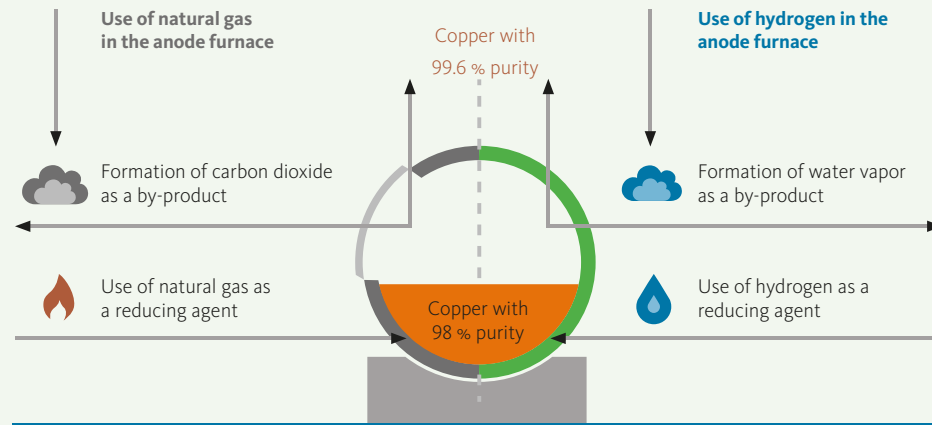
The winners of the four competition categories of the 2018 dena Energy Efficiency Awards

The more steps that have been implemented in energy efficiency in the past, the more challenging a further optimization is. Moreover, because there are limits to reducing energy consumption and emissions, the improvements being achieved today within the plant boundaries are only marginal compared to previous years. This is despite the same or higher levels of investment, which were already high to begin with. For example, complex recycling raw materials with relatively low metal contents and complex copper concentrates require a higher specific energy input to be processed. As a result, we focus not only on further increasing efficiency but on solutions that save energy and thus prevent CO<sub>2</sub> emissions outside of our plant, as well as on projects that contribute to the energy shift.

Furthermore, we are increasingly considering measures to replace fossil fuels with alternatives. Green hydrogen is considered a key technology for decarbonizing industry. Hydrogen is an energy source that can be used to store and transport energy. It can be converted to electricity and replace crude oil and natural gas in production – without releasing CO<sub>2</sub> in the process. Aurubis is investigating how hydrogen can be efficiently and cost-effectively integrated in production and currently sees the biggest potential in the material use of hydrogen in the anode furnaces. In this process step, the copper's purity is enhanced by using natural gas as a reducing agent. When the natural gas is substituted by hydrogen, the hydrogen reacts with the copper and reduces copper oxide in the process. This forms water vapor alone, and not CO<sub>2</sub> as before.

The use of renewable energies on a large scale is a challenge for us, since generating them is associated with energy supply fluctuations. However, our production processes require a constant energy supply. We are therefore working on measures to make our energy uptake more flexible so that we can react to fluctuating energy availability and thus use more renewable energies.

**Fig. 1.7: Possibility of using hydrogen instead of fossil fuels**



#### Hydrogen as an opportunity for energy-intensive industry

Green hydrogen is considered a key technology for decarbonizing industry. It can store energy, be converted to electricity, and replace crude oil and natural gas in production – without forming greenhouse gases.

For this reason, Aurubis is participating in the Living Lab Northern Germany and, within the scope of this project, investigating the cost-efficiency of producing and using hydrogen in copper production. The goal of the Living Lab Northern Germany is to continue carrying out trials related to the energy system transformation and decarbonization possibilities. One focus in this context is integrated energy with a concentration on hydrogen. As part of the precursor project NEW 4.0, Aurubis commissioned a study on

the limits and the potential of making electricity consumption more flexible at the Hamburg plant. One part of the project involved installing a power-to-steam facility (electrode boiler) at the Hamburg plant, which, during periods of surplus renewable energy in the grid, converts the energy into steam for internal processes and contributes to integrated energy. For the Hamburg plant, over 10% of the installed electricity consumption capacity can be flexibly controlled already as a result.

## OUR SUCCESSES

### Best Newcomer Germany and Index Leader MDAX: Aurubis

Aurubis has participated in the investor initiative CDP (formerly Carbon Disclosure Project) since 2015. The CDP surveys companies about risks and opportunities related to the climate, as well as CO<sub>2</sub> reduction potential. CDP awarded Aurubis the distinction of Best Newcomer Germany (2015) and Index Leader MDAX (2016). 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 CO<sub>2</sub> 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 CO<sub>2</sub> reduction and energy and resource efficiency.

### Best Practice in Energy Efficiency: 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, for instance converting it into electricity and using the residual heat, the recycling center achieves the optimum energy recovery possible. The installation can produce up to about 23 million KWh of electricity (about 14 % of the site's energy needs, or the average energy demand of around 6,500 three-person households). It therefore simultaneously manages to prevent up to 14,000 t of CO<sub>2</sub> annually. The energy efficiency initiative of the German Energy Agency (dena) rated the project as exemplary and awarded it the label Best Practice in Energy Efficiency in 2015.



## OUR FLAGSHIP PROJECT – THE CLIMATE ALLIANCE BETWEEN AURUBIS AND ENERCITY

Hamburg's Hafencity East is the first urban neighborhood to be almost fully supplied with CO<sub>2</sub>-free industrial heat. Using a chemical subprocess of copper production, Aurubis extracts CO<sub>2</sub>-free heat and, together with the energy supplier enercity, delivers it through a roughly 3.7 km long pipeline to Hafencity East.

In its size and complexity, the project is unique in Germany. It cuts up to 20,000 t of CO<sub>2</sub> annually. This is equivalent to the emissions of about 10,000 mid-range cars, each driving 12,000 km per year. Industrial Heat is a flagship project for a climate-friendly heat supply.

The two participating companies invested over € 20 million in the project each, 30 to 40 % of which was publicly funded. Aurubis received funding from the German Reconstruction Loan Corporation (KfW), while enercity received support from the European Regional Development Fund (ERDF) and the KfW. The funding was initiated by the German Federal Ministry for Economic Affairs and Energy (BMWi) and the Hamburg Ministry for Environment and Energy (BUE).

If the full industrial heat potential of the Hamburg plant is utilized, CO<sub>2</sub> emissions could even be reduced by about 140,000 t CO<sub>2</sub> per year. However, the necessary framework and incentives have to be created, for example the full recognition of the CO<sub>2</sub> reduction within the scope of the emission trading system. Calculations by the German Energy Agency (dena) show: Throughout Germany, companies could save up to 37 million t of CO<sub>2</sub> and roughly € 5 billion in energy costs if industrial heat were used consistently.

The following distinctions the project has received from 2018 to 2020 impressively demonstrate the flagship character of the climate alliance.



Responsible Care – ein Beitrag zur Nachhaltigkeitsinitiative Chemie<sup>3</sup>



## Our raw materials – Responsibility in the supply chain

As a producer of copper and other non-ferrous metals, we are aware of our responsibility toward the environment and people who could be directly or indirectly impacted by our business activities. It is important to us to carry out a risk assessment and select business partners carefully in Germany and abroad. This is all the more important because we source raw materials from around the world for our business. In our Sustainability Strategy, we have set the target of managing our supply chain responsibly. In the process, we take impacts on the social environment, economic aspects, and the natural environment into account. It's important to us to minimize environmental strains and risks and to improve environmental performance along the supply chain as well.

We use copper concentrates, copper scrap, other metal-bearing recycling materials, and bought-in intermediates as feed material, which we largely source on the European market. Aurubis has a globally diversified supplier portfolio. We source a significant portion of our copper concentrates from South American countries such as Peru, Chile, and Brazil. For primary raw materials, we value long-term relationships and strategic cooperation with our suppliers. Most of the copper scrap and metal-bearing recycling raw materials for our four secondary smelters in Lünen (Germany), Olen and Beerse (both in Belgium), and Berango (Spain) are sourced in the European and North American markets. Compared to primary raw materials, secondary raw materials are largely purchased on the basis of short-term supply contracts.

To close the value chain for copper and other metals, we place a high priority on the “closing-the-loop” approach. The focus of this approach is on materials such as production waste and residues that accumulate along the copper value chain in production, for example with our customers. We therefore provide the downstream value chain with solutions to conserve resources while promoting waste prevention.

Aurubis has participated in the United Nations Global Compact (UNGC) since 2014 and is therefore committed to implementing its Ten Principles related to human rights, labor, the environment, and anti-corruption. In fiscal year 2019/20, the Aurubis Business Partner Code of Conduct was introduced across the Group. This outlines our requirements regarding human rights and labor standards, occupational health and safety, environmental and climate protection, business integrity and responsible mineral sourcing, as well as reporting procedures and the monitoring of the business partner's due diligence obligation. Aurubis AG expects its business partners to follow the fundamental conventions of the International Labour Organization (ILO), the United Nations Declaration of Human Rights, and applicable national and local laws and regulations.

We have implemented Aurubis Business Partner Screening to fulfill our due diligence obligation. Using this tool, we structure our business partners in a screening process and analyze them with regard to their integrity in relation to social and ecological criteria. The focus of the process is on the topics of compliance, corruption,

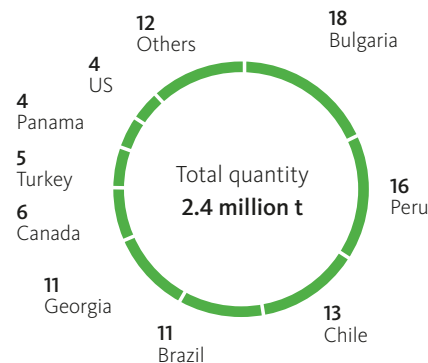
human rights violations, and environmental and climate protection. Based on this assessment, management decides on possible contracts or restrictions. For existing business partnerships, the analysis is repeated regularly depending on the original risk. The screening is based on the principles of the OECD.

### SHARED STANDARDS FOR RESPONSIBLE METAL PRODUCTION

Since 2013, Aurubis' gold production has been annually certified as conflict-free according to the standards of the London Bullion Market Association (LBMA). The certificate verifies that we carry out our due diligence processes in accordance with the OECD standards promoting responsible supply chains for minerals from conflict and high-risk areas in connection with the procurement of gold-bearing raw materials. This certification option has been available for silver since 2019, and Aurubis has been certified as conflict-free in this area since then as well. Suppliers of other raw materials go through a comparable process to those who supply gold- and silver-bearing raw materials.

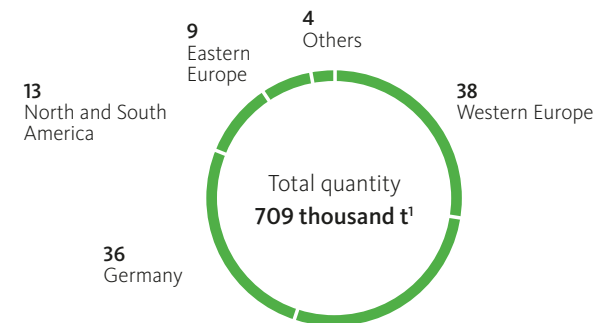
**Fig. 1.8: Origin of copper concentrates**

for the Aurubis Group in 2019/20<sup>1</sup>, in %



**Fig. 1.9: Origin of recycling materials**

for the Aurubis Group in 2019/20<sup>1</sup>, in %



<sup>1</sup> Excluding FRP

The Copper Mark is an initiative that entails a review of the sustainability standards of copper production sites including mines, smelters, and refineries. Aurubis Bulgaria was the first primary smelter in the company to successfully conclude the multi-stage review process in fiscal year 2019/20. With this standard, we want to foster responsibility throughout the value chain, boosting and verifying our own sustainability performance with an external certification from an independent body. Additional locations will follow in 2021.

In addition to purchasing primary and secondary raw materials, Aurubis procures goods, services, and operating supplies that are required for our production but that don't go into our sales products (indirect procurement). We select suppliers and service providers according to established supplier assessment processes, for example by consulting a catalogue of questions about environmental protection, occupational safety, and social issues. It is updated regularly and has to be answered by all new suppliers. Suppliers that do not complete the questionnaire or that provide insufficient answers are not considered in the rest of the tendering procedure. When it comes to purchases with environmental importance made by Aurubis AG, we carry out an authorization process related to the purchases' environmental compatibility. This is used for waste disposal services, for example. We annually review the documents from our suppliers whose work is environmentally relevant to ensure that they are complete. When sourcing investment goods, environmental protection and safety requirements for the product, services connected with the product, or the supplier are defined and taken into consideration. The criteria include energy consumption, emissions, material input, prescribed disposal methods, the expected life cycle, and whether important test certificates are available, for example for material quality or employee qualifications.

## Risks and opportunities

### RISK MANAGEMENT IN THE AURUBIS GROUP (RISK MANAGEMENT SYSTEM)

Risk management is a fundamental part of corporate governance at Aurubis. Our objective in risk management is to manage and monitor the risks associated with our business with the help of a risk management system (RMS) suited to our activities. Identifying and observing risk development early on is of major importance. Furthermore, we strive to limit negative effects on earnings caused by risks by implementing appropriate and economically sound countermeasures.

Risk management is an integral component of the centralized and decentralized planning, management, and monitoring processes, and covers all of the Aurubis Group's main sites, business sectors, and central functions. The planning and management system, risk reporting, open communication culture, and risk reviews at the sites create risk awareness and transparency with regard to our risk situation. The RMS is documented in a corporate policy.

Risk management officers have been appointed for all sites, business sectors, and central functions, and they form a network within the Group. The Group headquarters manages the network. Corporate Risk Management has regular discussions with the Corporate Environmental Protection, Sustainability, and Corporate Energy & Climate Affairs departments, for example to report on new legislative proposals, broadly identify risks related to them, and prepare measures to control these risks in good time. These discussions also promote the risk culture and risk awareness in the Aurubis Group.

Standard risk reporting takes place bottom-up each quarter using a uniform, Group-wide reporting format. Within this format, the identified risks and risks beyond a defined threshold are explained and evaluated on the basis of their probability of occurrence and

their business significance. Measures to manage them are then outlined. The risks registered with Group headquarters are qualitatively aggregated into significant risk clusters by Corporate Risk Management and reported to the entire Executive Board. The report also establishes the basis for the report to the Audit Committee as well as external risk reporting.

### LOCAL RISK MANAGEMENT AND OPPORTUNITIES

Based on the system described above, every site and every centralized function is required to maintain and carry out "local" risk management. For example, the Corporate Environmental Protection and Energy & Climate Affairs departments have codified their own corporate policies that govern the way they handle risks in their specific areas of responsibility – in alignment with the Corporate Risk Management Policy.

Moreover, the environmental risks for all Group sites are regularly analyzed and assessed by external experts. Measures are developed and stipulated to effectively counter possible risks.

In 2021, these risk analyses were expanded to include the areas of biodiversity, water availability, and nature conservation. Opportunities were systematically analyzed as well. The reports for the Hamburg, Lünen, Pirdop, Olen, Beerse, and Berango sites were completed in April 2021. If they exceed the thresholds mentioned above, key results from these analyses are included in the risk reporting that is submitted to Corporate Risk Management.

One opportunity is that Aurubis can contribute substantially to achieving the targets of the European Green Deal. We enable a more efficient use of resources and an increase in recycling in particular. At Aurubis, we produce multimetals using environmentally compatible methods and play a role in a circular, climate-friendly economy. With the ongoing integration of the plants in Beerse and Berango, Aurubis is reinforcing its recycling capabilities and opportunities. Recycling is crucial for a sustainable society.

Aurubis is committed to the goal of becoming carbon-neutral by 2050 at the latest. In late 2019, we joined the UNGC initiative Business Ambition for 1.5°C, which requires the Group to set science-based emission reduction targets (Science-Based Targets) and thus to contribute to achieving the 1.5°C objective from the Paris Climate Agreement. Our metals are a key component of modern environmental technologies; without our products, an energy transition wouldn't be possible. Aurubis is also taking advantage of the opportunity to continue developing the best available techniques (BAT). For instance, we are investing in a new ridge turret suctioning system in our copper smelter in Hamburg to develop innovative, IT-controlled environmental protection technologies and to reduce emissions even further. This project makes us a forerunner that can serve as a role model to other multimetal producers.

## EXPLANATION OF RISKS

The main risks for the risk clusters “Energy and climate,” “Sustainability,” and “Environmental protection,” including the specific measures to control the risks, are explained in the Risk and Opportunity Report of the Annual Report [Annual Report 2019/20, pages 111–115](#). The climate risks in the Annual Report are categorized in physical and transitory risks, in alignment with the definition given by the TCFD (Task Force on Climate-Related Financial Disclosures). In this way, we document that we take climate protection very seriously on the one hand, and, on the other, that we fulfill the heightened interest in information that the readers of the Annual Report have regarding our climate risks.

In addition to the financial risks just described, there are also non-financial risks that are reported separately in the scope of the Non-Financial Report [Annual Report 2019/20, page 47](#). In the process, no non-financial risks were identified that were very likely to cause a serious negative impact on employee and environmental matters, on respect for human rights, on the prevention of corruption and bribery, or on social matters. Nevertheless, it is important to us to handle non-financial risks even if they are evaluated as non-material according to the strict definition of the German Commercial Code (HGB), and we have developed and implemented related management approaches.

## Iron silicate:

### A versatile and sustainable substitute for primary raw materials

For us, practical resource conservation includes using our raw materials as completely as possible and directing them into the value chain. One example is our synthetic minerals consisting of iron silicate that we produce in our metal refining and recycling processes and whose qualities we specifically adjust and monitor for applications in the construction sector in particular.

#### WHAT IS IRON SILICATE?

Iron silicate is an industrially produced mineral comparable to natural stone from quarries, but without the disadvantage of strong interference in nature. Aurubis is a leading global provider of non-ferrous metals and one of the largest copper recyclers worldwide. Iron silicate has different uses, especially in construction as a replacement for primary building materials.

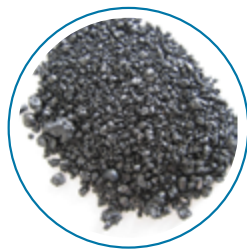
#### WHAT DOES IRON SILICATE CONSIST OF?

As the name suggests, it mainly consists of the mineral iron silicate, as well as silicates of aluminum and calcium. Trace metals are largely included in the silicate phases, which are therefore characterized by high bounding stability and low leachability.

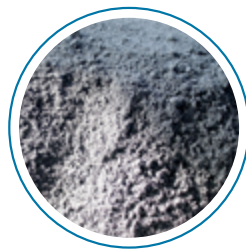
There are three basic products, depending on the process:



Iron silicate stone, with edges up to 450 mm in length, comparable to igneous rock



Iron silicate fines, similar to mineral flour



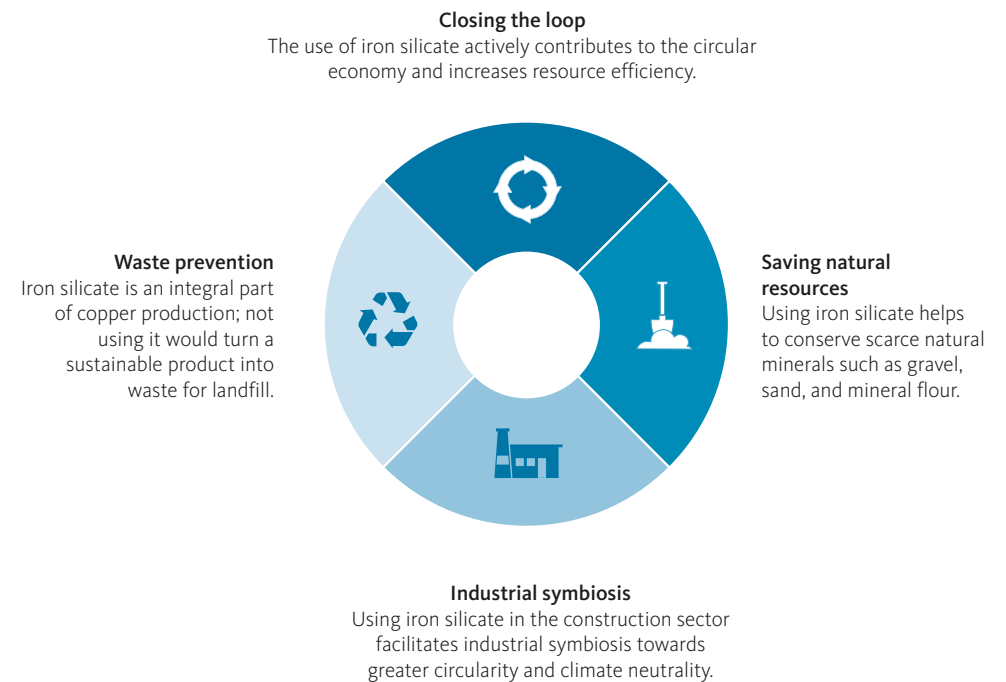
Iron silicate granulate, similar to natural volcanic glass, e.g., obsidian

#### ADVANTAGES OF IRON SILICATE:

- » High dry bulk and specific density
- » Ideal volume stability
- » Optimal surface coarseness
- » Very durable
- » Doesn't absorb much water
- » Very hard
- » Dense pore structure
- » Very good frost resistance
- » Cubic grain shape
- » High weather resistance
- » No linear deformations

A long-lasting, sustainable replacement for natural building materials

Fig. 1.10: A heavyweight with considerable potential in the circular economy and climate protection





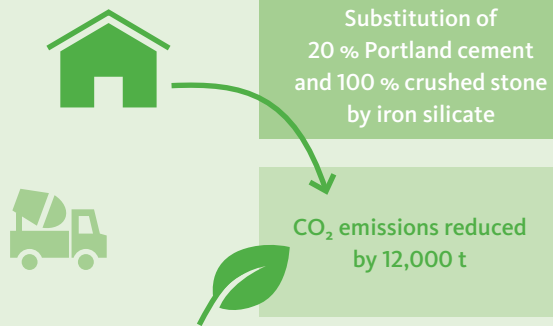
### ACTIVE CLIMATE PROTECTION

Iron silicate can save the following CO<sub>2</sub> volumes per year:

- » 11,400 t CO<sub>2</sub> as an aggregate in road construction, by avoiding the extraction of gravel in quarries
- » 170,000 t CO<sub>2</sub> as a reactive mineral additive in blended cements
- » 116,000 t CO<sub>2</sub> as a substitute for cement and crushed stone in concrete

Baseline: Use of 1 million t of gravel, cement, and concrete. Substitution of 100 % gravel, 100 % crushed stone, and 20 % Portland cement by iron silicate.

Source: Life cycle assessment of different substitution scenarios for iron silicate, Quantis, technical report, September 2020/Aurubis calculation



The environmental benefits of using iron silicate compared to natural materials are confirmed by a life cycle assessment. The results come to a clear conclusion: the use of iron silicate can significantly reduce CO<sub>2</sub> emissions as well as other environmental impacts.

When constructing a larger building, CO<sub>2</sub> emissions can be reduced by around 12,000 t if iron silicate is used.

### AURUBIS' COMMITMENT TO INNOVATION FOR LOW-CARBON CONSTRUCTION MATERIALS

We are continuously collaborating with EU innovation and research projects to further investigate the potential offered by iron silicate in new applications and to develop less carbon-intensive construction materials.



**Target:** Development of a new generation of construction material/concrete with a low carbon footprint. Application in alkali-activated binders/geopolymers based on iron silicate.

**Financing:** Horizon 2020

**Partners include:** Ghent University, Delft University of Technology, Karlsruhe Institute of Technology, ETH Zurich, and 15 industrial partners



**Target:** European training network for the valorization of industrial process residues, such as cementitious materials and inorganic polymers.

**Financing:** Horizon 2020 MSCA-ETN

**Partners include:** Katholieke Universiteit Leuven, University of Leicester, University of Bonn, TU Bergakademie Freiberg



**Target:** Upscaling project to produce inorganic polymer building materials from iron silicate, using a modular and mobile upscaling unit. This would result in a lower environmental footprint and would make metallurgical industries an important raw material supplier with integrated zero-waste processes.

**Financing:** EIT KIC Raw Materials

**Partners include:** Katholieke Universiteit Leuven, University of Athens, ResourceFull, ZAG



**Target:** Development of innovative, recyclable inorganic polymer-based materials, based on slags from non-ferrous metallurgy.






**Financing:** SIM ICON MARES

**Partners include:** Katholieke Universiteit Leuven, VU Brussels, BRRC, Flamac



## WHAT IS IRON SILICATE USED FOR?

Its technical properties enable iron silicate to be deployed in a wide range of applications. Fifty years of practical experience and substantial testing demonstrate that it is safe to use throughout its entire life cycle. Iron silicate is registered in compliance with the EU's REACH regulation and is available at a consistent quality throughout the year.

Area		Purpose	Special advantages
Hydraulic engineering		Protecting embankments and the beds of rivers, canals, and harbor basins against tides and waves	<ul style="list-style-type: none"> <li>» Thinner stone layers and less excavation work</li> <li>» Stability through high dry bulk density, cubic particle shape, and optimal surface texture</li> </ul>
Road construction		Used as an anti-frost and gravel-bearing layer as well as an underlay for paving	<ul style="list-style-type: none"> <li>» Very good load-bearing capacity</li> <li>» Frost resistance</li> <li>» Water permeability</li> </ul>
Cement production		Fines and granules used as iron additive in bricks or as a reactive mineral additive in blended cements	<ul style="list-style-type: none"> <li>» Ready-to-use source of iron</li> <li>» Decreases burning temperature and therefore fuel consumption</li> </ul>
Concrete production		Versatile use as a substitute for natural aggregates and Portland cement	<ul style="list-style-type: none"> <li>» Enhances workability in its fresh state, improves mechanical properties, enhances durability</li> <li>» Enables special types of concrete, e.g., radiation protection concrete, heavyweight concrete</li> </ul>
Abrasives		Granulate used for blast cleaning	<ul style="list-style-type: none"> <li>» Provides a perfect grit for blasting steel, stone, and concrete</li> </ul>

In addition to these examples, **iron silicate can also be used in asphalt, ceramics, dry mixtures, coal flotation, soil stabilization,** and many other ways.

## BIODIVERSITY

We are actively involved in creating and maintaining good conditions for species conservation and biodiversity in our plants and their surroundings. Protecting biodiversity is one of our environmental targets.

The aspect of biodiversity was also inspected by governmental authorities as part of authorization procedures with environmental compatibility tests. If any impacts on biodiversity were expected, we implemented the required compensating measures. 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.

Wherever possible, we maintain or expand green areas on the grounds of every plant: for instance, we take part in the Hamburg initiative UnternehmensNatur to promote biodiversity at our site there. Due to long-time industrial use, however, there can be soil contamination typical for industrial areas, which we work to prevent from mobilizing and spreading. We commissioned a new sewer line at the Olen site to protect the nature conservation area Olens Broek in late 2015. When we have to expand the usable area on any plant premises, we choose areas that naturally have limited biodiversity.

Additional measures are currently being devised to protect and reinforce biodiversity. For example, a fayalite landfill that was closed at the Pirdop site in late 2018 was ecologically restored. At the Hamburg site, a pilot project to set up a green facade was implemented to promote biodiversity and improve the ambient air.

**Fig. 1.11: Conservation areas in close proximity to copper production sites**

	Name	Distance	Direction
Hamburg (DE)	Hamburger Unterelbe	200–600 m	Southeast
	Holzhafen	600–1,000 m	East
	Heuckenlock/Schweenssand	3,600 m	South
Pirdop (BG)	Tsentralen Balkan – bufer (nature conservation area)	approx. 1,000 m	North
	Tsentralen Balkan – bufer (Bird conservation area)	approx. 1,700 m approx. 2,300 m	North East
	Sredna Gora*	approx. 2,300 m	South
Lünen (DE)	In den Kämpen, Im Mersche, and Langerner Hufeisen	<2,000 m	Northeast
	Lippeaue	<5,000 m	Northwest
	Lippe-Unna, Hamm, Soest, Warendorf	<2,500 m	Northwest
Olen (BE)	Valleigebied van de Kleine Nete met haar brongebieden, moerassen en heiden	approx. 1,000 m	North
	De Vallei van de Kleine Nete Benedenstroom	approx. 1,000 m	North
	Het Olensbroek en Langendonk	approx. 1,000 m	North
Beerse (BE)	Eksterheide	approx. 500 m	West
	Duivelskuil	approx. 750 m	Southwest
	Pomp-Poelberg	approx. 1,000 m	Northwest
Berango (ES)	Ría de Mundaka-Cabo de Ogoño Marine Area	approx. 3,500 m	North
	Ría del Barbadun	approx. 10,000 m	Southwest

\* The nature conservation area Sredna Gora is home to the Dushantsi Reservoir, which was created at the same time the copper smelter was constructed in the 1950s to supply industrial water to the Pirdop plant and is operated by Aurubis.

## A comparison – Life cycle assessment for Aurubis copper cathodes

To evaluate our environmental protection performance, we carried out a life cycle assessment (LCA) for our main product, the copper cathode. When observing the entire life cycle up to the finished cathode, Aurubis production has lower impacts than the global average in all of the environmental categories investigated.<sup>1</sup> Aurubis thus makes a real contribution in light of the monumental challenge of climate protection right now: across the Group,<sup>2</sup> the CO<sub>2</sub> emissions related to our copper cathodes are more than 40 % lower than the global average. In the calculation, we included production from both primary and secondary raw materials combined – taken alone, the recycling portion would result in much lower figures.

A key reason for the better performance lies in the modern plant technologies at Aurubis, which enable particularly environmentally sound production. Moreover, the high input of recycling materials and the nearly complete conversion of raw materials into marketable products at Aurubis also help make environmental impacts lower than the global average.

The following diagrams show the industry's average results of the life cycle impacts for copper cathode production (ICA,<sup>3</sup> left bar) and the Aurubis average (right bar).

The system boundary of the ICA study comprised a cradle-to-gate life cycle inventory from the recovery of copper ore in the mine to the production of the primary and secondary copper cathode. The ICA study was carried out in compliance with the ISO 14040 (Environmental management - Life cycle assessment - Principles and framework) and ISO 14044 (Environmental management - Life cycle assessment - Requirements and guidelines) eco-balance standards and was then subjected to a critical review by a committee of experts.

The data collected included representative annual data for the year 2013 for all technological routes in the copper production process. The background data was representative for the years 2010 to 2013. The ICA is currently working on an update and Aurubis is once again providing active support. Copper is produced in a

pyrometallurgical method at the Aurubis sites in Hamburg, Pirdop, Lünen, Olen, and the new sites Beerse and Berango that were added through the Metallo acquisition. In the update of the life cycle analysis, the Beerse and Berango sites are now being included for the first time.

Estimates of potential environmental impacts are separated into five main impact categories and energy demand. These impact categories were selected because they represent a broad spectrum of environmental impacts and are each determined by an established scientific approach. For characterization purposes, the LCIA<sup>4</sup> method from the Institute of Environmental Sciences (CML) at the University of Leiden in the Netherlands was used due to its wide acceptance in the global LCA community.



<sup>1</sup> Source: ICA – International Copper Association: Copper Environmental Profile, Sept. 2017

<sup>2</sup> Excluding the newly acquired Metallo sites.

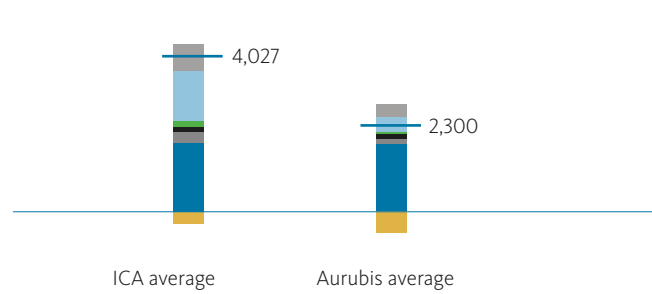
<sup>3</sup> International Copper Association

<sup>4</sup> Life Cycle Impact Assessment

Fig. 1.12: Life cycle assessment for the copper cathode

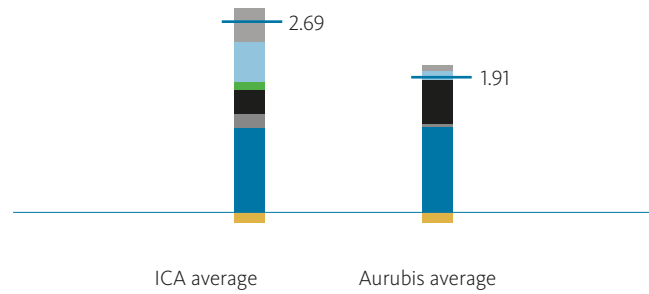
**Global warming potential (GWP)**

kg CO<sub>2</sub> eq.



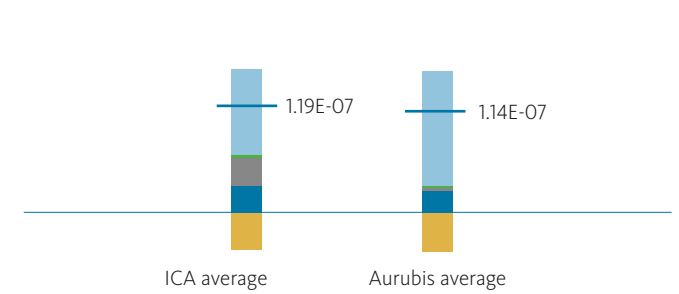
**Eutrophication potential (EP)**

kg phosphate eq.



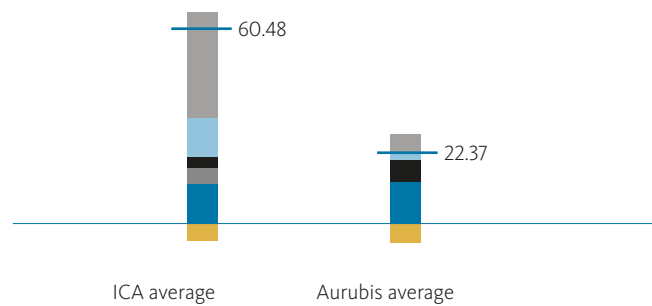
**Ozone layer depletion potential (ODP)**

kg R11-e



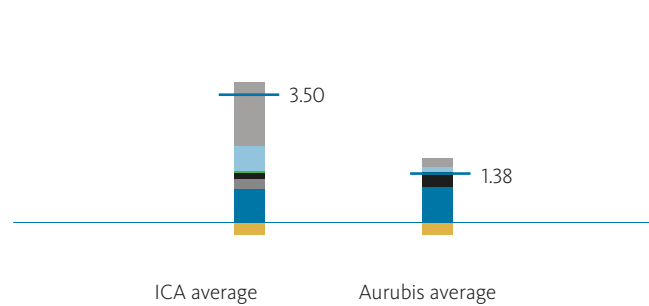
**Acidification potential (AP)**

kg SO<sub>2</sub> eq.



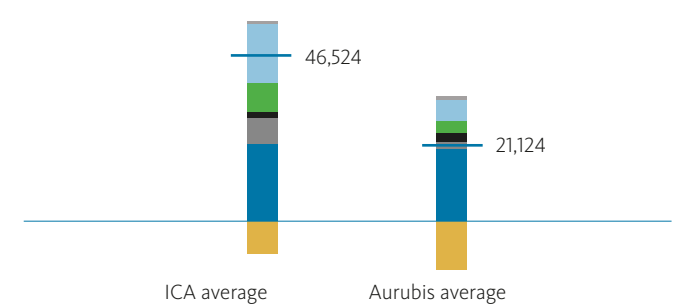
**Photochemical ozone creation potential (POCP)**

kg ethene eq.



**Primary energy demand (non-renewable sources)**

MJ



- Direct emissions
- Upstream energy
- Auxiliary materials
- Credit
- Electricity
- Transport
- Concentrate
- Total

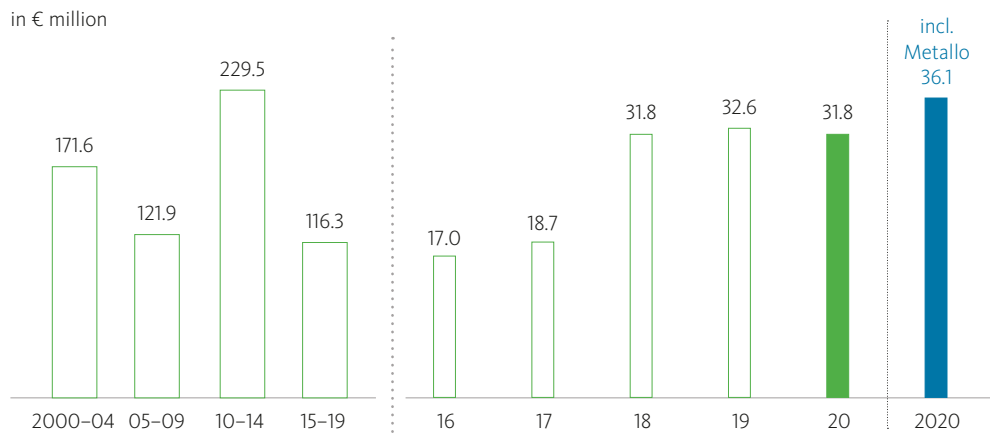
Each figure in relation to the production of one ton of cathode copper.  
Source: ICA – International Copper Association: Copper Environmental Profile, Sept. 2017

## 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 the guidelines of the Global Reporting Initiative (GRI) and EMAS.<sup>1</sup>

» We have invested more than € 670 million since 2000 and about € 270 million since 2012 in measures to improve environmental protection throughout the Group.

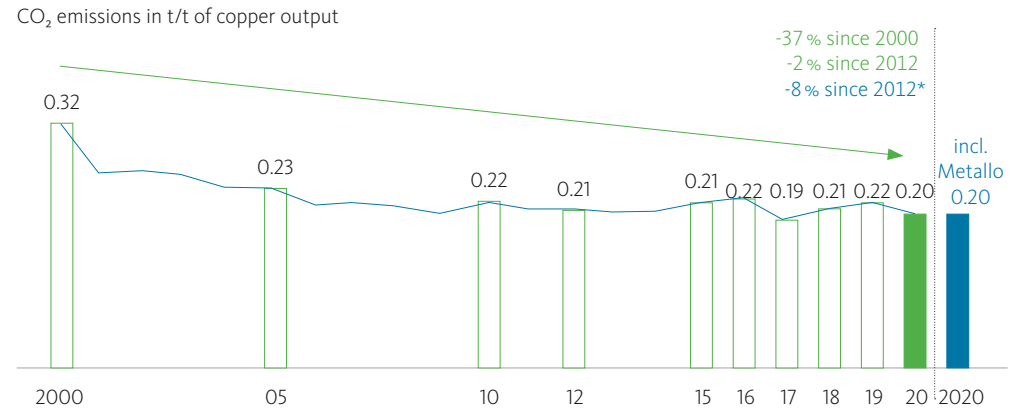
**Fig. 1.13: Capital expenditure for environmental protection in the Aurubis Group\***



\* Environmental investments of all production sites that are majority-owned by Aurubis (>50 %); data collected from some of the smaller sites starting in 2013. The data relates to environmental investments per fiscal year. Single years are provided for readability, for example 2020 for fiscal year 2019/20.

<sup>1</sup> This report may include slight deviations in the totals due to rounding. Some of the data is preliminary since it hadn't been validated externally as of the editorial deadline.

**Fig. 1.14: CO<sub>2</sub> emissions from fuels in Aurubis Group copper production**

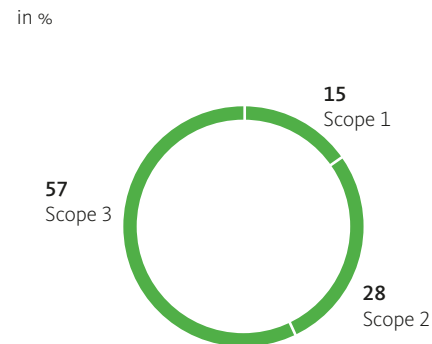


\* Reduction when including Metallo

At 0.20 t of CO<sub>2</sub> per ton of copper output, emissions from fuels were at a low level in 2020. Product-related emissions have been reduced by 37% since 2000.

Compared to the reference year 2012, CO<sub>2</sub> emissions from fuels per ton of copper were reduced by 2% [see Fig. 1.14.](#)

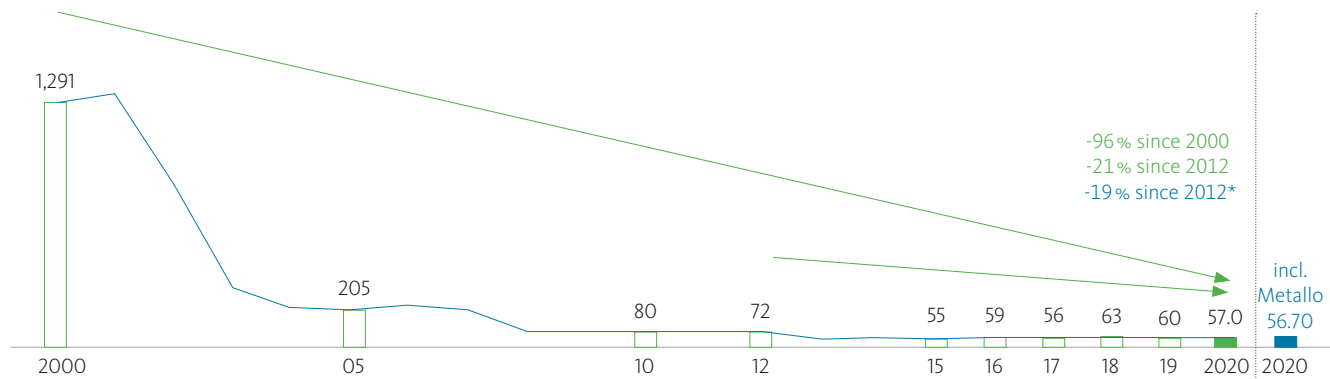
**Fig. 1.15: Aurubis Group CO<sub>2</sub> emissions – estimated**



Aurubis reports the emissions produced as a direct result of burning fuels in its own facilities (Scope 1) and emissions related to purchased energy, for example electricity (Scope 2). Furthermore, an estimate of the emissions caused by the services provided by third parties, such as transport, and purchased preliminary services is created with partially aggregated data (Scope 3).

**Fig. 1.16: Successful reduction of dust emissions in Aurubis Group copper production**

Dust emissions in g/t of copper output



\* Reduction when including Metallo

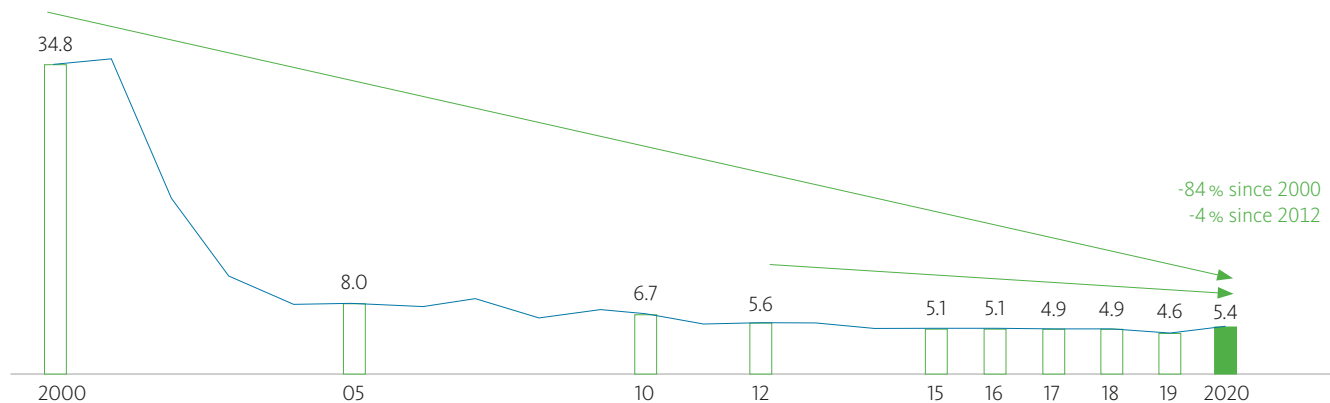
The dust emissions arising during copper production can contain metals and metal compounds. The consistent use of the best available plant techniques has led to a 96% decline in dust emissions in copper production per ton of copper since 2000.

Compared to the reference year 2012, dust emissions per ton of copper were reduced by 21%, or by 19% when including Metallo [see Fig. 1.16](#).

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 around 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. 1.17: Sulfur dioxide emissions in Aurubis Group primary copper production**

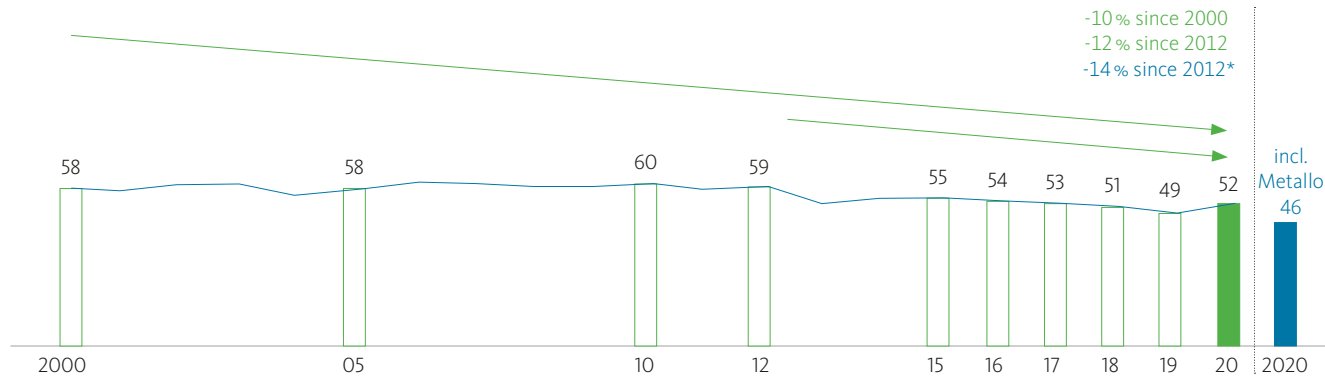
SO<sub>2</sub> emissions in kg/t of copper output



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 84% since 2000 [see Fig. 1.17](#).

**Fig. 1.18: Water withdrawal in Aurubis Group copper production**

Water withdrawal in m<sup>3</sup>/t of copper output



\* Reduction when including Metallo

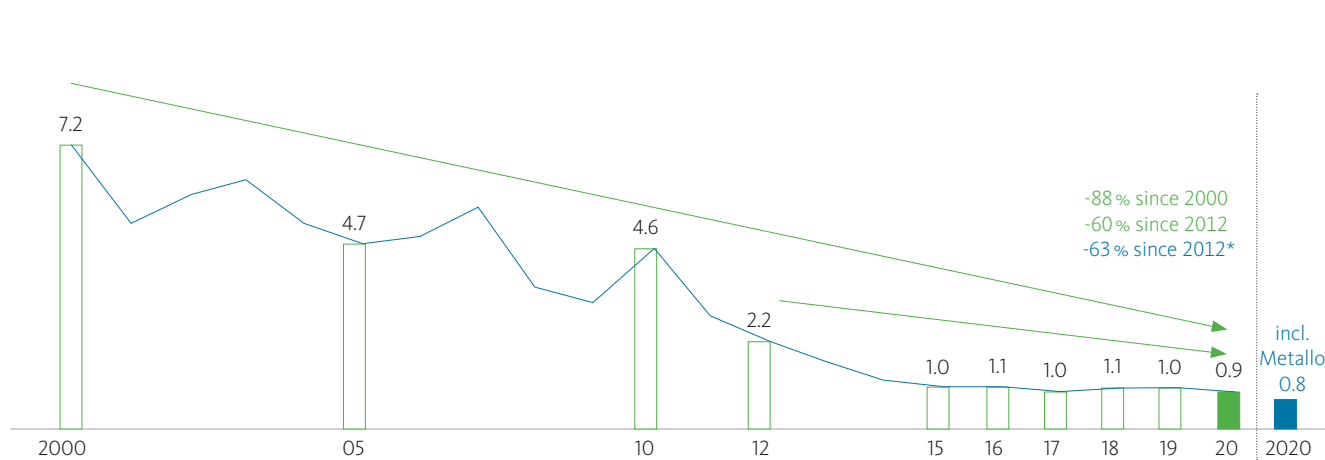
We use water for production processes and cooling purposes. Conserving water resources is one of our environmental protection targets in the Group. Wherever possible, Aurubis uses river water and rainwater to save potable water resources. We have reduced water withdrawal in copper production by a total of 10% per ton of copper output since 2000 thanks to more efficient facilities.

Compared to the reference year 2012, water withdrawal per ton of copper was reduced by 12 %, or by 14 % when including Metallo in 2020 [see Fig. 1.18](#).

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 0.9 g per t of copper output since 2000. This is a decline of 88%.

**Fig. 1.19: Metal emissions to water in Aurubis Group copper production**

Metal emissions to water in g/t of copper output



\* Reduction when including Metallo

Compared to the reference year 2012, metal emissions to water per ton of copper were reduced by 60 %, or by 63 % when including Metallo [see Fig. 1.19](#).

## At a glance – Environmental KPIs for the Aurubis Group<sup>1</sup>

	Unit	2016	2017	2018	2019	2020	2020 incl. Metallo
<b>Emissions to air</b>							
Dust	t	93	101	110	99	90	100
NO <sub>x</sub>	t	870	809	846	769	785	877
SO <sub>2</sub>	t	4,648	5,145	4,859	4,154	5,263	5,264
<b>Water consumption</b>							
<b>Total water withdrawal</b>	<b>million m<sup>3</sup></b>	<b>77.7</b>	<b>82.6</b>	<b>80.5</b>	<b>71.0</b>	<b>77.6</b>	<b>78.3</b>
<b>Water withdrawal by source</b>							
Surface water	million m <sup>3</sup>	74.1	79.0	76.6	67.7	74.3	74.6
Rainwater	million m <sup>3</sup>	0.4	0.4	0.4	0.3	0.4	0.6
Groundwater	million m <sup>3</sup>	0.6	0.5	0.6	0.5	0.5	0.6
Municipal water	million m <sup>3</sup>	2.3	2.1	2.6	2.1	2.2	2.2
Other	million m <sup>3</sup>	0.4	0.5	0.3	0.3	0.3	0.3
<b>Total water discharge</b>	<b>million m<sup>3</sup></b>	<b>72.9</b>	<b>77.1</b>	<b>77.0</b>	<b>66.1</b>	<b>71.7</b>	<b>71.9</b>
<b>Water discharge by destination</b>							
Surface water	million m <sup>3</sup>	71.5	75.8	75.6	64.7	70.3	70.5
Municipal wastewater system	million m <sup>3</sup>	1.4	1.3	1.4	1.3	1.3	1.3
Wastewater to third parties	million m <sup>3</sup>	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

<sup>1</sup> These KPIs include all production sites that are majority-owned by Aurubis (>50 %); excluding Metallo until 2020.



	Unit	2016	2017	2018	2019	2020	2020 incl. Metallo
<b>Waste<sup>1</sup></b>							
<b>Hazardous waste</b>	<b>t</b>	<b>41,423</b>	<b>51,799</b>	<b>46,886</b>	<b>48,659</b>	<b>48,575</b>	<b>51,350</b>
Landfilling	t	27,430	34,417	34,032	36,429	36,079	36,512
Disposal (thermal)	t	197	139	81	123 <sup>4</sup>	300	370
Thermal utilization	t	365 <sup>4</sup>	452 <sup>4</sup>	447 <sup>4</sup>	391	441	441
Recycling	t	9,220	13,063	10,457	8,731 <sup>4</sup>	9,722	11,980
Storage	t	3,722	1,264	1,846	1,682	1,899	1,899
Internal utilization/recycling	t	487	2,464	24	1,303	134	149
<b>Non-hazardous waste</b>	<b>t</b>	<b>44,494</b>	<b>45,350</b>	<b>43,255</b>	<b>46,992</b>	<b>66,546</b>	<b>79,497</b>
Landfilling	t	1,991	1,899	2,134	1,739	16,505	17,537
Disposal (thermal)	t	197	139	717 <sup>4</sup>	682	624	624
Thermal utilization	t	499	446	472	590	435	435
Recycling	t	33,916	35,768	32,947	38,354 <sup>4</sup>	44,478	56,398
Storage	t	1,265	184	128	89	133	133
Internal utilization/recycling	t	6,626	6,914	6,857	5,537	4,371	4,371
<b>Construction waste</b>	<b>t</b>	<b>51,029</b>	<b>38,826</b>	<b>46,558</b>	<b>122,503<sup>4</sup></b>	<b>17,436</b>	<b>17,828</b>
<b>Energy and CO<sub>2</sub></b>							
Primary energy consumption <sup>1</sup>	million MWh	1.72	1.66	1.75	1.69	1.55	1.72
Secondary energy consumption <sup>2</sup>	million MWh	1.73	1.88	1.89 <sup>4</sup>	1.78	1.82	1.98
<b>Total energy consumption</b>	<b>million MWh</b>	<b>3.45</b>	<b>3.54</b>	<b>3.64<sup>4</sup></b>	<b>3.47</b>	<b>3.38</b>	<b>3.70</b>
Direct CO <sub>2</sub> emissions <sup>3</sup>	kt CO <sub>2</sub>	508	517	522	503	482	540

<sup>1</sup> Including energy consumption for on-site vehicle traffic.

<sup>2</sup> Including electricity for oxygen generation.

<sup>3</sup> Excluding CO<sub>2</sub> emissions from vehicles in line with the emission trading system.

<sup>4</sup> KPI was corrected after the fact.

Updated Aurubis AG Environmental Statement 2021

# HAMBURG SITE



## THE HAMBURG PLANT

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. At the Hamburg plant, Aurubis operates facilities to produce copper and other non-ferrous metals as well as to process copper.

The plant was constructed in 1908 on an area of about 870,000 m<sup>2</sup> 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 about 2,500 personnel are employed at the Hamburg site, including around 180 apprentices (as of May 2021).

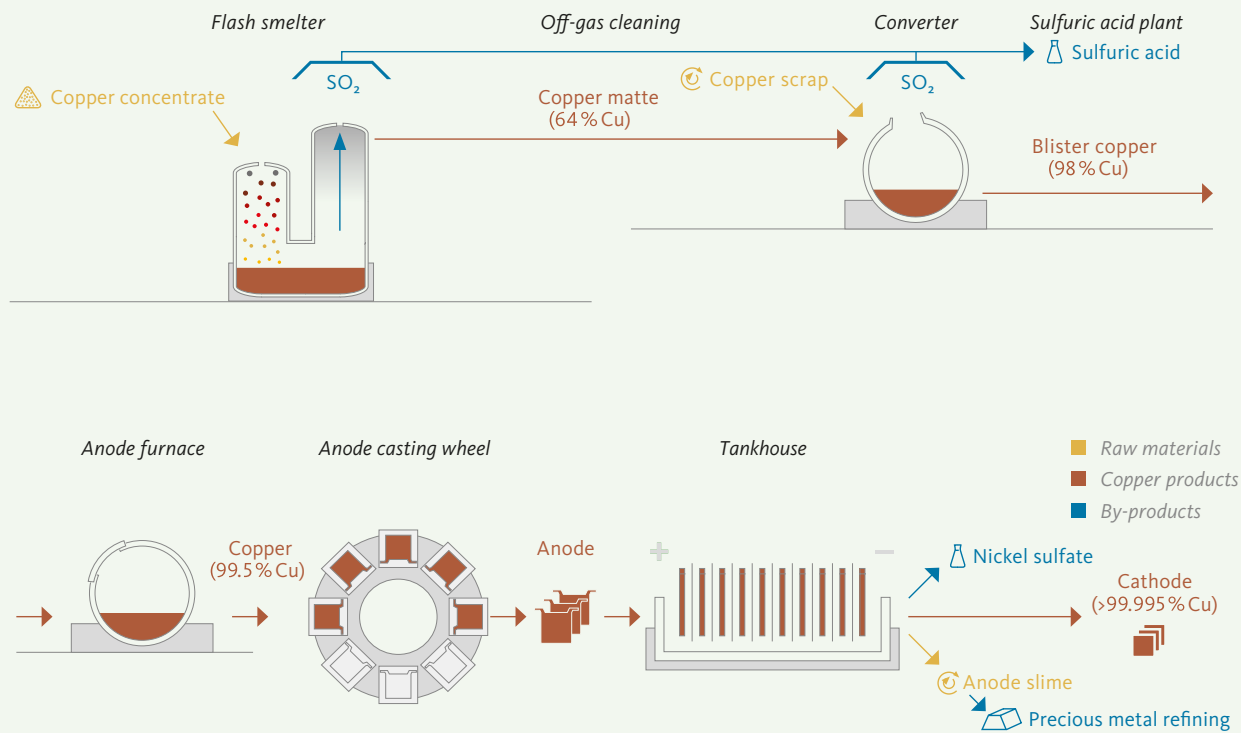
The individual production sectors at Aurubis AG in Hamburg are divided into three plant areas – see Fig. 2.1: Plant North (RWN) is mainly comprised of the administrative building, the workshops, the secondary copper smelter, and precious metal production. Plant South includes the sludge decomposition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

Fig. 2.1: The 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) 6 Administrative building

Fig. 2.2: From copper concentrate to cathode



## PROCESSES AT THE HAMBURG PLANT

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) [see Fig. 2.2](#). The cathodes can be traded on the global metal exchanges.

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

Minor metals such as zinc, nickel, antimony, selenium, and tellurium are collected and enriched in a targeted way in the matrix metals copper and lead. In the subsequent pyro- and hydrometallurgical processes of multimetal recovery, these elements are brought out in metallic form or as metal compounds.

Internal intermediates and purchased recycling materials rich in precious metals are processed to extract these 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.

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 the secondary smelter (RWN), the primary smelter (RWO), sampling, and precious metal production. The total dust emissions at the Hamburg site will be significantly reduced again.

### ENVIRONMENTAL PROTECTION ORGANIZATION AT THE HAMBURG SITE

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

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

### THE INTEGRATED MANAGEMENT SYSTEM (IMS) FOR THE ENVIRONMENT, QUALITY, AND ENERGY

In 2017, the three separate management systems for the environment, energy, and quality were combined into an integrated management system (IMS) and jointly certified.

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

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 ISO 50001 for the first time in May 2013. The switch to the revised 2018 standard took place in 2019, accompanied by internal workshops and coordinated dialogue about experiences within the Aurubis Group.

Quality management in accordance with 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, as was the precious metal smelter in 2018.

Occupational health and safety management was certified pursuant to ISO 45001 as an integral part of the IMS for the first time in 2021.

### TARGETS AND TASKS OF THE ENVIRONMENTAL MANAGEMENT SYSTEM

Within the scope of the environmental management system, targets and measures are defined and their implementation is monitored. The environmental management processes include the documentation of operational processes, external environmental inspections, internal audits, routine recordings, and site inspections. Situational evaluations form the basis for decisions about the type, extent, suitability, and execution of environmental protection measures.

The environmental management officer ensures that the requirements for the environmental management system conform to the ISO 14001 and EMAS standards. 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 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. To make sure that operations comply with the law, the Environmental Protection department in Hamburg regularly organizes internal training sessions for department heads and employees to explain current environmental law issues, such as pending amendments to laws and their consequences. Because of the high complexity of the legal standards and requirements that have to be applied, the existing legal register has been supplemented by a web-based EHS software.

The systems and organization of the IMS are described extensively and clearly in two handbooks available to employees. The general IMS handbook governs procedures that apply to the Aurubis AG sites, Hamburg and Lünen. The integrated management system handbook for the Hamburg plant describes the site-specific procedures. The environmental management system EMAS also helps in the implementation of the Aurubis Group sustainability targets, which were newly defined in 2018, at the Hamburg site [see \*\*www.aurubis.com/sustainabilitystrategy\*\*](https://www.aurubis.com/sustainabilitystrategy).

### MONITORING AND INTERNAL AUDITING OF ENVIRONMENTAL MANAGEMENT

The effectiveness of the integrated management system is reviewed with internal audits pursuant to EMAS regulations, ISO 9001, ISO 14001, ISO 45001, and ISO 50001. Internal and external audits take place regularly in compliance with the requirements of the standards.

Within the scope of internal audits, the fulfillment of legal obligations and collateral clauses from permits is reviewed and confirmed, among other things. Furthermore, the audits ensure that inspection and maintenance requirements are followed.

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

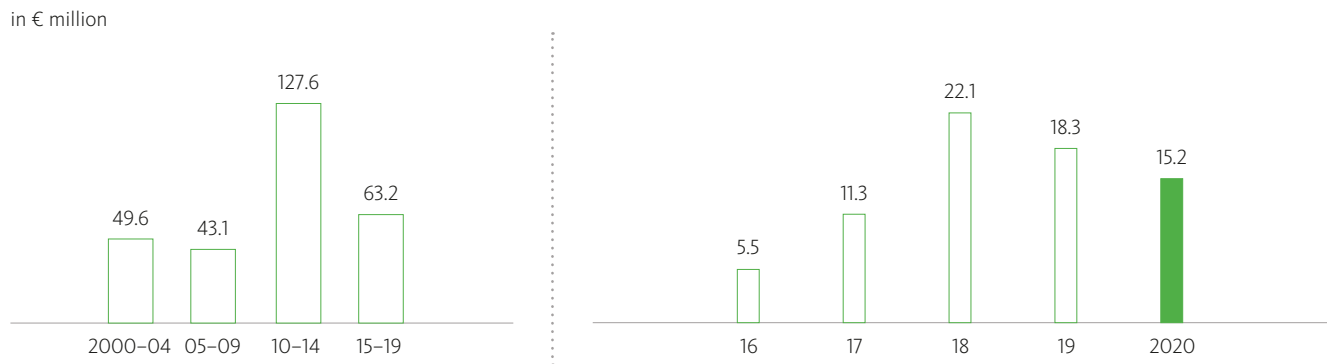
Following fundamental investments in filtering technologies in the 1980s and 1990s, nearly € 300 million has been invested in environmental protection in the Hamburg plant since 2000. With total capital expenditure of more than € 1 billion, environmental measures account for 27 % of overall capital expenditure on average. Among other things, dust emissions have been reduced by about 33 % with these investments. This makes a significant contribution to improving air pollution control in the environment. Investments are being made in the areas of water and noise as well [see Fig. 2.3](#).

When compared worldwide, Aurubis Hamburg holds a top position in environmental protection that extends beyond staying up to date with the state of the art. Additional improvements require higher and higher capital expenditure for the same level of

reduction and the development of modern technologies. The objective of plant management is to continue improving the plant's environmental performance and to expand its top position in environmental protection. Consequently, corresponding environmental protection projects were planned and initiated in 2020 as well.

In December 2020, we applied for the permit to modernize the return of internal intermediates to the production process in a way that conserves resources and the environment, in connection with other initial measures to reduce fugitive emissions as part of the RDE project (Reducing Diffuse Emissions). Moreover, the installation of the equipment for suctioning and cleaning fugitive emissions from the converter area started in primary copper production. The commissioning of this important project stage is scheduled for 2021.

**Fig. 2.3: Capital expenditure for environmental protection measures at the Hamburg site\***



\* The data relates to environmental investments per fiscal year. Single years are provided for readability, for example 2020 for fiscal year 2019/20.

## AIR – EMISSIONS

It is crucial for Aurubis to develop innovative technologies for air pollution control 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.

The Hamburg site emissions stayed at a low level in 2020. Additional investments in air pollution control were made in both primary and secondary copper production in 2020. Larger and larger investments are required in order to continue reducing the level that has already been achieved. The first part of a large-scale investment to continue reducing fugitive dust emissions in primary copper production is scheduled to start up in 2021.

In 2017, the 5S methodology<sup>1</sup> 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. In 2020, the implementation in all production and service areas was further intensified and expanded.

All of the information in this chapter is 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 mostly recorded as classified values from continuous measurements taken with a system provided by DURAG data systems GmbH. Fugitive emissions from hall ventilation facilities, etc. are determined on a representative basis in recording campaigns carried out by both external recording institutes and the company's own Environmental Monitoring department and are

<sup>1</sup> 5S is the designation for the five steps of this method: sort, set in order, shine, standardize, sustain.

Fig. 2.4: Dust emissions at the Hamburg site

Dust in g/t of copper output

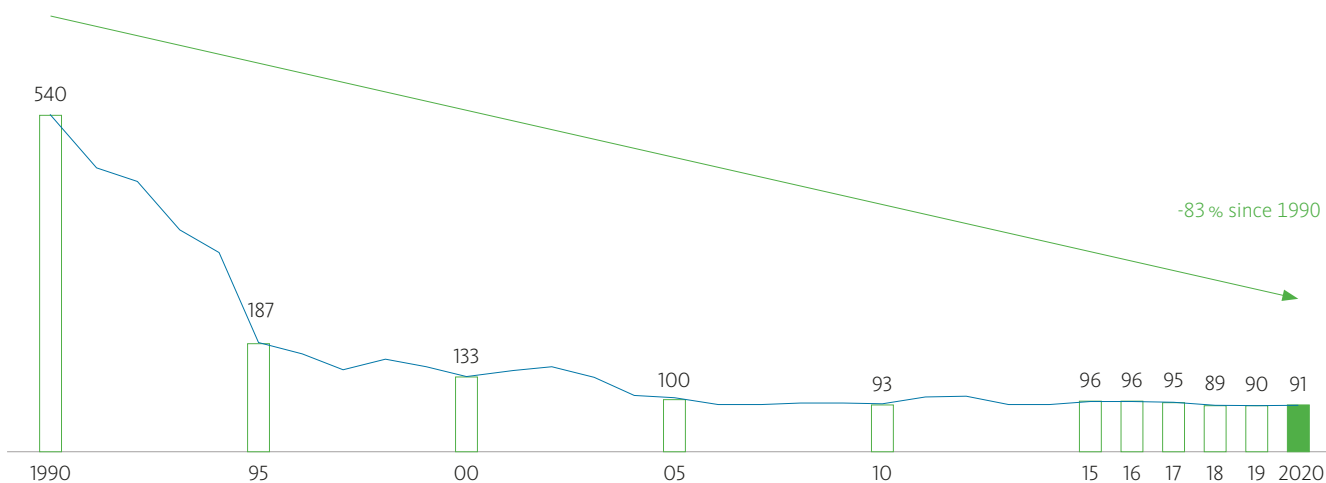
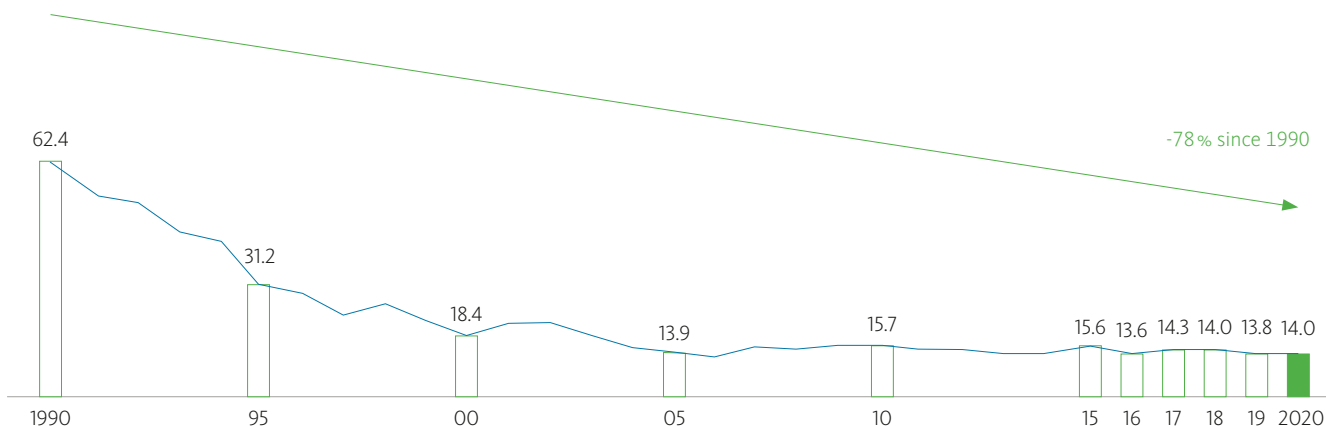


Fig. 2.5: Copper emissions at the Hamburg site

Copper in g/t of copper output



used to calculate the annual loads. Fugitive emissions due to transshipments in storage areas, etc. are calculated using the corresponding emission factors from the technical literature and from measurements.

Specific dust emissions have been reduced by 83 % since 1990 and by 32 % since 2000 [see Fig. 2.4](#).

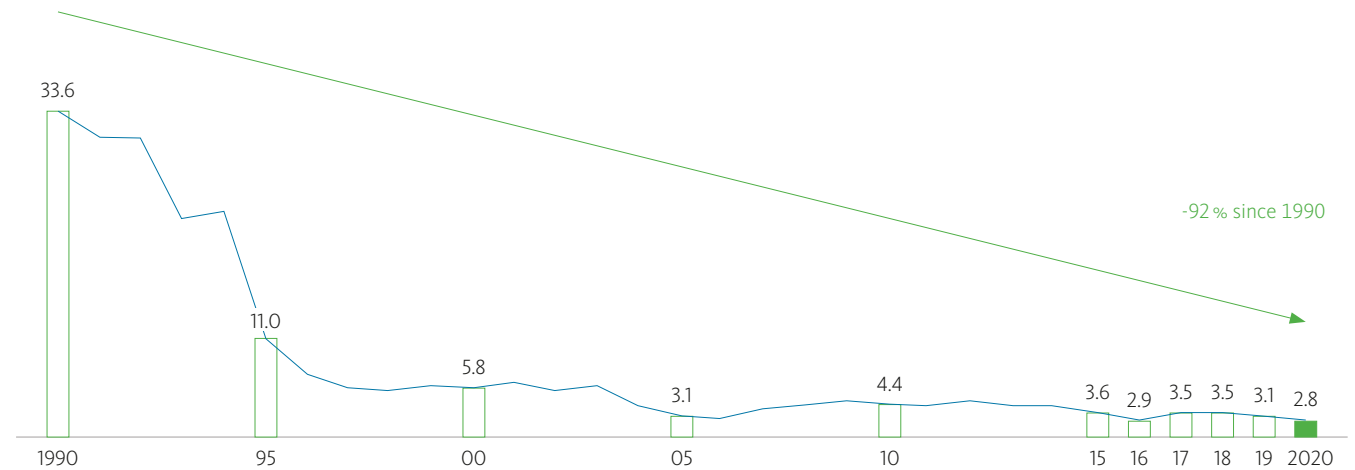
Copper is the main metallic substance in the dust at the Hamburg production site. Specific copper emissions have been reduced by 78 % since 1990 and by 24 % since 2000. This low level was maintained, as the changes compared to the previous year were in the expected range [see Fig. 2.5](#).

Specific lead emissions have been reduced by 92 % compared to 1990 and by 52 % since 2000. They therefore continue to be at a low level. The fluctuations observed are due to the use of various concentrates [see Fig. 2.6](#).

Arsenic is a natural component of copper concentrates. Specific arsenic emissions have been reduced by 91 % since 1990 and by 47 % since 2000 in various steps of the copper refining process and have been at a low level in the last several years [see Fig. 2.7](#).

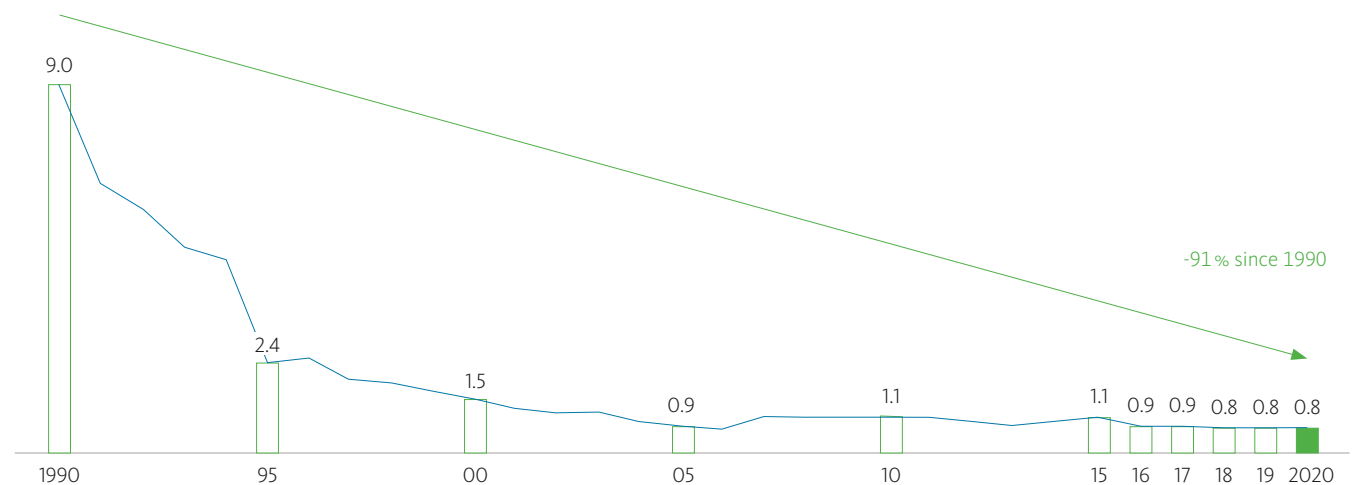
**Fig. 2.6: Lead emissions at the Hamburg site**

Lead in g/t of copper output



**Fig. 2.7: Arsenic emissions at the Hamburg site**

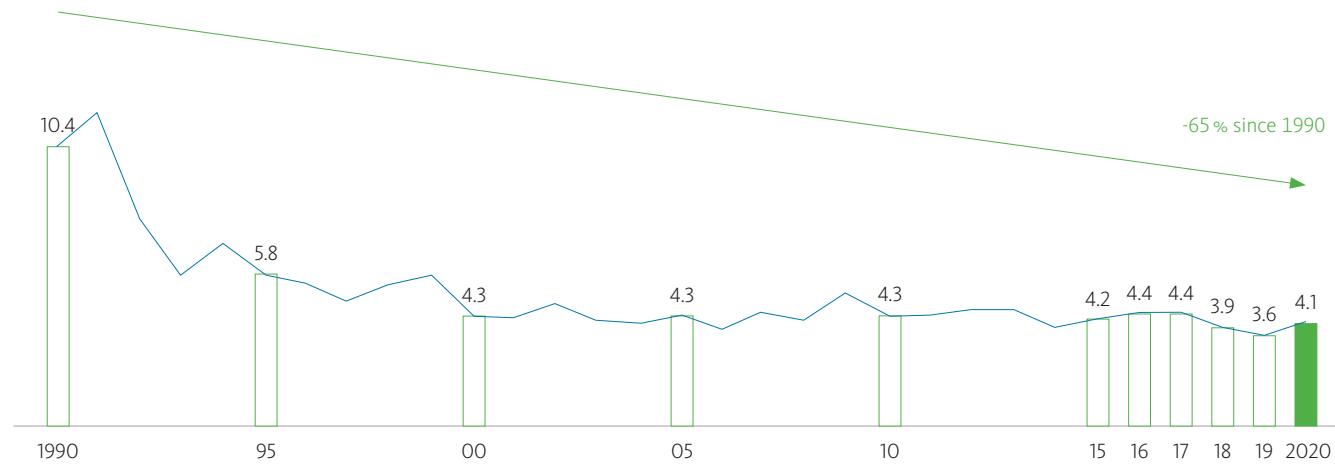
Arsenic in g/t of copper output





**Fig. 2.8: SO<sub>2</sub> emissions at the Hamburg site**

SO<sub>2</sub> in kg/t of copper output

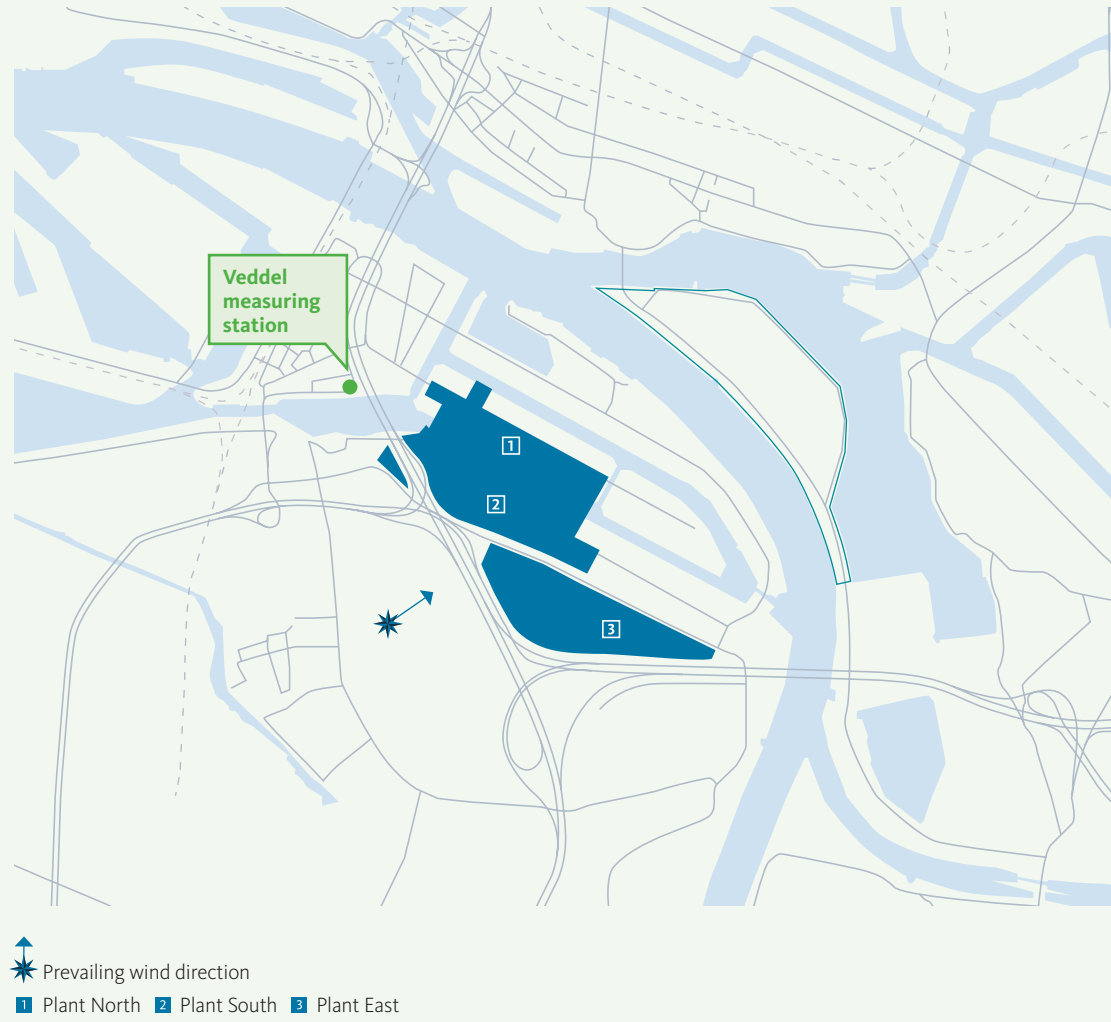


Sulfur is one of the main components of the copper concentrates. The gaseous sulfur dioxide produced when ore is smelted is converted into sulfuric acid in the sulfuric acid plant using the modern double catalysis process. The sulfuric acid is mainly used in the chemical industry. Specific sulfur dioxide emissions have been reduced by 65% since 1990 and by 17% since 2000 and are at a low level [see Fig. 2.8](#).

The Aurubis Hamburg site continues to be a forerunner in reducing specific sulfur dioxide emissions.

Aurubis adhered to and fell significantly below 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 in 2020. 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.

Fig. 2.9: Location of Veddel measuring station near the Aurubis plant in Hamburg



## AIR – IMMISSIONS

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 stayed 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.

Due to extensive investments in emission reduction, the immission situation has improved continuously since the 1990s. Limit values for air pollutants in the ambient air haven't been exceeded in the area surrounding Aurubis for many years.

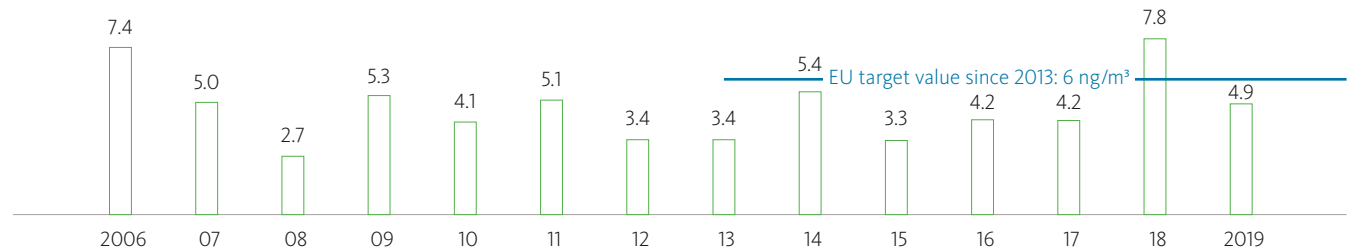
The value measured for arsenic at the Veddel measuring station was well below the target level (a yearly average of 6 ng/m<sup>3</sup>) in 2020.

To continue reducing the site's immissions into the surrounding area, a project to capture fugitive emissions from the primary smelter production hall on a demand-driven basis started implementation in 2020. Roof openings will also be closed, the air will be suctioned, and an adjustable amount of over 1,000,000 m<sup>3</sup>/h will be filtered in an innovative and highly efficient installation. The project has an investment volume of over € 100 million. The first stage will be commissioned in 2021. In addition to equipment to capture emissions on the current ridge turrets (openings in the roof that serve to conduct the heat released in the production process away from the hall), the existing suctioning equipment will be optimized and the flow conditions in the production hall will be improved through an adjusted air intake duct.

After the project concludes (2024), the fugitive emissions from the production hall area will be reduced by about 70 %.

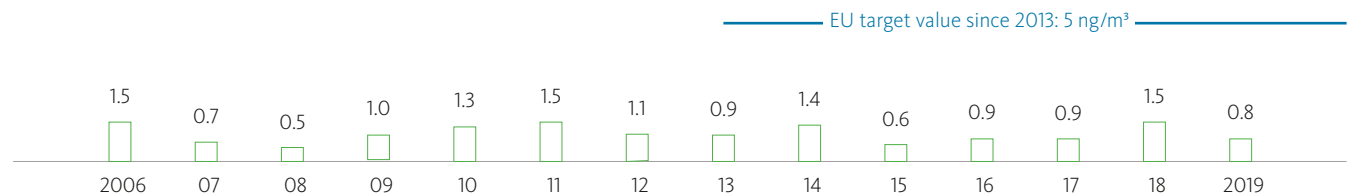
**Fig. 2.10: Low immission values (arsenic) at the Veddel measuring station<sup>1</sup>**

Arsenic immissions at Veddel measuring station in ng/m<sup>3</sup>



**Fig. 2.11: Low immission values (cadmium) at the Veddel measuring station<sup>1</sup>**

Cadmium immissions at Veddel measuring station in ng/m<sup>3</sup>



<sup>1</sup> Data published by the State Ministry for the Environment, Climate, Energy, and Agriculture. Official results for 2020 aren't available yet.  
1 gram (g) = 1 billion nanograms (ng)

## 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 separately and cleaned in two separate processing facilities. Precipitation is reused in some cases, for instance as cooling water. Sanitary wastewater is discharged into the city sewer system.

### DIRECT DISCHARGE

In the plant's internal wastewater treatment facility, process wastewater and precipitation are cleaned using state-of-the-art technology. The Hamburg plant has water law permits for direct discharge into the Elbe River and observes their requirements. Compliance with these requirements is closely monitored both as part of the internal company audits and through the audits performed by the governmental authorities.

At 1.4 g/t of copper output, the metal loads connected to direct discharge, which are related to production volumes, were once again at a low level in 2020 that fell slightly below the 2019 figure. Since 2000, this KPI has decreased by nearly 30 % due to investments and process improvements and, in the meantime, is close to the technically feasible minimum. In the last several years, there has thus been only a marginal downward trend despite further optimization measures. Minimizing the wastewater volume and load is a criterion for implementing projects. Improvements in wastewater management to limit the load and volume were tested and implemented in 2020 again.

The figure has been below the stricter requirements of the BAT (best available techniques) conclusions for many years already. In 2020, the new, stricter emission limits were adopted in the German wastewater regulations.

The proportion of heavy metals discharged by Aurubis in the Elbe's total load is currently less than 0.1%.

### INDIRECT DISCHARGE AND POTABLE WATER

In 2020, the declining long-term trend for the discharged wastewater load continued for indirect discharge in the city sewer system. Compared to the year 2000, the wastewater volume entering the city sewer system decreased by over 20 %, while the metal loads even fell by about 70 %.

Accounting for 85 %, most of the wastewater is used in production and for measures to reduce dust (sprinklers, misters, cleaning streets and open areas with a sweeper). A total of 15 % is used in kitchens and sanitary installations and is discharged indirectly after use.

The consumption of potable water has declined by over 40 % since 2000. Potable water mostly hasn't been used to produce steam since 2002. Recirculated condensate and, mainly as a supplement, available canal water are used to conserve resources. In 2020, potable water accounted for only 6 % of the boiler feed water produced (304,517 m<sup>3</sup>). The goal is to limit potable water use to maintenance of the treatment plant.

In 2020, a key measure to save water by replacing potable water with process water from cooling water production to clean open areas and streets was successfully tested and commissioned. This will save about 12,000 m<sup>3</sup> of potable water each year.

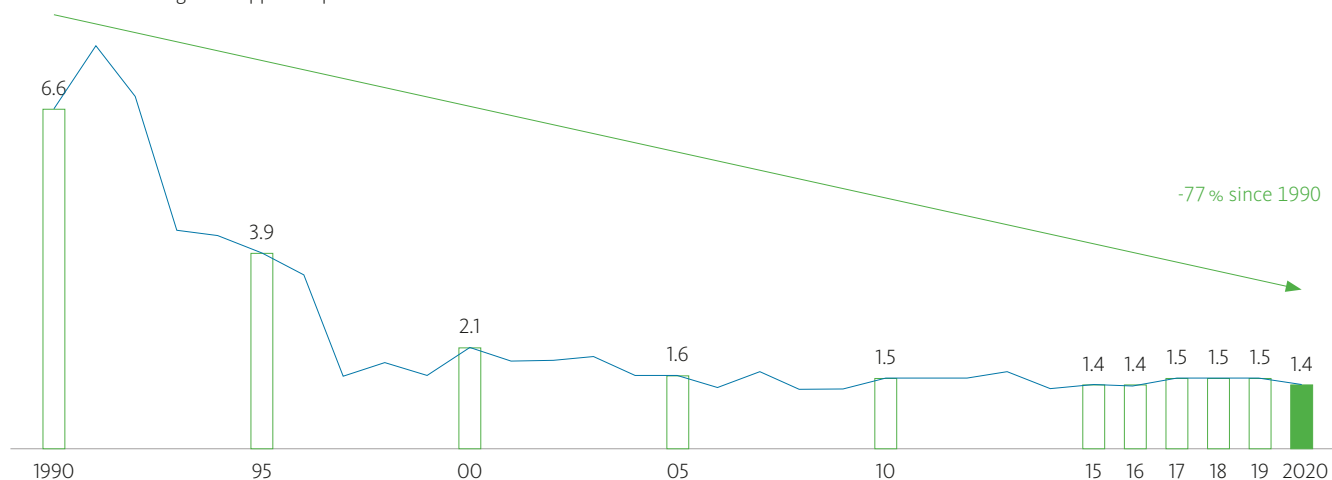
### COOLING WATER

In 2020, the CO<sub>2</sub>-free industrial heat generated in line 1 of the contact acid plant was released into the district heating network on a demand-driven basis without any disruptions. In cases where not all of the heat was taken up, the contact acid plant was cooled with air coolers without using cooling water.

In 2020, a three-year monitoring of bodies of water resulted in practical proof that the warming of these bodies of water was clearly below the limits outlined in the quality requirements of the Water Framework Directive. An extrapolation of the measurement data to a theoretical maximum capacity has now verified the

**Fig. 2.12: Metal emissions in water at the Hamburg site since 1990**

Metal emissions in g/t of copper output



compatibility of a full load with bodies of water. This had already been established by experts and has now been proven in practice as well.

As in the previous year, over 60 % of the precipitation was used as cooling water prior to discharge.

### FACILITIES HANDLING SUBSTANCES HAZARDOUS TO WATER

At the Hamburg plant, Aurubis operates about 300 installations to handle substances hazardous to water that fall under the scope of the Ordinance on Equipment Handling Substances Hazardous to Water. During the technical audits carried out in 2020, the TÜV once again didn't find any safety-relevant deficiencies whatsoever.

The Aurubis plant in Hamburg is a TÜV-certified specialist company in accordance with the German Water Management Act. Another recertification is planned for 2021.

### SOIL AND GROUNDWATER

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. This protective measure is regularly inspected through advisory backwater monitoring to ensure that it is working properly.

To prevent negative changes in the soil and groundwater, Aurubis

operates systematic soil and groundwater monitoring, which is also a component of the applicable report on the initial state that was issued on May 4, 2018 for the entire plant premises.

Soil management in connection with treatment capacities on site limit the volume of soil that accumulates during construction measures, for example, and therefore conserves landfill capacities.

### 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. Aurubis is planning to update the noise register in the scope of an upcoming project.

There was a complaint regarding noise at a distance of 3.5 km in 2020. Sound level measurements taken by Aurubis and the relevant governmental authority didn't identify any unauthorized noise sources at Aurubis.

### BIODIVERSITY

As an industrial site, Aurubis would like to promote urban biodiversity. We want to leave unpaved areas close to their natural state whenever this is feasible, carrying out the minimum amount of maintenance required. We don't use any chemical pesticides on plants. By participating in the project UnternehmensNatur supported by NABU, the Hamburg environmental authority, and the Hamburg Chamber of Commerce, we utilize an idea network for useful contributions to promoting biodiversity.

We plan to maintain the number of trees we currently have for the long term. The plant has its own tree registry. Wherever possible, new plants and greenery are integrated into project planning.

We prioritize native plant species when we plant new greenery. Because of the limited amount of space available, we will grow upwards in the future. We want to spruce up suitable building facades with vertical gardens, improving their appearance and also creating new habitats for birds and insects. In 2019, native plants were planted on the outer facade of the lead refinery's production and office building as part of an initiative to provide greenery on vertical surfaces.

The Aurubis plant premises are one of 13 Hamburg territories for peregrine falcons. We still maintain the nesting aid at 50 m height. We were pleased about another successful brood in 2020 again.

### WASTE

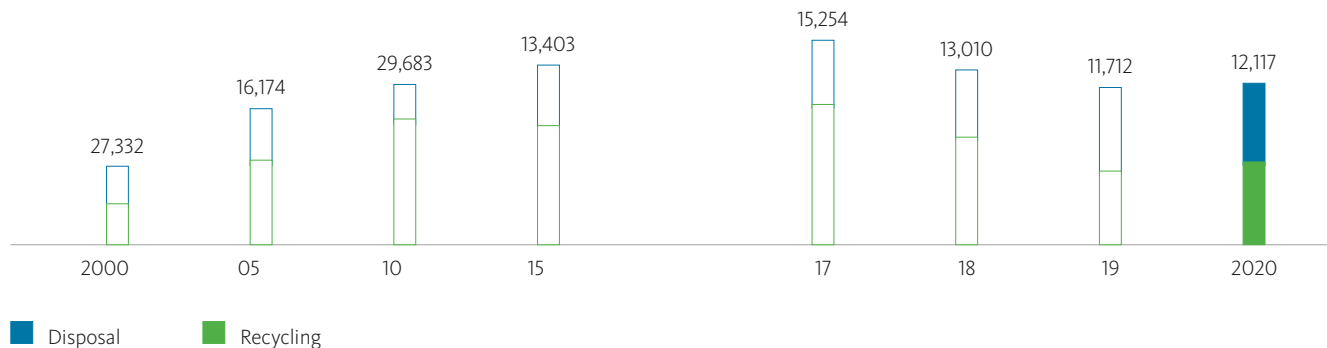
A total of 131,662 t of waste was accepted and recycled at the Hamburg site in 2020, of which 5,938 t were classified as hazardous waste. A total of 3,333 t of this came from other countries and was registered.

Overall, 10.9% of the waste accepted was used as a slag former (e.g., spent abrasives, sand, and excavation residues), and 89.1% was used for metal recovery (dust, slimes, slags, and precious metal-bearing sweeps). At about 117,306 t, the use of metal-bearing secondary raw materials increased compared to the previous year.

In 2020, about 1.53 million t of input materials were processed at the Hamburg site. During processing, 12,117 t of production-related waste accumulated, which was disposed of in an environmentally sound manner [see Fig. 2.13](#). The conversion of raw materials into products thus remained at a high level. Of the entire volume, 6,085 t was directed to recycling and 6,032 t to external disposal. This corresponds to a recycling rate of approximately 50 %.

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

in t per year



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

With an output of 456,830 t of copper output for the year, the specific waste level is 26.52 kg per ton of product (2019: 26.56 kg/t).

A total of 45,070 t of olivine pyroxene rock from the secondary smelter (RWN) and 1,154 t of slag material from the primary smelter (RWO) couldn't be marketed as a product and were taken to landfills. In the process, large pieces were recycled for use as landfill construction material.

Due to various construction activities to modernize the site, 14,203 t of construction waste accumulated during the past year. The volume of construction waste declined by more than 85 % compared to the previous year.

## ENERGY AND 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 1,224 GWh of energy at the Hamburg site in 2020. With an annual copper output of 456,830 t, this amounts to specific energy consumption of approximately 2.68 MWh/t of copper output. This is slightly higher than in previous years. This includes the electricity used to produce the oxygen necessary for the processes.

Furthermore, landfill gas was used in the production processes instead of natural gas (2020: 1.8 GWh). Aurubis thus uses 100 % of the landfill gas collected in the former Georgswerder landfill.

Specific energy consumption has stagnated at the Hamburg site in the past several years despite the energy efficiency measures that have been implemented. An important reason for this is the higher

level of multimetal recycling in the meantime and the commissioning of new facilities, such as the ridge turret suction system in the secondary smelter.

Taking a longer-term view, specific energy consumption has been significantly reduced at the Hamburg production site in the last few decades, falling by 42% compared to 1990. It has even been possible to reduce fuel-related specific CO<sub>2</sub> output by 70 % since 1990. The reason for this is the strongly reduced use of particularly CO<sub>2</sub>-intensive fuels, especially coal.

With an output of 456,830 t of copper output in the calendar year, specific CO<sub>2</sub> emissions from fuel amounted to 0.25 t CO<sub>2</sub>/t of product in 2020 [see Fig. 2.14a and 2.14b](#). This corresponds to 115,999 t of CO<sub>2</sub>.

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.

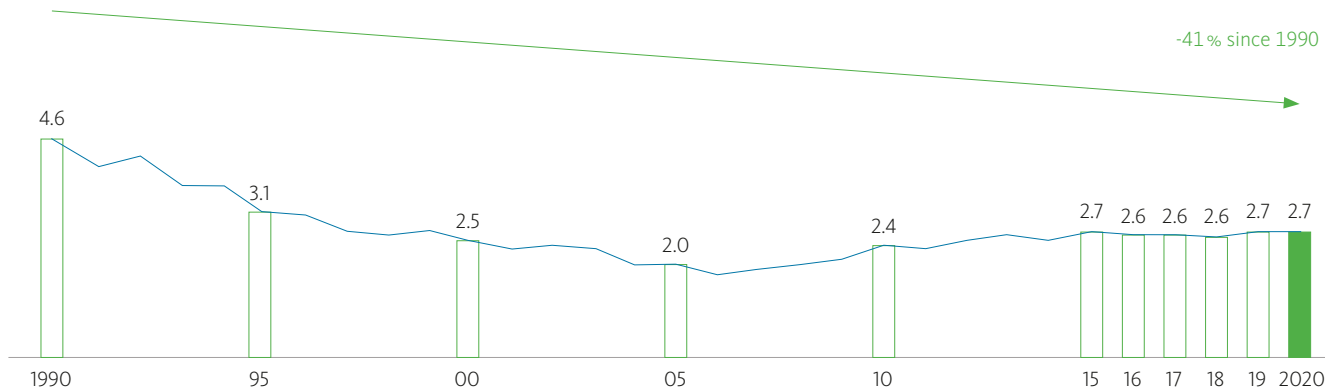
The calculation is based on CO<sub>2</sub> emission factors from the following sources:

- 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 in January 2020

To enable the use of renewable energies, we are arranging a more flexible electricity feed-in to be able to react to fluctuating availability. In 2019, the first power-to-steam installation at the Hamburg plant was commissioned. This is an electrode steam boiler that can be hooked up to the grid during phases in which there is a surplus of renewable energy. In parallel, the existing steam boilers powered by natural gas are ramped down accordingly. This allows for a heat output of 10 MW created by fossil fuels to be substituted by the use of renewable energy at the site. This reduces the load on the energy grid at the same time.

**Fig. 2.14a: Energy consumption at the Hamburg site**

in MWh/t of copper output

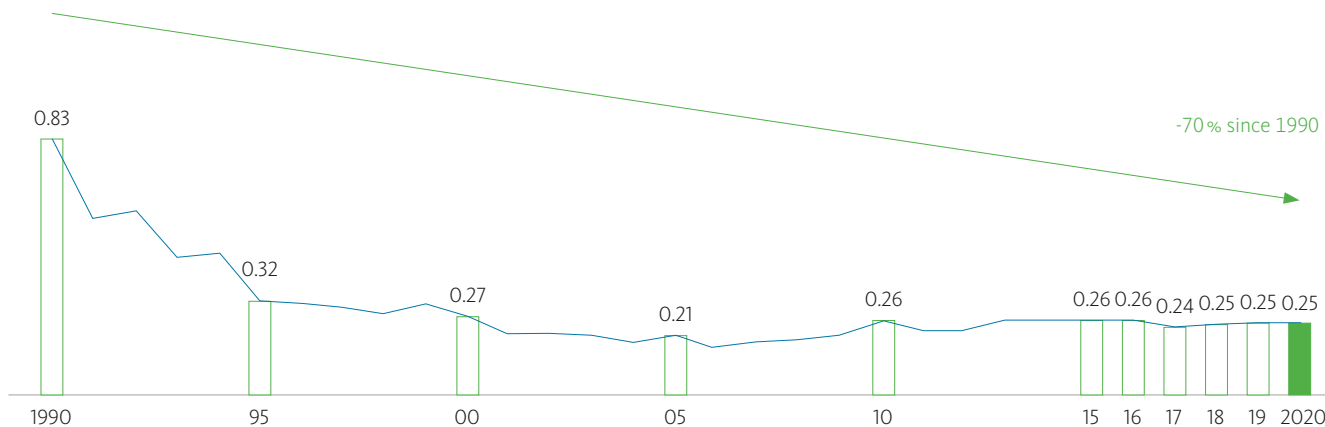


The extraction of CO<sub>2</sub>-neutral industrial waste heat from line 1 of the acid plant to heat the HafenCity East neighborhood, which was commissioned on October 29, 2018, was successfully continued in 2019. In the meantime, additional residents along the pipeline are planning to connect their heating systems to it. Furthermore, the pipeline was extended toward the district Rothenburgsort north of Aurubis to make the 20 MW of CO<sub>2</sub>-neutral heat available to other neighborhoods.

The planning of implementation steps 2 and 3 for the use of the remaining potential for extracting CO<sub>2</sub>-neutral industrial heat started in 2020. Negotiations with the city's district heating grid operator have started. After completion, an additional 35–40 MW of heat can be used in the entire city of Hamburg. When all three stages are in operation, a total of about 140,000 t of CO<sub>2</sub> will be saved annually. This project is another important contribution to achieving the climate protection targets set in Hamburg and Europe.

**Fig. 2.14b: CO<sub>2</sub> emissions from fuels at the Hamburg site**

in t CO<sub>2</sub>/t of copper output



New power-to-steam facility in the Hamburg plant

## 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 2020, 87% of the steam needed was produced from waste heat, so only about a quarter was produced from fossil fuels.

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

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 5.8 GWh of electricity was produced from waste heat in 2020, or approximately 1% of total electricity consumption (2019: 1%).

On October 29, 2018, the supply system for providing the district HafenCity East with industrial heat from Aurubis was commissioned in an inauguration ceremony. With the implementation of this joint project, which is unique in Germany and is supported by the climate alliance between Aurubis and the energy service provider enercity, up to about 160 million kWh of heat per year can be transferred to consumers via pipeline. This is equivalent to the heat demand of about 8,000 four-person households. A total of 40 million kWh of this is used in Aurubis' production facilities. Aurubis and enercity each invested about € 21 million.

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





The heat is CO<sub>2</sub>-free. It is formed without the use of fossil fuels and is released as heat of reaction in sulfuric acid production. This forward-looking use of waste heat can save up to 20,000 t of CO<sub>2</sub> annually. The Elbe River benefits as well: recovering the heat saves about 12 million m<sup>3</sup> of cooling water per year.

The pipeline has already been dimensioned to accommodate the entire waste heat potential of sulfuric acid production and additional potential sources of waste heat. We could thus provide up to 60 MW or 500 million kWh of industrially generated, climate-neutral district heat per year to supply the city. The CO<sub>2</sub> savings potential would then amount to 140,000 t per year.

The heat transition is an important 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-scale power plants and heat generation from coal, gas, and waste. The implementation of the project is therefore a central milestone on the path to more sustainability and better climate protection.

The German Energy Agency distinguished the joint project as a flagship project and gave it the Energy Efficiency Award 2018 in the category "Energy Transition 2.0." Furthermore, the project was distinguished with the German Renewables Award 2018 from the Renewable Energies Cluster, the ener.CON Europe Award 2019, and the Responsible Care Award 2019 from the VCI. The climate alliance was honored as a finalist for the EUSEW Awards by the European Commission and the Innovation Prize for Climate and the Environment by the German Federal Ministry for the Environment in 2019 and 2020, respectively.

Additional projects to use waste heat are being reviewed, such as the use of the heat from iron silicate stone and the process gases from secondary copper production.

### DIRECT CO<sub>2</sub> EMISSIONS – EMISSIONS TRADING SYSTEM (ETS)

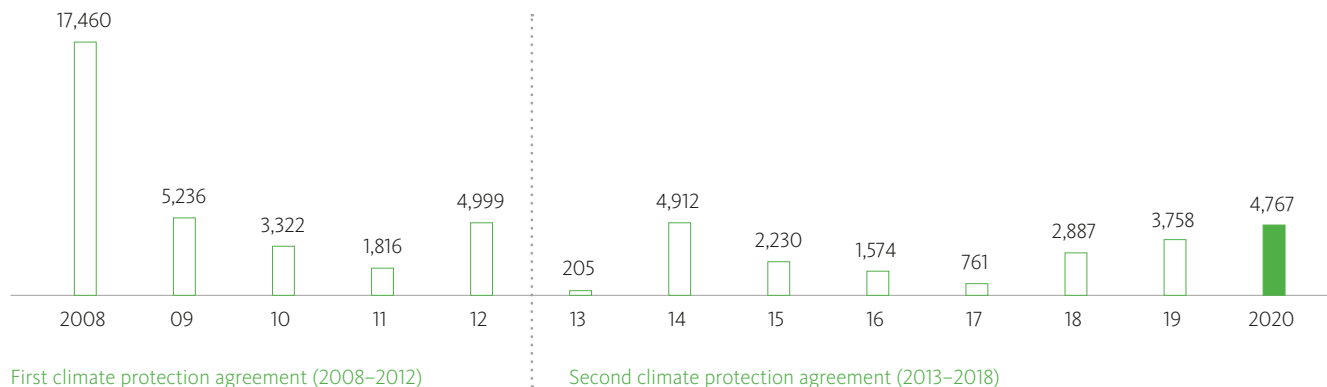
As an energy-intensive company, the Hamburg site has been required to participate in the European Emissions Trading System (ETS) since 2013. The direct CO<sub>2</sub> emissions, mainly from natural gas consumption, are verified by TÜV Nord and reported to the German Emissions Trading Authority (DEHSt).

Registered CO<sub>2</sub> emissions amounted to 164,051 t for 2020. More than 70% were caused by the fuels used, mainly natural gas, while the remainder was caused by the carbon contained in the raw materials, recycling materials, and additives.

The fourth trading period beginning in 2021 includes stricter requirements for verifying emission and operations data.

**Fig. 2.16: Annual CO<sub>2</sub> reduction at the Hamburg site in the context of the Hamburg Climate Protection Concept**

First and second climate protection agreement in t of CO<sub>2</sub>/year



## INDIRECT CO<sub>2</sub> EMISSIONS

Copper production is an energy-intensive process, so a reliable electricity supply is very important. Aurubis therefore has a long-term electricity supply contract. Electricity production leads to CO<sub>2</sub> emissions, which are indirect CO<sub>2</sub> emissions for Aurubis, and therefore indirect environmental effects. In 2020, these indirect CO<sub>2</sub> emissions totaled 299,365 t (pursuant to ETS reporting).

The electricity producer already reported these indirect CO<sub>2</sub> emissions to the trading authority. Any costs were passed on via the electricity price. Therefore, these indirect CO<sub>2</sub> emissions are not included in the amount reported by Aurubis to the trading authority.

## CLIMATE PROTECTION AGREEMENT WITH THE HAMBURG SENATE TO REDUCE CO<sub>2</sub>

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 the Climate Protection Concept and implemented a number of projects between 2007 and 2012 that cut CO<sub>2</sub> by 32,000 t each year [see Fig. 2.15](#).

With the agreement to reduce an additional 12,000 t of CO<sub>2</sub>, Aurubis participated in the follow-up agreement for the period from 2013 to 2018.

Aurubis achieved a roughly 12,569 t reduction in CO<sub>2</sub> by the end of 2018. The city isn't planning an additional follow-up agreement. Nevertheless, additional reduction potential has been identified and accompanying measures have been implemented, saving an additional 4,767 t of CO<sub>2</sub> until the end of 2020.

Aurubis continues to participate in the IVH Energy Efficiency Network of Hamburg industry. The network serves to create a best-practice dialogue, leading to a mutual innovation boost. The identified potential is coordinated with Hamburg's central climate office.

Thanks to industrial heat extraction from the contact acid plant to deliver district heating for the new HafenCity East neighborhood and for internal use, up to 20,000 t of additional CO<sub>2</sub> can be saved annually.

Overall, through waste heat use and efficiency improvements, the Hamburg site thus makes a significant contribution to the corporate goal of reducing 100,000 t of CO<sub>2</sub> annually by 2023 compared to 2012.

We demonstrate that this aligns with our targets with our affirmation of the Science-Based Targets initiative. We have committed to setting science-based CO<sub>2</sub> reduction targets for the Hamburg site based on the initiative, contributing to the 1.5 °C goal of the Paris Climate Agreement. With the implementation of correspondingly ambitious measures, we want the entire Aurubis Group to become carbon-neutral well before 2050. The first important step is to carry out initial investigations regarding the use of hydrogen in primary copper production until mid-2021.

## AUDITS AND INSPECTIONS BY GOVERNMENTAL AUTHORITIES

The production facilities at the Hamburg site are monitored by the relevant governmental 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 2020:

- » Lead refinery
- » Chemical plants
- » Precious metal production
- » Tankhouse, Plant East
- » Contact acid plant, Plant East, including Plant East washing and cooling plant
- » Primary smelter Plant North (RWN)
- » Primary smelter Plant East (RWO)
- » Selenium facility/SO<sub>2</sub> storage
- » Top-blown rotary converter south

All inspections verified proper operation in accordance with permits.

## MAJOR ACCIDENTS ORDINANCE

All inspections specifically related to the Major Accidents Ordinance were carried out without the identification of any defects. For three plant sections, expert opinions in addition to the partial safety reports confirmed that the safety equipment adhered to the state of the art.

## INDIRECT ENVIRONMENTAL ASPECTS

Indirect environmental impacts are not directly caused by our production processes on site and therefore can't be directly influenced by Aurubis. They arise first and foremost from the transport of material and from the mines supplying Aurubis with copper concentrates. Nevertheless, the supply chain for products and raw materials is very important to the Aurubis Group. In this context, we refer to our Sustainability Strategy and sustainability communication, which provides detailed information about our supply chain management.

## TRANSPORTING HAZARDOUS MATERIALS

An external hazardous goods officer was appointed for the Hamburg site.

In the 2019/20 fiscal year, about 1 million t of outgoing hazardous materials were registered at the Hamburg site of Aurubis AG. Of the total amount of hazardous materials, approximately 70 % are shipped by inland vessel, about 15% by truck, and about 15 % by train.

During the reporting period, there were no reportable incidents in the course of hazardous material transports. Monitoring and training were carried out again in 2020 in order to maintain this high safety standard.

## COMMITMENT TO THE ENVIRONMENT – PARTNERSHIP FOR AIR QUALITY AND LOW-EMISSION MOBILITY

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<sub>x</sub>, 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.

To promote the use of bikes and public transport, a city bike station was set up at the Hovestrasse plant entrance in 2019. The intention is to encourage bike use for employees in their daily commutes between home and work or between home and subway or train stations. The station connects the plant to Hamburg's city-wide bike-borrowing system.

Moreover, Aurubis rents 20 lockable bike spaces each at the closest train station, Veddel, and the new train/subway station Elbbrücken. This provides employees with free bike parking, an option that allows them to travel quickly and conveniently from public transport stations to work.

In order to promote e-mobility, efforts are still being made to set up charging stations at the employee parking lots on the streets Hovestrasse and Muggenburger Hauptdeich. E-mobility for internal plant traffic is also being emphasized.

Due to the voluntary environmental and climate protection measures it implemented in 2020 again, Aurubis Hamburg is still recognized as an active member of the Hamburg Environmental Partnership and is distinguished for its exemplary environmental performance.



## EMERGENCY MEASURES AND CRISIS MANAGEMENT

There are currently 64 so-called “hazardous incident companies” in Hamburg. A hazardous incident is any event in which a fire, explosion, or similar occurrence releases hazardous substances that put people and the environment at a serious risk. 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 site is therefore subject to particularly strict safety precautions to prevent serious operational disruptions. Furthermore, for the case that hazardous incidents occur despite the safety precautions, measures to limit impacts have to be available. The safety report outlines the technical and organizational safety precautions and is reviewed and updated whenever there are changes to any facilities, at the latest every five years.

There were no incidents or other serious disruptions in operations during the reporting period. The existing personnel resources were expanded in 2020 to prevent unauthorized individuals from entering.

The year 2020 was impacted by the COVID-19 pandemic. Preventing the spread had the highest priority. Plant-specific hygiene concepts, models with staggered shifts, and testing strategies helped maintain safe production operations. All reports on plant inspections released online by the governmental authorities in 2020 were free of any problems.

## Environmental Program

The targets set in the context of the Environmental Statement 2020 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 2021. The results are presented in the following Environmental Program.

Target	Planned measure	Degree of implementation/date
<b>Reducing emissions</b>		
Additional improvements to reduce fugitive emissions	Improving suctioning near the source Improving the process for internal cycles Suctioning of the ridge turrets in the primary smelter (RWO) to capture residual fugitive emissions	Suctioning of the relevant part 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, additional stages until 2024
	Constructing an additional closed storage hall in secondary copper production as part of FCM project implementation	Deferred, will be rescheduled
Efficiency improvement in reducing gas emissions	Optimizing wet gas cleaning in hydrometallurgical precious metal recovery to reduce NO <sub>x</sub> emissions	Implementation by mid-2022 planned (expanding the project scope by integrating measures to minimize wastewater)
	Optimizing the adsorbent injection control system to reduce SO <sub>2</sub> peaks in the off-gas of the RWO auxiliary hood filters	Completed
Improving raw material logistics and sampling, replacement for the former concentrate warehouse 1	Centralizing sampling activities Sampling concentrates and other raw materials	Deferred
<b>Climate protection</b>		
Participation in the Hamburg Senate's Climate Protection Concept	Implementing projects to cut 12,000 t of CO <sub>2</sub> from 2013 to 2018	Through individual measures, a reduction of 12,569 t of CO <sub>2</sub> per year was achieved until the end of 2018.
Voluntary pledge among Hamburg industrial companies		Furthermore, the Industrial Heat project created the conditions for recurring CO <sub>2</sub> savings of 20,000 t per year.  An additional reduction of 4,767 t of CO <sub>2</sub> per year was achieved by the end of 2020

Target	Planned measure	Degree of implementation/date
<b>Climate protection</b>		
Participation in the second round of the IVH Energy Efficiency Network	Voluntary savings potential of 75,000 t of CO <sub>2</sub> among the 15 participating companies	2019–2021 runtime
Decarbonization	Developing an action plan for decarbonization	In 2019, the study “Reducing Greenhouse Gases in the Copper Industry” was carried out at Aurubis Hamburg
<b>Energy optimization</b>		
Extracting industrial heat for internal use and supplying district heating to the HafenCity East neighborhood – reducing heat discharge in the Elbe River	Using extracted industrial heat internally	The heating of the tankhouse cells in the Plant East tankhouse, as well as the heating of the copper sulfate crystallization facility, was implemented internally in 2019.
	Review of additional potential for extracting industrial heat and delivering district heating from lines 2 and 3 to the city of Hamburg’s district heating grid	The basic engineering for lines 2 and 3 is currently underway The IFB Hamburg is supporting the project financially
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	The electrode steam boiler was installed and commissioned on August 22, 2019
<b>Water pollution control</b>		
Cooling water management compatible with bodies of water	Assessment of the three-year monitoring of bodies of water with proof of the ecological soundness of the cooling water discharge in bodies of water	Report on environmental compatibility was recognized in 2020
Continuously optimizing wastewater management	Investigative program to boost efficiency and minimize wastewater in precious metal production’s wastewater management	Initial wastewater reductions of at least 50 % were achieved – continuation in 2021
Improvement in ZABA (central wastewater treatment facility) cleaning efficiency	Continuous two-line design; increase in dwell times for metal precipitation and sedimentation; expansion of hydraulic throughput area	Deferred
	Increasing redundancy in the use of individual process stages (thickeners)	Implemented in 2020
	Investigation on reducing the halogen concentration	Planned for 2021
Substitution for potable water	Switching sweeper operation to process water from cooling water withdrawal. Savings of 10,000–12,000 m <sup>3</sup> of potable water annually	Test operation in 2020, stopped due to technical problems. Plans to resume in 2021

Target	Planned measure	Degree of implementation/date
<b>Partnership for Air Quality and Low-Emission Mobility</b>		
Sustainable, efficient, and climate-friendly mobility	Commissioning a Mobility Group that regularly develops measures	Takes place quarterly
Promoting public transport	Renting two bike boxes at the train/subway stations Veddel and Elbbrücken	Bike boxes were rented (2 locations with 20 spaces each), have been in use since October 2019, and are provided to employees free of charge
	Achieving full use of boxes	Around 80% are in use
	Reducing the price of the employer-subsidized public transport ticket	2021
Promoting sustainable mobility	Working towards the setup of a city bike station at the Plant East exit	City bike station for the Plant North exit has already been established (October 2019), talks about establishing a city bike station at the Plant East exit took place with the operator in 2020
	Enabling bike leasing (JobRad) for employees at the Hamburg site	2021
	Offering a car allowance (cash4car) as an alternative to a company car	June 2021
	Promoting "smaller" vehicles through an incentive system	June 2021
Promoting e-mobility	Reducing the CO <sub>2</sub> limit for the company vehicle fleet	June 2021
	Installing charging points (car and e-bike) at the employee parking lots in Plant North and Plant East	Empty conduit system was installed to be able to equip the parking lot with electric vehicle charging stations in 2021
	Successive replacement of all fuel-driven vehicles within the plant with electric vehicles	Three diesel vehicles were eliminated from the company's internal vehicle fleet in 2020
	Promoting fully electric vehicles through incentives and tax advantages	June 2021
	Converting forklifts from combustion engine to electric drive	2021

Target	Planned measure	Degree of implementation/date
<b>Promoting biodiversity</b>		
Promoting biodiversity at the Hamburg plant	Routinely reviewing possibilities for designing plant surfaces "close to nature" within the scope of projects	Collaboration with NABU in the UnternehmensNatur project continues
	Planting greenery in suitable places on facades	Repeat inspection of open areas with regard to vegetation in 2021
<b>Plant safety</b>		
Ensuring safety	Drill for the alarm and danger prevention plan	Takes place every three years at the most, in March 2019 most recently; flood protection drill carried out in September 2020
<b>Waste management</b>		
Promoting the circular economy	Introducing the collection of an additional material group for recycling substances	2021
	Optimizing internal disposal logistics by minimizing internal transports	2021
<b>Continuous improvement of integrated management system</b>		
Further development of an integrated management system (IMS) for Aurubis AG for the environment, quality, and energy as well as occupational health and safety	Introduction of general IMS handbook	By 2021
	Introduction of Hamburg IMS handbook	Continuous process
	Introductory phase – taking advantage of synergies	
	Start-up of ISO 45001	Audit pursuant to ISO 45001 took place in May 2021
	Continuing the implementation of the Aurubis Operating System (AOS) in the entire Hamburg plant	Ongoing
Developing and implementing additional processes to determine and update company-specific environmental aspects as well as opportunities and risks	Environmental aspects as well as opportunities and risks were systematically identified for the key departments in 2020	

Target	Planned measure	Degree of implementation/date
<b>Continuous improvement of integrated management system</b>		
Further implementation of Quentic in the IMS	Expanding the legal register by implementing an IT-supported legal and regulatory management system to ensure lawful plant operation as regulations become increasingly complex, in addition to:	Complete system integration in environmental law took place in 2020
	» Centrally recording and evaluating environmental law obligations and documents relevant from an environmental law aspect	Currently underway, to be finished by the end of 2021
	» Transferring internal audit management (audit invitations, audit report archiving, monitoring of measures) to Quentic	By 2021
	» Transferring IMS document management to Quentic	By 2021
Informing employees working in all plant areas relevant for environmental protection about current environmentally relevant topics	Annual training for employees in environmentally relevant departments	Repeated annually
	Additional introduction of e-learning until 2021 for employees to deepen their knowledge and make participation more flexible	The first e-learning sessions have taken place in 2021 – e-learning to be implemented in at least six departments by the end of 2021
Information and training sessions for departmental heads and plant managers on environmentally relevant topics	Further developing information transfer regarding relevant operator obligations using IT-supported legal and regulatory management systems	By the end of 2021
Plant tours by employees in the Environmental Protection department	Further developing the monitoring of plant operations with regard to environmental effects and compliance of the Environmental Protection department with regulations using IT-supported legal and regulatory management systems	Environmentally relevant conclusions have been documented and measures have been monitored in an IT-supported legal and regulatory management system since 2021
<b>Responsibility in the supply chain</b>		
Key measures regarding responsible supply chains within the context of the Sustainability Strategy 2018–2023 are documented in the separate Non-Financial Report.		



## Key figures for Aurubis AG, Hamburg site, in the 2020 calendar year

Developments in KPIs are explained in the text

Input	Unit	2018	2019	2020
<b>Raw materials</b>				
Copper concentrates	t	1,191,475	1,037,382	1,299,405
Copper scrap/refining material	t	54,933	48,897	46,796
Other Cu-bearing raw materials	t	140,365	146,718	112,491
Precious metal-bearing raw materials	t	28,446	12,251	12,631
Lead concentrate, scrap, and waste	t	25,013	20,575	30,788
Other waste for recycling	t	1,179	4,005	7,052
<b>Total TC/RC-earning raw materials</b>	<b>t</b>	<b>1,441,411</b>	<b>1,269,827</b>	<b>1,509,162</b>
<b>Operating supplies and materials</b>				
Sand and additives incl. cyclone sand	t	176,865	122,033	124,589
Iron as an additive	t	15,626	13,162	14,096
<b>Total input materials</b>	<b>t</b>	<b>1,633,902</b>	<b>1,405,022</b>	<b>1,529,066</b>
<b>Input material per t copper</b>	<b>t/t Cu</b>	<b>3.5</b>	<b>3.2</b>	<b>3.3</b>
<b>Energy</b>				
Electricity consumption	MWh	552,307	520,765	567,563
Additional electricity consumed to produce oxygen (informative) <sup>1</sup>	MWh	127,278	125,441	131,208
Natural gas	MWh	480,771	465,037	440,856
Coke	MWh	47,857	43,912	69,967
Other energy sources	MWh	16,269	15,982	15,385
<b>Total energy consumption</b>	<b>MWh</b>	<b>1,224,482</b>	<b>1,171,143</b>	<b>1,224,980</b>
<b>Energy consumption per t copper</b>	<b>MWh/t Cu</b>	<b>2.6</b>	<b>2.7</b>	<b>2.7</b>

<sup>1</sup> The compressors used to produce oxygen haven't been operated internally since 2018, but they are still monitored.

Input	Unit	2018	2019	2020
<b>Water withdrawal/uptake<sup>1</sup></b>				
River water	m <sup>3</sup>	64,033,000	56,896,000	62,672,000
Potable water	m <sup>3</sup>	340,000	362,000	373,000
Precipitation	m <sup>3</sup>	319,000	348,000	365,000
<b>Total water uptake</b>	<b>m<sup>3</sup></b>	<b>64,951,000</b>	<b>57,606,000</b>	<b>63,410,000</b>
<b>Water consumption per t copper</b>	<b>m<sup>3</sup>/t Cu</b>	<b>137</b>	<b>131</b>	<b>139</b>
<b>Area used at the Hamburg site</b>				
Total plant area	m <sup>2</sup>	871,000	871,000	871,000
Buildings and paved area	m <sup>2</sup>	766,000 (equivalent to 88 %)	766,000 (equivalent to 88 %)	773,000 (equivalent to 89 %)

<sup>1</sup> Figures rounded to the nearest 1,000.

Output	Unit	2018	2019	2020
<b>Products</b>				
Copper output	t	473,367	440,896	456,830
Sulfuric acid products as H <sub>2</sub> SO <sub>4</sub> (from exhaust gas cleaning, standardized to 100 % acid)	t	989,091	922,260	982,392
Iron silicate stone (incl. granules)	t	717,375	689,790	767,611
Silver, gold, and PGMs	t	1,273	1,357	1,476
Nickel sulfate	t	2,041	2,432	3,794
Other metal compounds	t	932	1,009	963
Lead	t	11,891	11,415	11,268
<b>Total products</b>	<b>t</b>	<b>2,195,970</b>	<b>2,069,159</b>	<b>2,224,334</b>
<b>Waste</b>				
Recycling	t	7,905	5,319	6,085
Disposal	t	5,105	6,393	6,032
<b>Total recycling and disposal</b>	<b>t</b>	<b>13,010</b>	<b>11,712</b>	<b>12,117</b>
of which hazardous waste	t	9,590	8,648	9,115
<b>Waste per t copper output</b>	<b>kg/t Cu</b>	<b>31</b>	<b>27</b>	<b>27</b>
<b>Waste per t input material<sup>1</sup></b>	<b>kg/t</b>	<b>8</b>	<b>86</b>	<b>17</b>
Construction waste (informative)	t	37,925	109,513	14,203
<b>Total waste</b>	<b>t</b>	<b>50,935</b>	<b>121,225</b>	<b>26,320</b>
<b>Conversion into products</b>		<b>99.2 %</b>	<b>99.2 %</b>	<b>99.2 %</b>

<sup>1</sup> Including construction waste.

Output	Unit	2018	2019	2020
<b>Emissions</b>				
Dust <sup>1</sup>	t	42	40	41
Dust per t copper	g/t Cu	89	90	91
SO <sub>2</sub>	t	1,830	1,591	1,871
NO <sub>x</sub> per t copper	g/t Cu	450	425	424
Direct CO <sub>2</sub> emissions (ETS, excluding diesel)	t	165,029	156,601	164,051
of which CO <sub>2</sub> from fuels	t	116,767	112,244	115,999
CO <sub>2</sub> from fuels per t copper	t/t Cu	0.25	0.25	0.25
Direct CO <sub>2</sub> emissions (Diesel for vehicles)	t	3,454	3,565	3,513
Indirect CO <sub>2</sub> emissions from electricity consumption (incl. oxygen production) <sup>2</sup>	t	504,672	480,312	519,731
Metal discharge in water	kg	718	678	637
Metal discharge in water per t copper	g/t Cu	1.5	1.5	1.4
<b>Water discharge</b>				
Direct discharge	m <sup>3</sup>	63,676,000	54,941,141	60,402,855
Indirect discharge	m <sup>3</sup>	42,000	51,220	42,403
<b>Total water discharge</b>	<b>m<sup>3</sup></b>	<b>63,718,000</b>	<b>54,992,361</b>	<b>60,445,258</b>
<b>Water discharge per t copper</b>	<b>m<sup>3</sup>/t Cu</b>	<b>135</b>	<b>125</b>	<b>132</b>

<sup>1</sup> For dust content (metals), see the information provided in the "Air – Emissions" section.

<sup>2</sup> The supplier's CO<sub>2</sub> emission factor is taken as a basis.

Updated Aurubis AG Environmental Statement 2021

# LÜNEN SITE



## The Lünen plant

Aurubis AG's Lünen plant 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 AG 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. The then-Norddeutsche Affinerie AG acquired the majority of Hüttenwerke Kayser shares in 2000, and 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 one of the world's leading secondary copper smelters

### THE PROCESSES AT THE LÜNEN PLANT

Lünen's smelting and refining processes involve recycling raw materials almost exclusively. These include traditional raw materials such as copper scrap and alloy scrap, slimes, and industrial residues, as well as high quantities of complex materials and other processing products from e-scrap, old cars, and ashes from garbage incineration. The feed materials, which are primarily delivered by truck, are first sampled, in some cases crushed and

separated in a material 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. Anode quantities from other Aurubis sites are also processed in the copper tankhouse [see Fig. 3.2.](#)

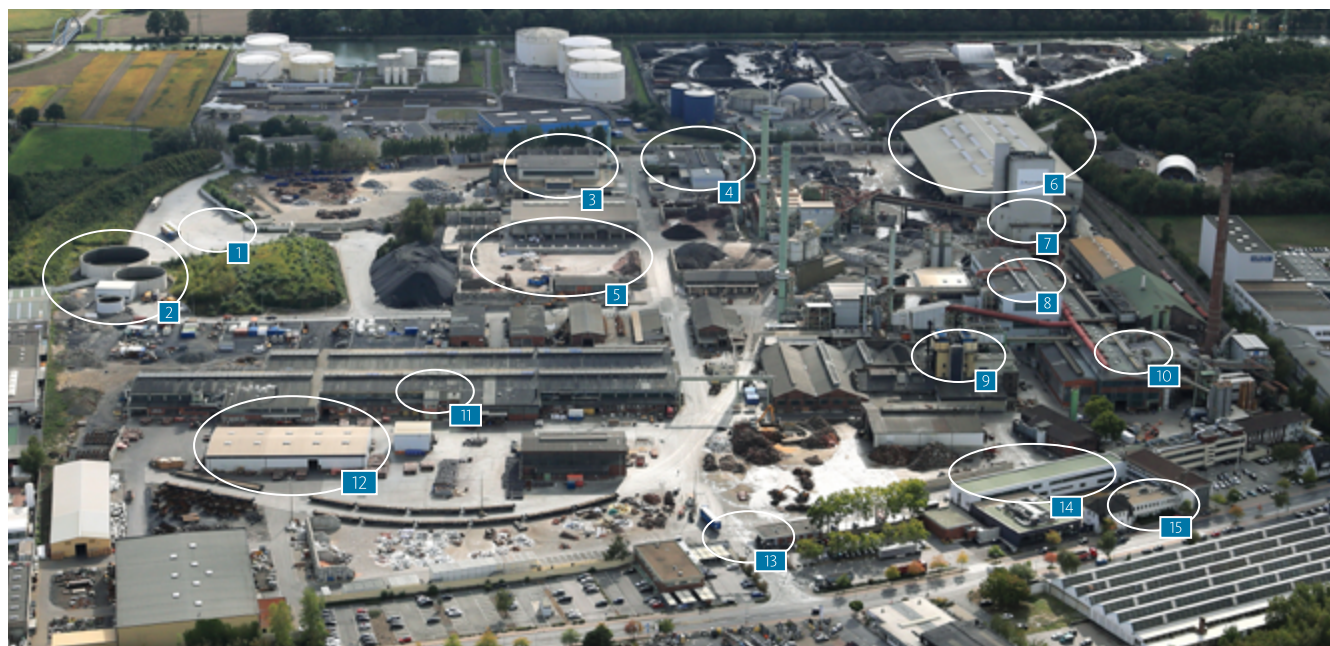
The core facility for metallurgical processes has been the Kayser Recycling System (KRS) since 2002, which gained a TBRC (top-blown rotary converter) in 2011 as part of the KRS-Plus project. The converter copper produced in the TBRC is refined together with copper scrap in the anode furnace and cast 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, and anode slimes are produced as by-products of "multimetal recycling." The anode slimes are processed into gold and silver metal as well as a PGM<sup>1</sup> solution in the Hamburg site's precious metal recovery process. The ratio of copper cathodes to by-products is about 1:1, though the increasingly complex recycling raw materials are steadily shifting the ratio to more by-products with minor metals relative to copper production. No process-related waste accumulates.

There are about 650 employees at the Lünen site, around 40 of whom are apprentices.

### THE INTEGRATED MANAGEMENT SYSTEM (IMS) FOR THE ENVIRONMENT, QUALITY, AND ENERGY

The Lünen site has an environmental management system that has been certified in accordance with ISO 14001 and EMAS since 1997. It is incorporated in an IMS (integrated management system) that also includes quality management pursuant to ISO 9001 and the certified energy management system pursuant to ISO 50001. For 2021 there are also plans to introduce an occupational health and safety management system in accordance with ISO 45001.

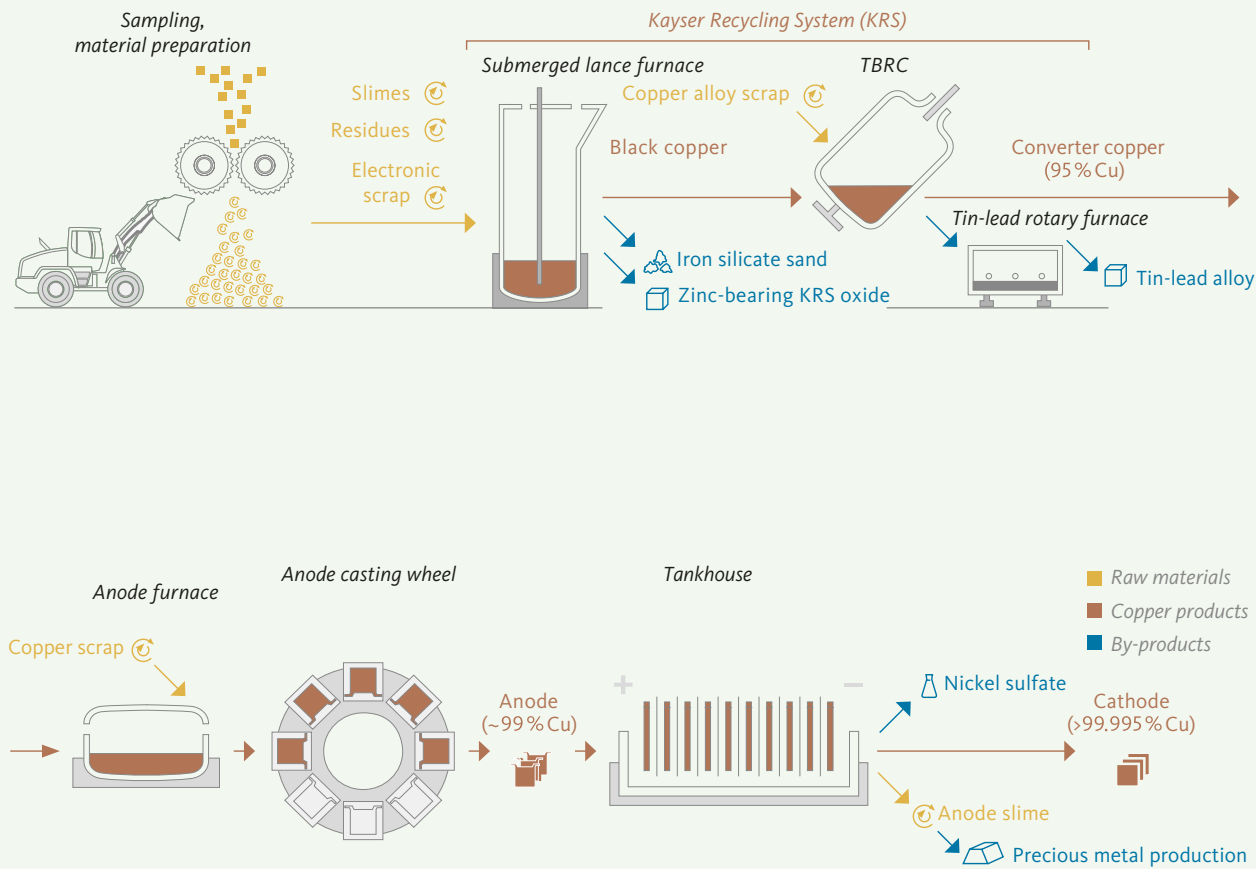
Fig. 3.1: Overview of Lünen site facilities



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 ATASI 15 Administrative building

<sup>1</sup> PGM = platinum group metal

Fig. 3.2: Multimetal recycling at the Lünen site



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 has been a certified primary treatment facility in accordance with the ElektroG. As of December 2018, the Lünen plant is also certified as a pre-processor and end processor of electrical and electronic scrap in accordance with the WEEELABEX/CENELEC standard 50625.

The effectiveness of the environmental and energy management system is reviewed with internal audits pursuant to the EMAS Regulation 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). The management evaluates how suitable, appropriate, and effective the management system is and whether the requirements for the integrated management system are being successfully implemented.

## TARGETS AND TASKS OF THE ENVIRONMENTAL MANAGEMENT SYSTEM

The production processes are securely managed through the environmental management system at the Lünen plant. 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 pursuant to 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 comparative assessment of the site's performance. These key figures include emissions to air and water, for instance. 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 measures that were initiated. In the process, the environmental protection officer always attempts to directly contact those who submitted the complaints.

## ENVIRONMENTAL MANAGEMENT ORGANIZATION

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

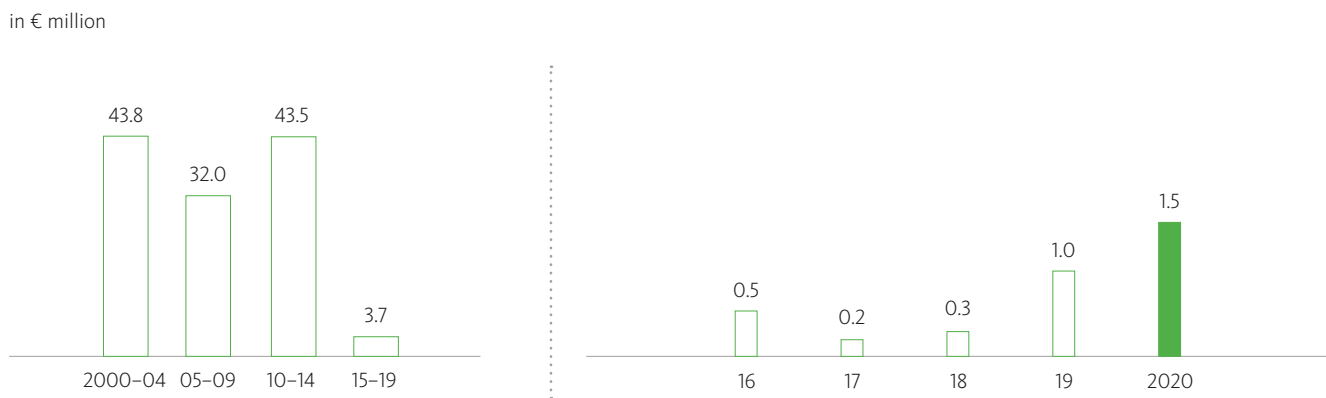
The officer functions at the Lünen site for

- » Immission protection and accident prevention
- » Waste management
- » Radiation protection
- » Specialist company under the Water Management Act
- » Occupational safety

are carried out by employees of the plant. The role of hazardous goods officer is filled by an employee with a corporate function who works in Lünen. The Lünen site has had its own plant medical services 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 by the corporate departments.

**Fig. 3.3: Capital expenditure for environmental protection measures at the Lünen site\***



\* The data relates to environmental investments per fiscal year. Single years are provided for readability, for example 2020 for fiscal year 2019/20.



## ENVIRONMENTAL ASPECTS AND PERFORMANCE

Investments in environmental protection 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 governmental authorities for the period from 2005 to 2009 was initially estimated at about € 10 million but was then supplemented with further 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. Environmental protection accounted for € 17.5 million of the investment costs of the KRS-Plus project as well.

Overall, around € 125 million has been invested in environmental protection from 2000 to 2020 [see Fig. 3.3](#). Starting in 2000, following the acquisition of Hüttenwerke Kayser, Aurubis AG made huge investments in new and improved facilities. In the last several years, process optimizations were the focus at the plant, so investments in new facilities decreased accordingly. Aurubis will continue to invest in modernizing the facilities and possibly building new facilities in the coming years.

## 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 regulation 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.

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, such as  $\text{NO}_x$ , HCl, and HF.

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 mitigation measures. The figures presented here incorporate the fugitive emissions including storage and handling.

Emission measurements using drones at the Lünen plant



The dust emissions in 2020 were again at about the same low level of the past several years; in particular, metal loads as a component of the total dust volume continued to decrease significantly.

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 raw materials, and the miniaturization of technical devices has also resulted in an increase in the number of processing steps. This leads to lower copper output but more by-products per ton of material input.

The Lünen plant's KPIs will therefore be adjusted in the years to come to optimally depict the shift in the plant's strategy towards increasingly complex input materials. These alternative KPIs have already been reviewed within the context of energy management, for example to evaluate energy performance and energy efficiency to include minor metal production.

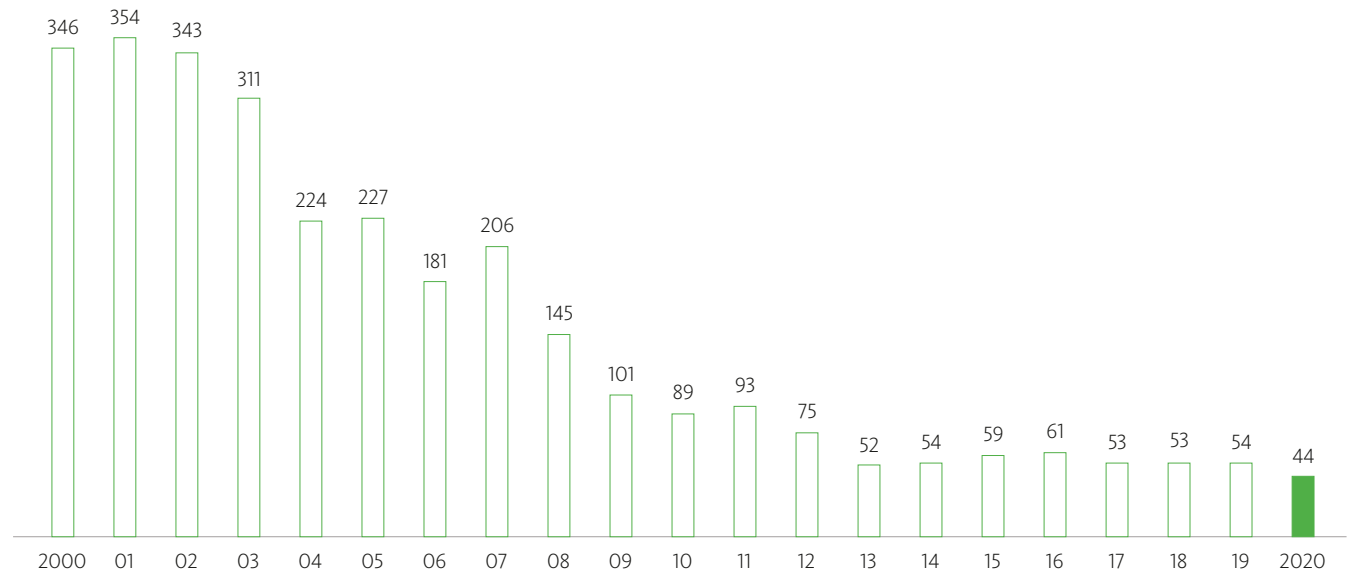
As a first result of these adjustments at the Lünen plant, the processed external bleed was included in the input streams since it constitutes a substantial portion of both plant traffic and the metal loads of wet chemistry. Furthermore, copper production as it is shown in the KPIs was expanded to include the volumes of purchased anodes and blister copper, as growing volumes of these preliminary products are increasingly being delivered to other Aurubis sites and not being directly processed into cathodes in Lünen anymore.

Another development is clear when observing the emission curves: they seem to be transitioning to an asymptotic trend in the meantime. Slight increases in emissions can also be observed in places. It's important to mention here that the measured emissions from the Lünen plant's facilities are meanwhile at low concentrations that are within the range of measuring inaccuracy. Fluctuations in annual emissions in these areas can therefore be due to calibrations of measuring devices, among other reasons. Moreover, reductions of the magnitude reflected in the past can't be expected through individual technical measures anymore.

In 2020, an innovative method for recording fugitive emissions using drones was used for the first time in close collaboration with the University of Düsseldorf. Drones with installed dust measuring devices fly around the plant and provide live evaluation data on the existing dust pollution. This method enables precise measurement of the current fugitive emissions. This helped identify potential emission sources in the anode furnace area, which are being closed in the next several months. For instance, a building adjoining the boiler of the anode furnace area is being better dust-proofed and a roof section in the anode furnace casting area is being equipped with a water sprinkler for dust abatement.

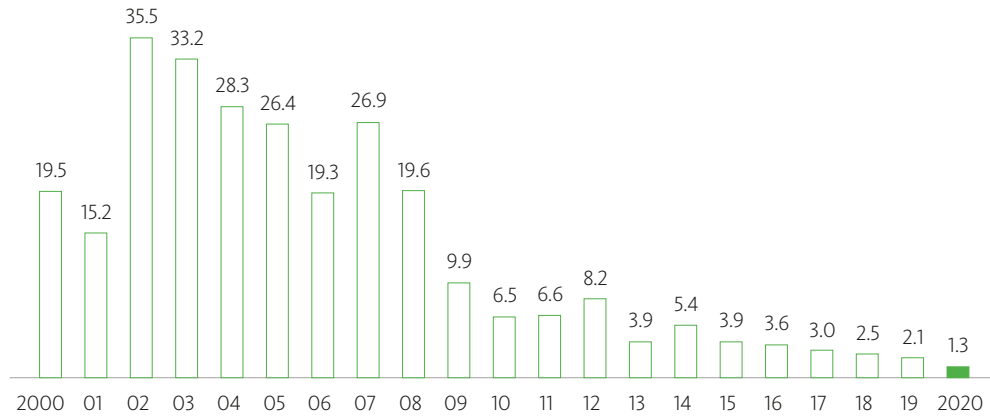
Fig. 3.4: Dust emissions at the Lünen site

Dust in g/t of input material



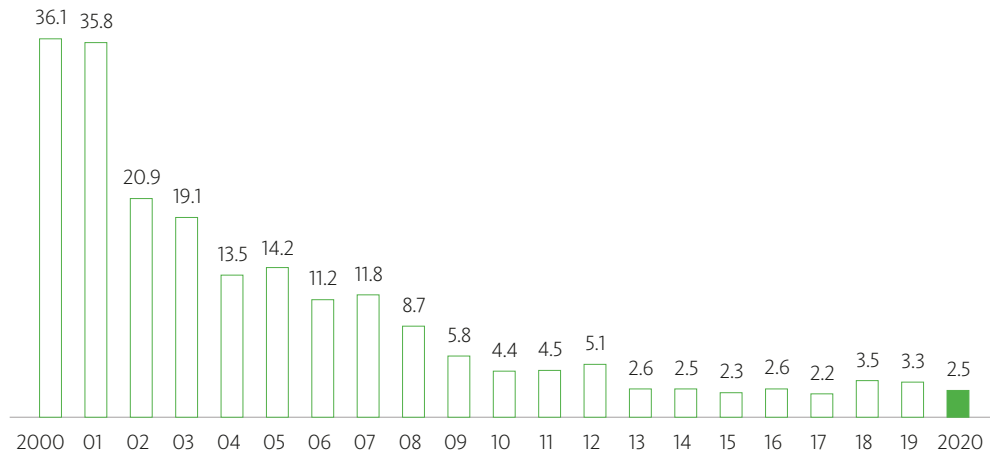
**Fig. 3.5: Copper emissions at the Lünen site**

Copper in g/t of input material



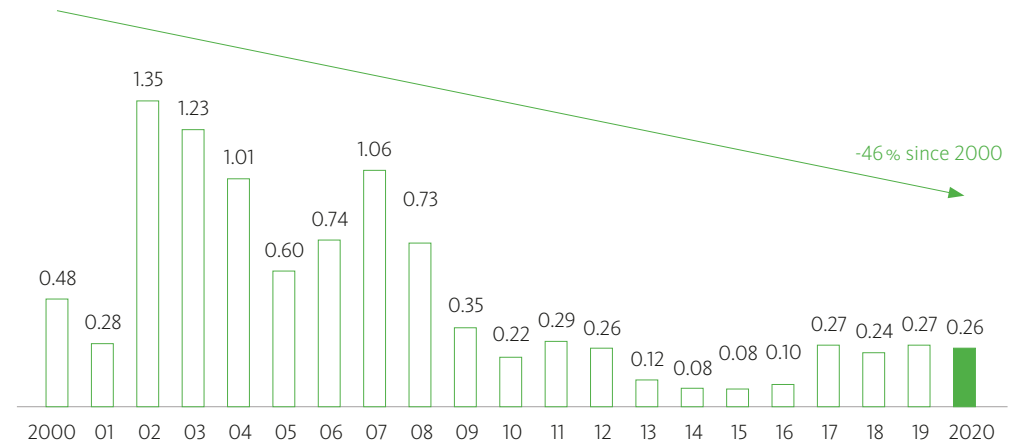
**Fig. 3.6: Lead emissions at the Lünen site**

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 2002 and 2003 were estimated in a comparable manner, but there are no reliable values for the missing years.

## AIR – IMMISSIONS

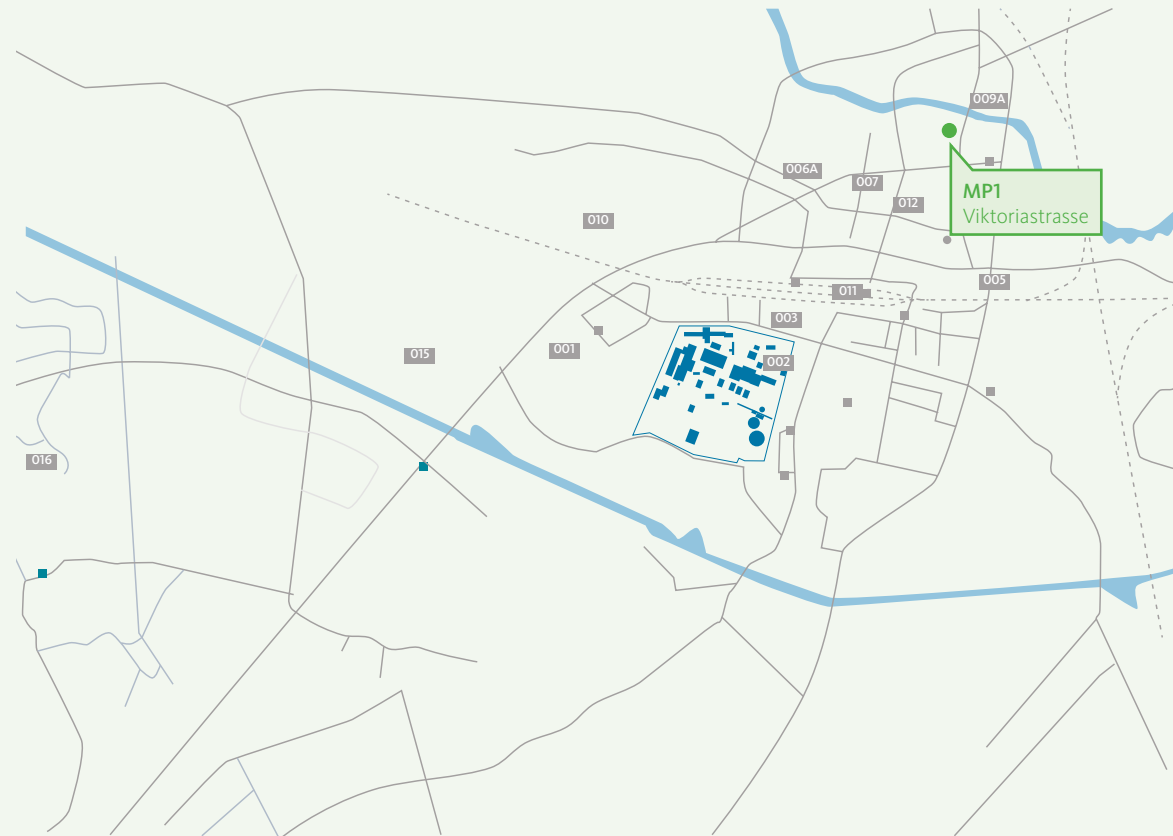
To measure the immissions of dust precipitation including metallic components, the LANUV (NRW State Agency for Nature, Environment and Consumer Protection) operates a network of currently 12 “Bergerhoff” measurement points in the area surrounding the Lünen plant [see Fig. 3.8](#).

In the last ten years, there has been a significant reduction in dust emissions, primarily in dust components. Although individual deposition values of the TA Luft regulation are still being exceeded, the deposition involves a complex situation and not immissions that can be directly assigned to an individual emitter. With regard to the immission situation in the Kupferstrasse industrial area, Aurubis is in close, ongoing dialogue with the relevant governmental authorities and the other companies on site to identify and implement suitable reduction measures.

In addition, a LANUV measurement station for particulate matter (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 reference measurement station without industrial impact.

**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 July 2020, the results of the investigations of leafy vegetables from small gardens in Lünen near the plant were released for 2019. The assessment took place on the basis of Commission Regulation (EC) No 1881/2006 on setting maximum levels for certain contaminants in foodstuffs. This regulation is based on the assumption of regular consumption of the tested foodstuffs, which, due to the actual vegetation period of the leafy greens in question, can't actually be achieved by the harvested plants from the gardens.

The trend in the immissions determined in this process is very positive and has improved continuously in the past few years. In 2019, no pollution of the cultivated vegetables was identified that would have led to a recommendation not to consume them.

As a result, LANUV suspended the measuring program starting in 2020 due to the recorded values, which had stabilized at a low level, and recommends another evaluation in five years.

**Fig. 3.9: Immissions of particulate matter (PM10) compared to the plant's calculated immission maximum**

Comparison of dust immissions in  $\mu\text{g}/\text{m}^3$  at the Lünen site, Victoriastrasse, and Niederaden

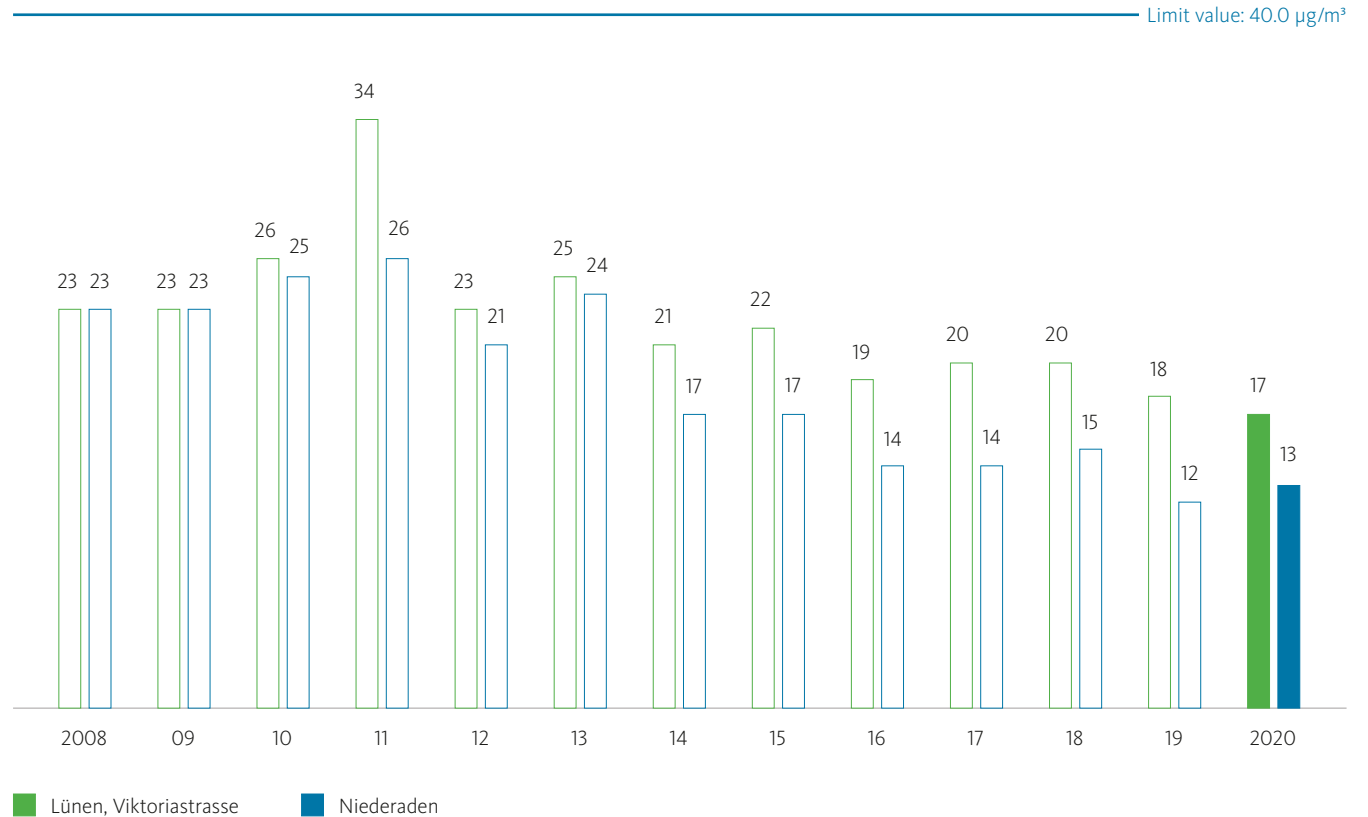


Fig. 3.10: Lead

Lead immissions in  $\mu\text{g}/\text{m}^3$

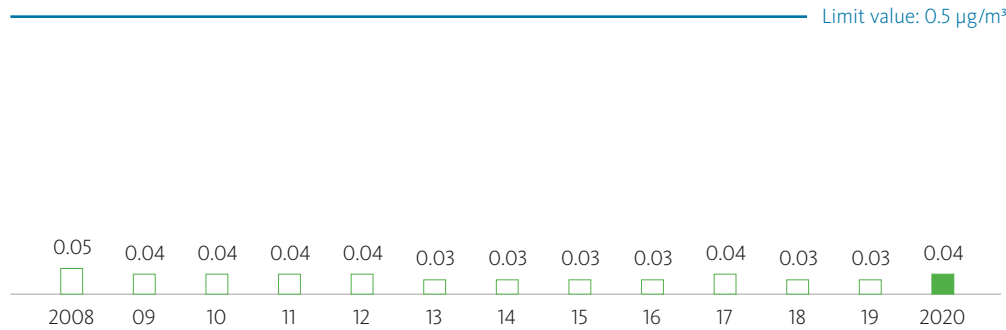


Fig. 3.11: Cadmium

Cadmium immissions in  $\text{ng}/\text{m}^3$

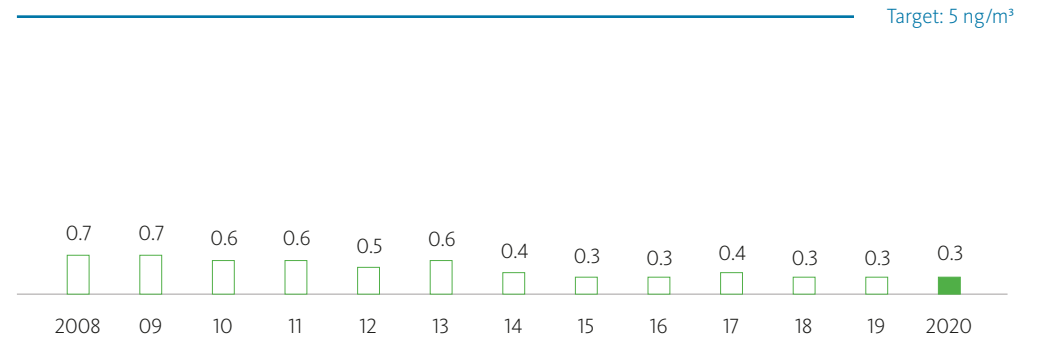


Fig. 3.12: Arsenic

Arsenic immissions in  $\text{ng}/\text{m}^3$

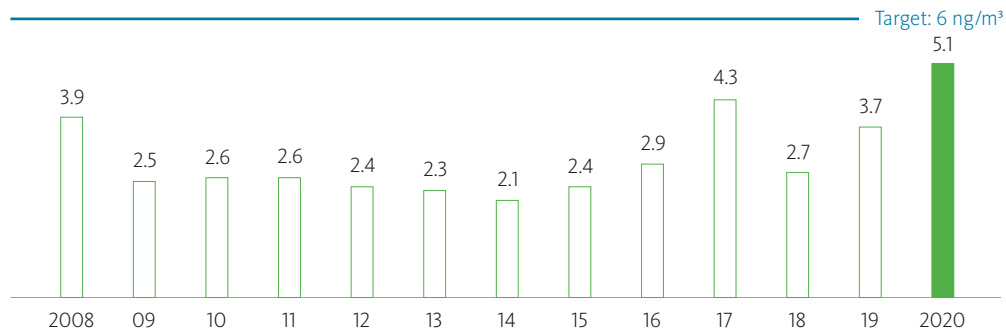
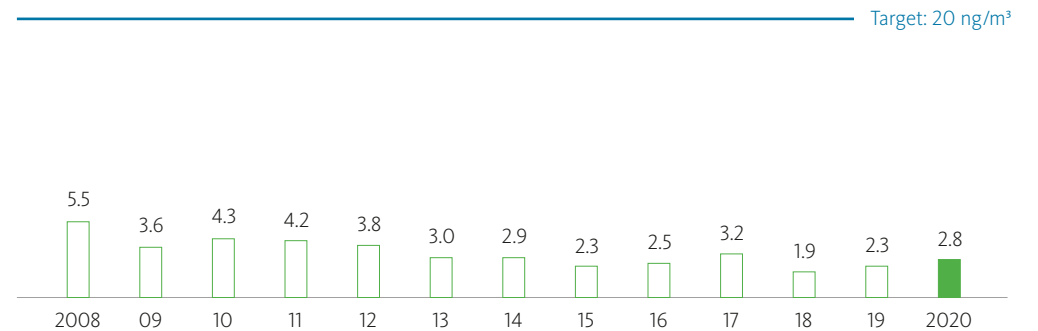


Fig. 3.13: Nickel

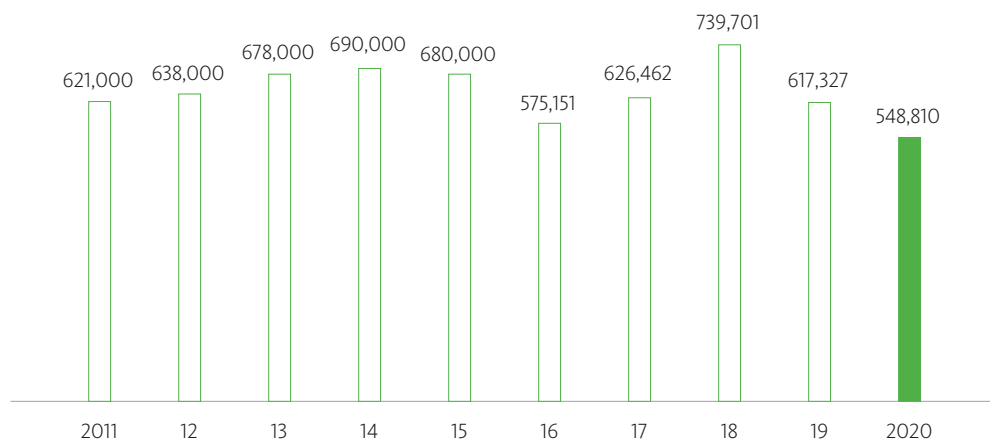
Nickel immissions in  $\text{ng}/\text{m}^3$



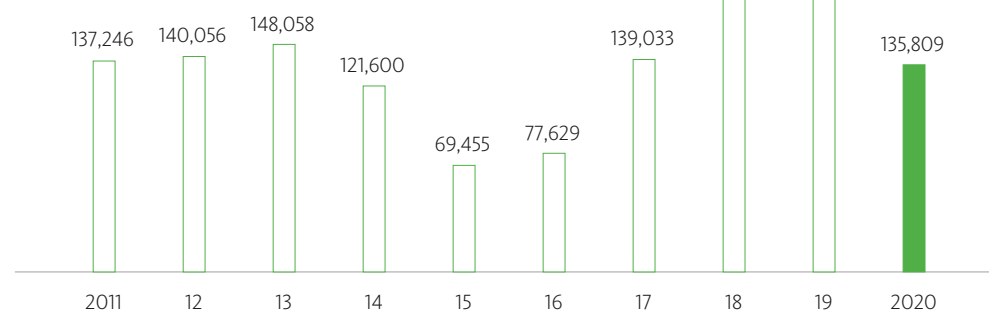
The measurements of air quality for suspended particulates and their components indicate that the levels are significantly and consistently below both the limit values for PM10 and lead, as well as below the EU target values for arsenic, cadmium, and nickel. The LANUV measurement station at Niederaden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

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

Water consumption in m<sup>3</sup>/year



Wastewater discharge in m<sup>3</sup>/year\*



\* In 2015 and 2016, the wastewater discharge from the rainwater retention hadn't been included in the figures yet, which explains why they are substantially lower than in comparable years.

## 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 make it difficult to significantly reduce water consumption.

To ensure that this consumption conserves resources, Aurubis operates a facility for rainwater retention, treatment, and utilization in Lünen, which covers a large part of the internal cooling and process water needs with collected rainwater.

The rainwater volume used in this way has increased continuously during the past several years, and water usage from the public water network has decreased accordingly. In 2020, more than 120,000 m<sup>3</sup> of process water was used for internal purposes. Overall, the rainwater-use project has significantly surpassed the projected quantities. Wastewater discharge was reduced by nearly 30 % in 2020 due to the optimization of water retention and supply in the last several years [see Fig. 3.14](#). For the coming years, additional optimizations are planned for internal water use, such as reviewing the further treatment of internal process water (reverse osmosis, evaporation). The goal is to use water internally to the greatest possible extent and prevent the discharge of process water into the public sewer system.

## SOIL – REMEDIATION 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 remediation plan was developed and coordinated with the responsible authorities. In late 2014, a remediation agreement was signed with the Unna district describing the further agenda and the steps planned to remediate the soil and groundwater at the Lünen site.

The remediation 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.

The oil damage remediation system, the first measure implemented to remediate an oil phase in a former oil storage area, went into regular operation in 2020. This system cleans the extracted groundwater, which is then used as internal process water; the separated oil phase is disposed of externally by the specialized company that operates the system for Aurubis.

For the other remediation measures, the goal is to similarly use the remediated water to take advantage of the site remediation in a way that conserves resources.

### 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, such as 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.

### NOISE AND ODORS

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

All of the measurements carried out by external experts showed that the reference values relevant for the respective applications were observed at the assessment points predetermined by the governmental authorities. In the areas classified as mixed-use areas

surrounding the plant, this is 60 dBA maximum during the day and 45 dBA maximum at night.

In 2020, there was a total of five noise complaints from local residents. The sources were attributed to Aurubis in four cases, which were quickly remedied (including noise in connection with shutdown work and a newly installed warning system on a machine in the tankhouse). As always, the company communicated directly and intensively with those who submitted the complaints. Their reactions were consistently positive.

Once again, two odor complaints were submitted in September regarding “chemical” or “sulfurous” odors. After reviewing the complaints with respect to wind direction, company incidents, and similar factors, Aurubis was nevertheless ruled out as a potential source of the odors; this was communicated to those who submitted the complaints accordingly.

### 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 FFH<sup>1</sup> assessments in order to identify possible impacts on biodiversity. In smaller projects in the plant and in the neighbor-

hood, 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, HOS<sup>2</sup> landfill) and setting up nesting sites on buildings and chimneys.

### WASTE

The waste from the Lünen plant mainly results from packaging from delivered materials, from construction measures, and from spent furnace lining from the KRS, anode furnaces, etc. The externally marketed contingents of the material preparation plant, such as aluminum 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.

A total of 433 t of hazardous waste accumulated in 2020, mainly spent furnace lining material. All of this waste was sent for recycling.

The total tonnage of generated waste is higher in 2020 overall because 15,000 t of slag was disposed of after the possibility of internal recycling (as return slag) was investigated and ruled out.

<sup>1</sup> Flora Fauna Habitat Directive (EU Habitats Directive)

<sup>2</sup> Blast furnace slag (Herdfenschlacke in German)

Fig. 3.15: Waste generated at the Lünen site

Type of waste in t/year	2015	2016	2017	2018	2019	2020
Non-hazardous waste	4,445	6,664	9,012	5,467	4,842	19,712
Hazardous waste	264	373	417	362	458	402
Construction waste	8,923	4,313	10,940	3,234	9,639	3,015
<b>Total waste volume including construction waste</b>	<b>13,632</b>	<b>11,350</b>	<b>20,369</b>	<b>9,063</b>	<b>14,939</b>	<b>23,129</b>



## ENERGY AND 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 or thermal energy for leaching and electrolysis is mainly produced in the waste heat boilers of the KRS submerged lance furnace and anode furnace. There are also two auxiliary boilers primarily fueled with natural gas.

Since 2015, a two-stage condensation turbine has been in operation to produce electricity for internal use from waste heat steam through cogeneration. The steam from the process waste heat is initially depressurized from about 18 bar to 5 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 for Economic Affairs 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 Practice in Energy Efficiency at the end of 2015. The necessary process adjustments in KRS operation reported on in 2019 fully returned to normal operation following the maintenance shutdown in May 2020, so 10 GWh of electricity was generated internally again in 2020.

Developments and background on the use of primary energy sources:

- » At 515.7 GWh, the plant's total energy demand in 2020 exceeded the 500 GWh threshold again. There were four key influencing factors:
  - » Additional demand of 10 GWh of SE oil compared to 2019
  - » Additional electricity demand of 7 GWh due to the tankhouse being in full operation temporarily
  - » Internal electricity generation about 5 GWh below average
  - » Additional demand of 5 GWh of petroleum coke as a reducing agent
- » The overall input of heating oil was reduced by 1/3% year-over-year.
- » A continued high input of energy-intensive, complex raw materials such as shredder materials and residues; however, due to factors related to the supply and the fact that KRS operation was curbed (including the time-consuming KRS shutdown), it wasn't possible to utilize the entire potential for processing low-grade raw materials.

The electricity demand for environmental protection measures remains unchanged at roughly one-third of total electricity demand.

The site's absolute energy demand has been relatively constant for ten years. At 515.7 GWh in 2020, the primary energy input is around 3 % lower than the nine-year average of 532 GWh. At the same time, at 159,739 t, the plant's direct CO<sub>2</sub> emissions also fell to under 160,000 t for the first time since data has been collected for the third trading period. According to the reporting methods pursuant to DEHSt standards, the organic components in the raw materials still contribute more to the site's CO<sub>2</sub> emissions than the main energy source, SE oil (42.5% compared to 37.5%). We expect this trend to continue.

Energy demand in 2020 reflects the following developments:

1. The fundamentally positive trend in process-related primary energy needs in smelting operations is progressing steadily. Anode output in Lünen was 185,000 t, approximately 4 % lower than in 2018 and 2019. Converter copper output from the KRS system was high, at 84,500 t.
2. The project to overhaul the tankhouse started in April 2019. The first overhaul stage was completed in early 2020. The second stage should have started directly afterward, but due to a longer tankhouse outage in the Olen plant, a decision was made to run the Lünen tankhouse in full operation for a good six months. This unscheduled mode of operation had a substantial influence on the plant's electricity and heating needs.

Copper cathode output rose accordingly, from 158,000 t to 172,150 t. At the same time, 10,300 t of converter copper and 7,000 t of copper anodes, or about 6 % of the copper output (2019: 11 %), was delivered as intermediate products to other Group sites for refining. The goal of the Lünen site is still to push the use of complex raw materials, which require more energy-intensive processing.

Fig. 3.16: Energy consumption<sup>1</sup> at the Lünen site

		2013	2014	2015	2016	2017	2018	2019	2020
Primary energy consumption	MWh	356,061	380,243	404,317	390,734	391,679	360,990	337,970	352,437
Secondary energy consumption	MWh	155,882	161,997	161,167	155,212	165,117	164,593	155,067	163,553
Total energy consumption	MWh	511,943	542,240	565,485	545,946	556,796	525,583	493,036	515,990
Energy consumption per ton of copper output	MWh/t Cu	2.61	2.81	3.04	3.05	2.89	2.73	2.79	2.83

<sup>1</sup> Calculated using DEHSt (German Emissions Trading Authority) standards.

Fig. 3.17: Breakdown of energy consumption at the Lünen site



Environmental protection facilities are very energy-intensive; Aurubis uses more than 30 % of the electricity at the Lünen site for environmental protection measures.

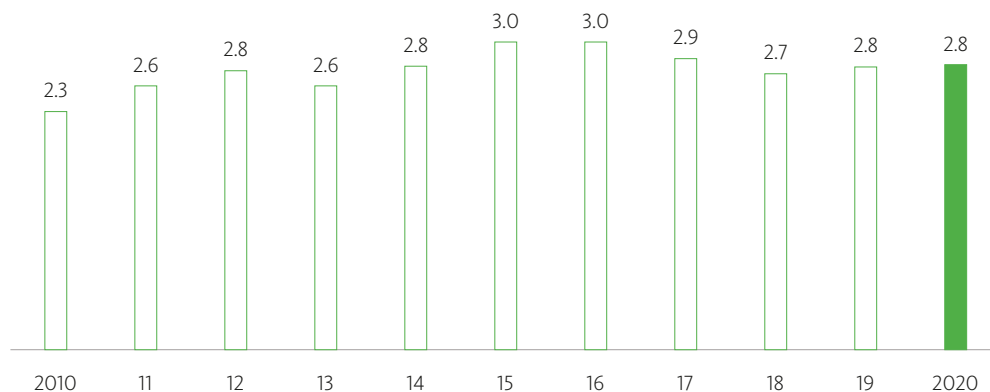
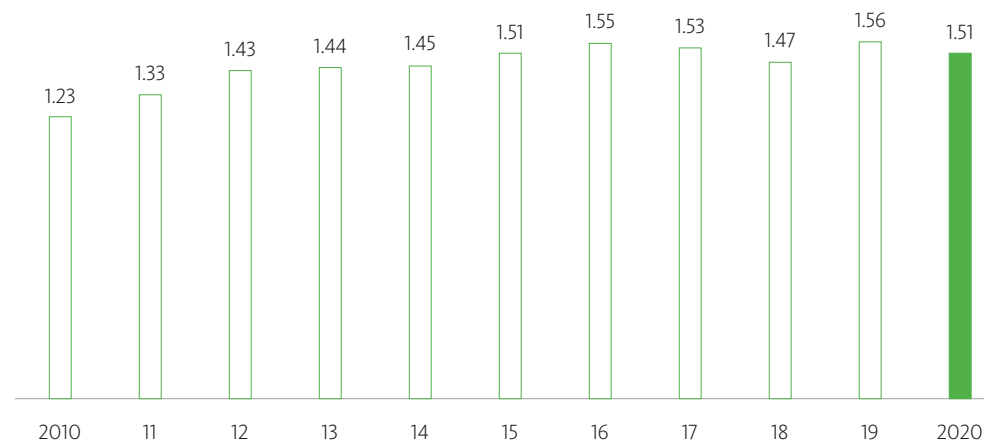
Fig. 3.18: Direct CO<sub>2</sub> emissions at the Lünen site

in t p.a.	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total CO <sub>2</sub>	172,870	168,297	172,461	174,549	176,067	186,544	169,415	163,572	162,166
Biogenic CO <sub>2</sub>	0	568	569	0	480	324	300	295	313
CO <sub>2</sub> subject to DEV 2020 <sup>2</sup>	172,870	164,995	169,134	171,858	173,202	183,839	166,918	161,113	159,739

<sup>2</sup> 2020 Data Collection Regulation for the third emissions trading allocation period.

Fig. 3.19: Energy consumption at the Lünen site

in MWh/t of copper output

Fig. 3.20: Direct CO<sub>2</sub> emissions at the Lünen sitein t CO<sub>2</sub>/t of copper output

### AUDITS AND INSPECTIONS BY GOVERNMENTAL AUTHORITIES

The following environmental inspection was carried out by the relevant governmental authorities in 2020:

- » IED<sup>1</sup> inspection of the HOS<sup>2</sup> landfill, local Arnsberg government, July 22, 2020

In 2020, the IED inspection for the plant was postponed to February 2021 due to the pandemic. 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 governmental authority, in which all incident scenarios are addressed and concrete safeguards are derived from them. The safety report is

regularly reviewed and updated so that it accounts 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. The safety report was fully revised in the course of 2020, expanded to include new calculations related to accident scenarios, and sent to the relevant governmental authorities for review.

<sup>1</sup> Industrial Emissions Directive

<sup>2</sup> Blast furnace slag (Herdfenschlacke in German)

## Environmental Program

The targets set in the context of the Environmental Statement 2020 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 2021. The results are presented in the following Environmental Program.

Target	Planned measure	Degree of implementation/date
<b>Air pollution control</b>		
Reducing fugitive emissions in the anode furnace area	Implementing the measures identified through drone recordings: sealing off boiler house 7, sprinkling water on the roof in the casting area	The measures have already been budgeted and commissioned externally, implementation in 2021
Reducing emissions and improving odor immissions in the plant surroundings	New filters in sampling with extraction ring in the sampling hall	The filter is budgeted, contract to be awarded in 2021
<b>Water pollution control</b>		
Optimizing wastewater flows	Separately treating sanitation water, improvement in the ratio of used surface water to drained surface water close to 100 %	The previous targets were achieved; an internal concept for water use is currently being developed that is supposed to fully prevent drainage of unused process water
<b>Energy optimization</b>		
Enhancing energy efficiency	Developing an assessment basis that takes the following aspects into account: <ul style="list-style-type: none"> <li>» Form of energy</li> <li>» Raw material structures</li> <li>» Raw material availability</li> <li>» Raw material composition (complexity)</li> <li>» Price volatility</li> </ul>	The ENPIs are reliable and sound. In the coming years, standards-based assessment benchmarks will be introduced for the entire process to be able to better monitor sustainable development
Optimizing the anode smelter cycles and primary smelter cooling cycles	Heat use and water quality (including expansion of process water use) have to be optimized to enhance performance	Concepts are being developed with external support. Projects are taken into account in the investment budget

Target	Planned measure	Degree of implementation/date
<b>Plant safety</b>		
Adapting the requirements to the Seveso III Directive	Preparation of a new hazardous substances register	The report pursuant to the new Hazardous Incident Ordinance was submitted to the governmental authorities. The hazardous materials register will be entered into a new EHS software that has already been purchased at AG level and is in use at the Hamburg site
<b>Environmental management system</b>		
Integrating ISO 45001 into the IMS	Organizational integration and additions to all relevant process instructions	Integration into the management system has concluded and the system was successfully certified in April 2021

## Key figures for Aurubis AG, Lünen site, in calendar year 2020

Developments in KPIs are explained in the text

Input	Unit	2018	2019	2020
<b>Raw materials</b>				
Recycling raw materials	t	323,519	295,343	311,934
Blister, etc.	t	19,013	19,479	12,661
Copper anodes from other Aurubis sites	t	29,438	29,690	22,335
Bleed	t	27,598	43,000	39,546
<b>Total raw materials</b>	<b>t</b>	<b>399,568</b>	<b>387,512</b>	<b>386,476</b>
<b>Input material/t Cu output</b>	<b>t/t Cu</b>	<b>1.82</b>	<b>2.20</b>	<b>2.12</b>
<b>Operating supplies and materials</b>				
Oxygen	million m <sup>3</sup>	38	39	44
Rhine sand	t	19,894	20,969	23,820
Limestone	t	6,671	3,493	3,646
<b>Energy</b>				
External power sources	MWh	153,953	151,274	153,478
Internal power sources	MWh	10,641	3,793	10,075
Natural gas, oil, coal	MWh	360,990	337,970	352,437
<b>Total energy consumption</b>	<b>MWh</b>	<b>525,583</b>	<b>493,036</b>	<b>515,990</b>

Input	Unit	2018	2019	2020
<b>Water withdrawal/uptake</b>				
Potable water	m <sup>3</sup>	739,701	617,327	548,810
Precipitation	m <sup>3</sup>	112,286	137,784	139,340
<b>Total water uptake</b>	<b>m<sup>3</sup></b>	<b>711,791</b>	<b>592,024</b>	<b>586,051</b>
<b>Water consumption/t Cu output</b>	<b>m<sup>3</sup>/t Cu</b>	<b>3.7</b>	<b>3.4</b>	<b>3.2</b>
<b>Area used</b>				
Total plant area (incl. south plant entrance)	m <sup>2</sup>	316,000	316,000	316,000
Buildings and paved area	m <sup>2</sup>	247,000 (equivalent to 78 %)	252,784 (equivalent to 80 %)	252,784

Output	Unit	2018	2019	2020
<b>Products</b>				
Copper products sold				
(Cathodes, anodes, and blister)	t	192,323	176,446	182,424
KRS oxide	t	18,982	20,887	20,327
Iron silicate sand	t	146,982	174,448	177,179
Other (tin composite, nickel sulfate, etc.)	t	23,401	23,048	21,087
<b>Total products</b>	<b>t</b>	<b>381,688</b>	<b>395,190</b>	<b>401,017</b>
<b>Waste</b>				
Recycling	t	5,829	5,300	4,442
Disposal	t	0	0	15,672
Waste/Cu output	kg/t	30	30	110
Waste/input material	kg/t	15	14	52
Construction waste	t	3,234	9,639	3,015
<b>Total waste</b>	<b>t</b>	<b>9,063</b>	<b>14,939</b>	<b>23,129</b>
<b>Emissions</b>				
CO <sub>2</sub> (direct emissions)/Cu output	t CO <sub>2</sub> /t Cu	0.87	0.91	0.89
Dust/Cu output	g/t	109	119	93
SO <sub>2</sub> /Cu output	kg/t	4.0	4.4	5.4
NO <sub>x</sub> /Cu output	kg/t	1.4	1.7	1.8
<b>Water discharge</b>				
Wastewater (indirect discharge)	m <sup>3</sup>	186,000	198,000	135,000
Water discharge/Cu output	m <sup>3</sup> /t	0.97	1.13	0.74



# URKUNDE



Aurubis AG

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Register-Nr.: DE-131-00035

Ersteintragung am  
01. November 2005

Diese Urkunde ist gültig bis  
19. Mai 2023.

Diese Organisation wendet zur kontinuierlichen Verbesserung der Umweltleistung ein Umweltmanagementsystem nach der Verordnung (EG) Nr. 1221/2009 und EN ISO 14001:2015 (Abschnitt 4 bis 10) an, veröffentlicht regelmäßig eine Umwelterklärung, lässt das Umweltmanagementsystem und die Umwelterklärung von einem zugelassenen, unabhängigen Umweltgutachter begutachten, ist eingetragen im EMAS-Register ([www.emas-register.de](http://www.emas-register.de)) und deshalb berechtigt das EMAS-Logo zu verwenden.

Hamburg, 10. September 2020  
HANDELSKAMMER HAMBURG



*Norbert Aust*  
Prof. Norbert Aust  
Präsident

*Malte Heyne*  
Dr. Malte Heyne  
Hauptgeschäftsführer



## DECLARATION OF VALIDITY

in accordance with the standards of  
**Regulation (EC) No 1221/2009 of 25 November 2009**  
on the voluntary participation by organisations in a Community  
eco-management and audit scheme (EMAS)



The signing environmental verifiers Wolfgang Wielpütz, Dr. Erwin Wolf and Ralph Mess, licensed for the scope "NACE Code 24.44", declare to have verified whether the whole organisation as indicated in the environmental statement of the organisation

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20539 Hamburg  
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**Aurubis AG**  
Kupferstrasse 23  
44532 Lünen  
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with registration number D-131-00035 meets all requirements of Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS) as amended by Commission Regulation (EC) No 2017/1505.

**By signing this declaration, we declare that**

- the verification and validation has been carried out in full compliance with the requirements of Regulation (EC) No 1221/2009,
- the outcome of the verification and validation confirms that there is no evidence of non-compliance with applicable legal requirements relating to the environment,
- the data and information of the environmental statement of the sites reflect a reliable, credible and correct image of all the sites' activities, within the scope mentioned in the environmental statement.

This document is not equivalent to EMAS registration. EMAS registration can only be granted by a Competent Body under Regulation (EC) No 1221/2009. This document shall not be used as a stand-alone piece of public communication.

Hannover, 19.05.2021

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