



Environmental Protection in the Aurubis Group

and Consolidated Aurubis AG Environmental Statement 2023

Hamburg and Lünen Sites



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Consolidated Aurubis AG Environmental Statement 2023

Hamburg Site



Consolidated Aurubis AG Environmental Statement 2023

Lünen Site



Dear readers,

At Aurubis, we have stood for innovation, passion for metallurgy, and the highest quality standards for 157 years now. This is also true of one of the most important goals of our time: sustainable economic activity. As an energy- and resource-intensive company, we recognized the need to act quite early and have done a lot to make our products and processes more sustainable.

We can only grow sustainably if we continue to expand our industrial leadership in this area. This is why sustainability and environmental protection are essential components of our corporate strategy and solidly enshrined in it.

We will continue to grow in the future, especially in recycling. Here we are making an important contribution to supplying Europe with raw materials for the energy transition and digital transformation. Aurubis already processes more than one million tons of recycling materials today. Roughly 44 % of our copper cathodes are made from recycling materials.

Today, the CO₂ footprint of our copper is already less than half the average of our competitors worldwide. We understand our responsibility for handling limited resources – so we will not let up in our efforts. Everything we do is always in line with our aim to responsibly transform raw materials into value. Our production will be carbon neutral well before 2050. We are making targeted investments in sustainable projects, continually improving and optimizing our plants, having our processes and supply chains certified, and keeping our sustainability promise to customers with Tomorrow Metals.

At Aurubis, we are laying the foundation for a society more in harmony with nature with our products. We are well aware of our responsibility as a leading multimetal company. We are part of the solution, because without metals, there's no sustainable future.

With this Environmental Report, we'd like to personally welcome you to learn about environmental protection performance at Aurubis.

We hope it's an interesting read.

Sincerely,



Dr. Heiko Arnold
Chief Operating Officer
Custom Smelting & Products



Inge Hofkens
Chief Operating Officer
Multimetal Recycling



Dr. Heiko Arnold

Chief Operating Officer
Custom Smelting & Products



Inge Hofkens

Chief Operating Officer
Multimetal Recycling

“We are doing pioneering work in environmental protection – whether it’s the implementation of innovative projects like RDE (Reducing Diffuse Emissions) at the Hamburg site, one of the largest environmental protection projects since the 1980s, the construction and operation of a pilot plant for recycling lithium-ion batteries, or the testing of alternative fuels like hydrogen and ammonia.”

“Aurubis already numbers among the leading multimetal recyclers in the world today. But for us, that’s not enough: We are expanding our recycling capability step by step with groundbreaking projects and underscoring our industry pioneering role in environmental protection.”

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. In June 2022, Aurubis began construction on the first secondary smelter for multimetal recycling in the US. The state-of-the-art plant is expected to be commissioned in 2024.

Aurubis AG sold four sites of the former Aurubis flat rolled products segment to KME SE, Osnabrück, with effect from July 29, 2022. Aurubis has approximately 6,900 employees Group-wide.

Sustainable conduct and business activity are integral components of Aurubis' strategy and solidly enshrined in our corporate culture. Based on binding targets and appropriate measures related to the environment, social issues, and corporate governance, we are enshrining sustainability even more strongly in the entire company and in all of our work-

flows, processes, and new projects. In addition to our products, our production techniques already make a pivotal contribution to responsibly handling resources and thus play a role in the energy transition.

Business model and Group structure

Metals play a pivotal role in a number of forward-looking applications. Following industrialization, automation, and digitalization, the transformation to a sustainable, carbon-neutral economy and society is currently posing significant challenges. Many of the solutions in this area – such as electric vehicles and wind turbines – are based on the use of metals.

The Aurubis Group's business model rests on three fundamental pillars: the processing of raw materials from the mining industry, the processing of recycling materials, and product business. This provides Aurubis with a great deal of efficiency and flexibility in managing raw material procurement, production, and sales. Different market cycles influence each of the three fundamental pillars as well.

We process copper concentrates that are obtained from ores and are offered by mining and trading companies on the global market. The necessary input 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 here 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 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 of these also reach us directly from industry through our closing-the-loop approach.

On the demand side, our main competitors for input materials are other copper and metal smelters, as well as metal processors that also utilize recycling materials. Most of the copper scrap reaches us by land.

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.

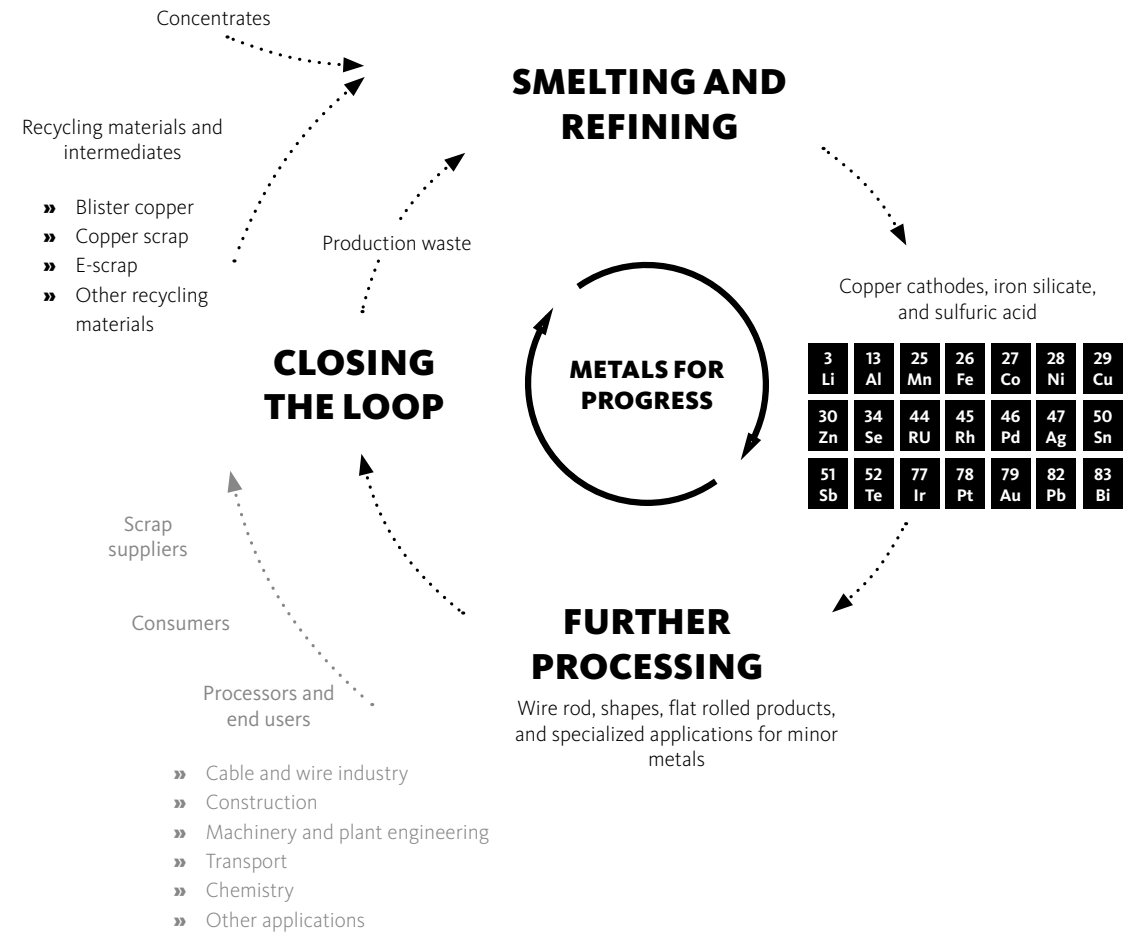
Additional products result from processing the elements that accompany copper in the feed materials. Targeted purchases of some of these are also made in the multimetal sector. In particular, these include different metals such as gold, silver, lead, nickel, tin, zinc, minor metals like tellurium and selenium, and platinum group metals.

We also produce synthetic minerals, our iron silicate products.

Sulfuric acid forms as a by-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 sector, and the chemical industry, as well as suppliers from the renewable energies, construction, and automotive sectors. 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. The materials range from copper scrap with very high copper content, which we can directly feed into the copper fabrication process, to stamping waste containing precious metals and high levels of copper, alloyed scrap, slags from foundries, and other industrial residues.

Fig. 1.1: The Aurubis AG business model



Our Group structure

In the reporting period, the Aurubis Group's organizational framework was based on the underlying business model. In the course of developing the Aurubis Group's strategy, the segmentation was adjusted with effect from October 1, 2021. Since then, the two Multimetal Recycling and Custom Smelting & Products segments have formed the fundamental organizational structure.

The **Multimetal Recycling (MMR)** segment comprises the recycling activities in the Group and thus the processing of copper scrap, organic and inorganic recycling raw materials containing metal, and industrial residues. The segment mainly includes the sites in Lünen (Germany), Olen and Beerse (both in Belgium), and Berango (Spain). The secondary smelter, Aurubis Richmond, currently under construction in the US state of Georgia, is also included in this segment.

The **Custom Smelting & Products (CSP)** segment comprises the production facilities for processing copper concentrates and for manufacturing and marketing standard and specialty products such as cathodes, wire rod, continuous cast shapes, strip products, sulfuric acid, and iron silicate. The Custom Smelting & Products segment is also responsible for precious metal production. The sites in Hamburg (Germany) and Pirdop (Bulgaria) manufacture copper cathodes, which are processed further into wire rod and shapes at the Hamburg (Germany), Olen (Belgium), Emmerich (Germany), and Avellino (Italy) sites. The Buffalo (US), Stolberg (Germany), and Pori (Finland) sites produce flat rolled products and specialty products.

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, protect nature and biodiversity, and prevent or minimize as far as is technically possible 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 impacts 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 corporate strategy

For Aurubis, responsible corporate governance is an integral contribution to securing the company's future.

The previous company strategy was updated in fiscal year 2020/21 and is now expressed by our "Metals for Progress: Driving Sustainable Growth" motto. The key elements of the strategy are securing and strengthening the core business, pursuing growth potential, and expanding our industry leadership in sustainability. With the development of the company strategy, our sustainability aspirations will be integrated even more strongly into all areas and activities of the company.

The key element "industry leadership in sustainability" includes the focus areas of people, the environment, and the economy, with our nine action areas. For each action area, new or continuing targets were defined for 2030. The existing Sustainability Strategy with its 2018–2023 targets is assimilated as a milestone into the new Group strategy for 2030.

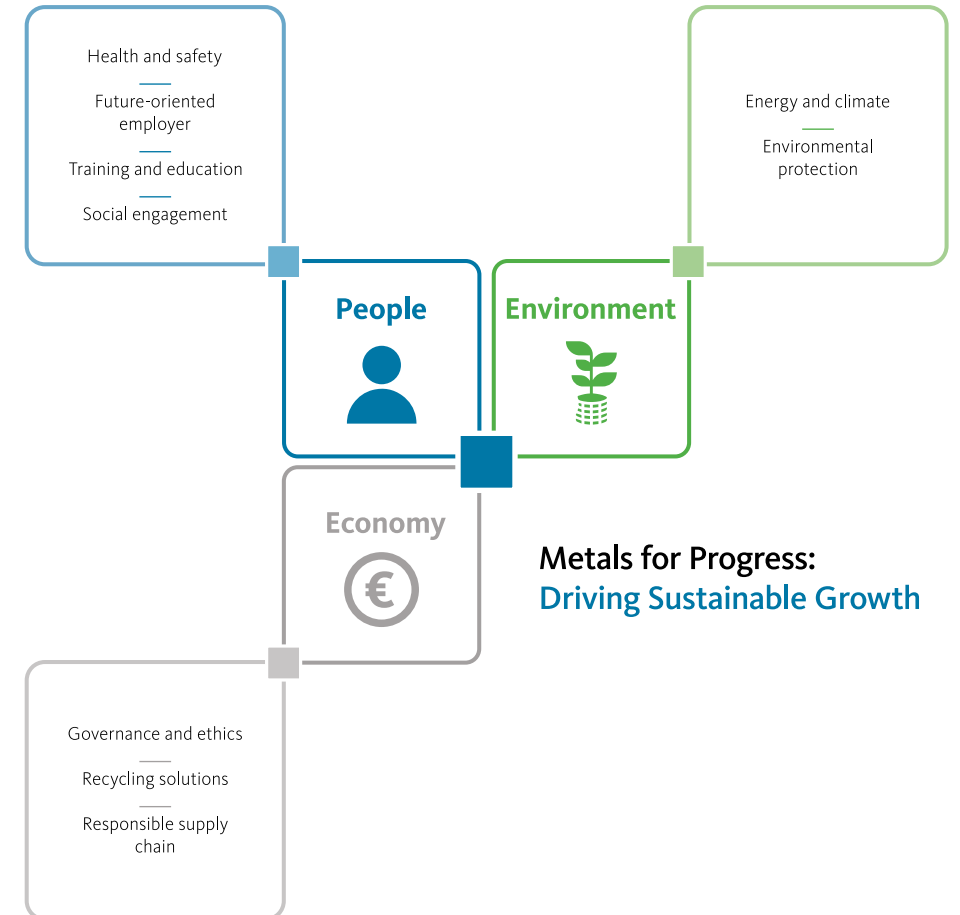
More information on sustainability at the Aurubis Group is available in our current Sustainability Report aurubis.com/en/responsibility/reporting-kpis-and-esg-ratings.

We are leaders in our industry 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 CO₂ 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 materials – especially for a country like Germany that lacks natural resources. It makes an important contribution to supply security, to environmental and resource protection, and to decarbonization. It is becoming more and more important to recycle products after their life cycle is over. Valuable raw materials are used efficiently, resources are conserved, and environmental pollution is avoided. 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. This is how customers also become suppliers. In the spirit of resource protection, nearly all raw materials are converted into marketable products, and waste is effectively avoided and – wherever possible – recycled.



Targets and successes in environmental protection

When determining the targets as part of our updated Sustainability Strategy, we provided for the company's transformation from a copper to a multimetal producer. In the future, our new specific reduction targets and the associated reporting of specific emissions will no longer be based on copper output, but rather on a multimetal indicator – the copper equivalent.

The calculation is based on an approach that has already been established at a European level within the framework of an EU project on the life cycle assessment (environmental footprint) of organizations and products, the Organisation Environmental Footprint and the Product Environmental Footprint. The copper equivalent describes all the metals Aurubis produces. It standardizes the entire metal production using a weighting factor based on the respective average metal prices. The observation period for the relevant metals ranged from seven to nine years. To prevent the influence of value fluctuations, the average prices used for the metals are fixed for the entire target timeframe of the Sustainability Strategy. The calculation method was verified by external auditors in 2021.


This Environmental Report contains the first reporting on target achievement based on the new KPIs. The closing of the target timeframe of the 2018–2023 Sustainability Strategy, now integrated as interim targets in the 2030 Aurubis Group Strategy, marks the final reporting of our specific emissions based on copper production.

Our 2022/23 interim targets as part of the 2030 Sustainability Strategy

Within the scope of the 2018–2023 Sustainability Strategy, we have set Group-wide targets in environmental protection and defined concrete targets for the individual sites. The effectiveness of these targets and measures was continuously reviewed.

With a 43 % reduction in dust emissions per ton of copper output in copper production in 2022 compared to 2012, we considerably exceeded our set target of a 15 % reduction by 2022.

Aurubis' 2030 sustainability targets

Action area	Ambition	2030 targets	2022/23 interim targets ¹
 Environment			
Energy and climate	We will be carbon-neutral well before 2050.	-50% absolute Scope 1 and Scope 2 emissions (base year 2018) -24% Scope 3 emissions per t of copper cathodes ² (reference year 2018)	» ISO 50001 at all production sites
Environmental protection	We produce with the smallest environmental footprint in our sector.	-15% specific dust emissions in g/t of multimetal copper equivalent (reference year 2018) -25% specific metal emissions to water in g/t of multimetal copper equivalent (reference year 2018)	» ISO 14001 at all production sites » Reduction of specific metal emissions to water by 50% in g/t of copper (Cu) output (reference year 2012) » Reduction of specific dust emissions by 15% in g/t of Cu output (reference year 2012)

¹ The previous Sustainability Strategy and its 2018–2023 targets were assimilated as “2022/23 interim targets” into the Group strategy through 2030 and supplement Aurubis' 2030 sustainability targets.

² Refers to copper cathodes from internal production.

Similarly, SO₂ emissions per ton of copper output in primary copper production were reduced by 24 % in the same period under review.

We have also made significant improvements in water pollution control. Since 2012, we have reduced metal emissions to water in copper production processes from 2.2 to 0.8 g per ton of copper output. This is a decline of 63%. We achieved our target, which was further tightened in 2020, of a 50 % reduction (previously 40 %) by 2022.

These successes were only possible through continuous investments: Since 2000, we have invested more than € 780 million 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 and the solar plant in Pirdop. This long-term commitment has been successful: We have considerably reduced our CO₂ emissions per ton of copper produced at the sites. Today, the CO₂ footprint of Aurubis copper cathodes is an impressive 60 % below the global average of all copper smelters and refineries* [🔗 A comparison – Life cycle assessments for our metal products.](#)

Group-wide introduction of the environmental management system in accordance with ISO 14001 was successfully completed. For example, over the course of 2022, certification audits of the Buffalo, Stolberg, and Retorte (Röthenbach an der Pegnitz) production sites, which had not yet been certified in accordance with ISO 14001, were successfully carried out. We were also able to achieve our goal of introducing an energy management system in accordance with ISO 50001 throughout the Group.

Fig. 1.2: Our environmental targets

Climate protection

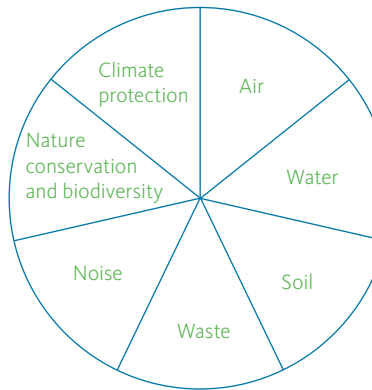
- » Target: Reducing CO₂ emissions by 100,000 t of CO₂ compared to 2012 through energy efficiency projects and heat recovery projects
- » Example: Use of industrial waste heat for district heating in Hamburg

Nature conservation and biodiversity

- » Target: Improving nature conservation at the production sites
- » Example: Participation in the NABU project UnternehmensNatur in Hamburg

Noise

- » Target: Reducing noise emissions, especially in new technical projects



Air

- » Target: Reducing dust emissions in copper production by 15% compared to 2012 by 2022
- » 43 % reduction achieved in 2022*
- » Example: Reduction of fugitive emissions

Water

- » Target: Reducing metal emissions to water in copper production by 50% compared to 2012 by 2022
- » 63 % reduction achieved in 2022*
- » Example: Optimizing the new rainwater treatment systems in Lünen and Pirdop

Soil

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

Waste

- » Target: Increasing recycling rates
- » Stronger marketing of fayalite in Pirdop

Environmental management

- » Target: Introducing ISO 14001 standard across the Group

The target for reducing metal emissions to water was increased from 40 % to 50 % in spring 2020.

* The Aurubis sites in Beerse and Berango have been included since 2020.

* Sources: International Copper Association, Copper Environmental Profile, 2022/ Aurubis, with support from Sphera. Reference years 2020 and/or 2021.

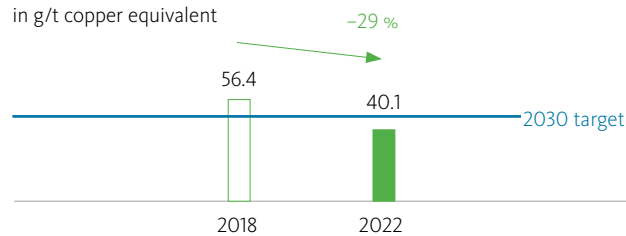
Our environmental protection targets as part of the 2030 Group Strategy

In 2022, dust emissions in multimetal production per ton of copper equivalent output were reduced by 29% compared to 2018 (target: -15%). The RDE project with a total investment of € 85 million thus far was a major contributor to this success

In focus: Our flagship projects in environmental protection. Our goal now is to maintain this low emission level and continue to improve through technical measures.

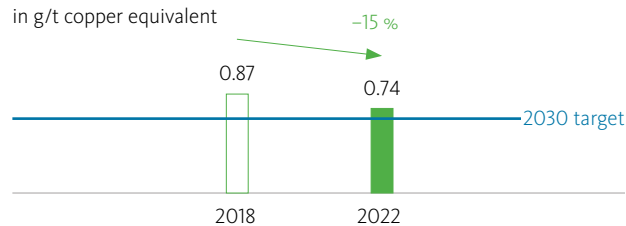
Specific dust emissions in Aurubis Group multimetal production

in g/t copper equivalent



Metal emissions to water in Aurubis Group multimetal production

in g/t copper equivalent



In 2022, metal emissions to water per ton of copper equivalent output in multimetal production were reduced by 15% compared to 2018. We plan to achieve our goal of a 25% reduction by 2030 by implementing new projects and making improvements to the existing facilities.

In focus: Our flagship projects in environmental protection

Producing with new, innovative environmental protection technologies

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 have invested about € 85 million so far in measures to continue reducing emissions in the primary smelter with our RDE project (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. For RDE, new technologies are being used and combined in completely new ways. The specially developed, needs-based control of the ridge turrets uses a level of digitalization in environmental protection that is unique in the metals industry thus far, and ensures efficient implementation with the high volumes of exhaust air. Once our plans are fully implemented, we will reduce diffuse emissions from the primary smelter by more than 70%. All of this contributes to the targets of our Sustainability Strategy – and makes the site ready for the future in the long term.

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

View of the new exhaust system at the Hamburg site close to the city



Solar energy for copper production

The Aurubis-1 internal 10 MW solar plant was constructed at the Aurubis site in Pirdop (Bulgaria) and came on stream at the end of 2021. It is currently the largest solar plant for in-house electricity production for a company in Bulgaria and comprises over 20,000 solar panels on a remediated and recultivated landfill of 100,000 m². In the reporting year, the Aurubis-1 solar park generated approximately 13,500 MWh of electricity for the Pirdop plant, significantly reducing external electricity consumption.

The electricity generated is equivalent to the annual needs of about 4,200 households. The site's goal is to cover 20% of its total energy needs from renewable sources by 2030. The expansion of the solar park was approved in December 2022. An investment around € 12 million will increase output from 14 MWp to 24 MWp. The plant is scheduled to be commissioned as early as 2024. This makes Aurubis Bulgaria the first industrial consumer in the country to invest in the production of renewable energy on this scale.




In a nutshell: Additional environmental projects

- » In cooperation with Hamburg Energie, one of the largest continuous charging parks for electric vehicles in northern Germany was built and commissioned at the Hamburg site in June 2021. A total of 150 charging stations with green electricity were installed in two parking lots at the plant for employees, company cars, the internal company vehicle fleet, and guests to use. Since many places don't have any charging options for electric cars, Aurubis built the charging park in part to motivate its employees to buy electric cars. In addition to e-mobility, additional offers such as bicycle leasing, public transport subsidies, sustainable company car provisions, and the introduction of a minimum distance rule for flights also offer employees incentives for making a contribution to environmentally-friendly mobility.
- » 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.
- » After optimized water collection and provision significantly reduced wastewater discharged at the Lünen site compared to 2019, we are working on an additional improvement in sustainable water use as part of a water concept. 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 any process water into the public sewer system. A feasibility study was completed in summer 2022, which additional testing will verify. The project is slated for implementation in 2024.
- » 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 as part of decommissioning.


New technology for decarbonization

In spring 2021, we became the first company in the copper industry to test the use of hydrogen on an industrial scale at our Hamburg site. Here we used a gaseous mixture of hydrogen and nitrogen in place of natural gas to pole copper melt in the anode furnace during production. Poling refers to a metallurgical purification process or a reduction process in melted metal.


The pilot project, in which hydrogen and nitrogen were introduced in the production facility instead of natural gas, went according to plan. By consistently using hydrogen, Aurubis could reduce its CO₂ emissions from just the Hamburg anode furnace by about 5,700 t per year. This reduction could be multiplied many times over throughout the Group. This pilot project enabled us to test how the facilities react to the introduction of hydrogen, and we were able to get this production step up and running smoothly. With the experience gathered here, Aurubis has laid the foundation for additional Group activities for using hydrogen. The pilot project was awarded first prize at the national and state level in the 2021 Responsible Care competition held by the German Chemical Industry Association (VCI)  *Energy and climate protection.*

Along with hydrogen, ammonia can also contribute to the decarbonization of industry. Ammonia is not just an ideal hydrogen carrier; it can also be directly used as a fuel. Furthermore, ammonia is much easier to transport over longer distances than hydrogen. We started a pioneering test series on the use of blue ammonia in copper rod production at the Hamburg site. In the production of blue hydrogen, the resulting carbon dioxide is captured and stored underground using the carbon capture and storage (CCS) technique. The blue ammonia used for testing was supplied as part of the deepened hydrogen cooperation between Germany and the United Arab Emirates. If testing proves successful, we will look into the permanent use of blue ammonia on an industrial scale. This application would offer huge potential savings of 20,000 MWh of natural gas, which corresponds to 4,000 t of CO₂ per year.

Industrial heat for Hamburg

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 m³ 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 began with the expansion of the Industrial Heat project in Hamburg at the start of 2022. By converting a sub-process in copper production at the Aurubis plant in Hamburg, from 2025 onward, up to 20,000 additional apartments will be heated each year in cooperation with the Hamburg city energy utility, reducing CO₂ emissions in the city by up to 100,000 metric tons. The planned heat supply represents the largest use of industrial heat in Germany  *Energy and climate protection.*

In a nutshell: Additional environmental projects

- » 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.
- » To further reduce the emission of carbon monoxide and volatile organic compounds from smelters, a regenerative thermal oxidizer (RTO) is being installed at the Beerse site. Following a thorough investigation, the technology was selected and a supplier engaged. The permit process will start in the third quarter of fiscal year 2022/23.
- » To reduce noise and CO₂ 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 11,000 truck transports per year and thus over 780 t of CO₂ emissions annually. The strategic BOB (Bleed Treatment Olen Beerse) project, which involves a hydrometallurgical electrolyte purification system, will also contribute to reducing noise and CO₂ emissions. Electrolyte that used to be treated at another site in the Aurubis smelter network will be treated at the Olen site in the future. This will prevent a total of about 2,600 truck transports per year and thus around 1,500 t of CO₂ emissions annually.
- » Within the scope of an EU project, Aurubis helped develop the Organisation 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  *A comparison – Life cycle assessments for our metal products.*

Expanding our pioneering role in recycling

The economy, industry, and society are facing enormous challenges. As a leading multimetal company, we want to be part of the solution, since without metals, there's no sustainable future.

In recycling we continue to build on growth with our Metals for Progress: Driving Sustainable Growth strategy and are investing significantly in an important contribution to the circular economy in Europe, also another step on the way to becoming the most efficient and sustainable integrated smelter network worldwide.



Largest multimetal recycling plant in the United States – Aurubis Richmond, US

Aurubis is blazing a trail with its new recycling plant in the US state of Georgia: With the signing of a supply contract for a second plant module in 2023, Aurubis anticipates a total investment of around € 640 million for both project stages in the first secondary smelter specializing in multimetal recycling in the US. The additional equipment will increase the capacity

of the metal recycling plant in Richmond, currently under construction, from an annual 90,000 t to 180,000 t of complex metal scrap materials per year. The plant is a key contribution to Aurubis' commitment to the circular economy. Groundbreaking for Aurubis Richmond took place in mid-2022, and construction is currently running at full steam. Stage one of the plant is scheduled to go online in the first half of 2024, with the second stage to follow in 2026.

Recycling plant for nickel and copper in Belgium

At the Olen site, we are investing around € 70 million in BOB (Bleed Treatment Olen Beerse), a strategic project adding an energy-efficient and effective process step for recovering nickel – an essential metal for lithium-ion batteries and as such an important building block for the e-mobility megatrend. The

new facility in Belgium is another excellent example of how Aurubis is realizing synergies in its smelter network and making an important contribution to the circular economy in Europe. The project is in implementation and commissioning is scheduled for fiscal year 2024/25.



Growth area of battery recycling

We have operated a pilot plant for recycling batteries at the Hamburg plant since March 2022. Our goal is to close the battery production cycle by recovering valuable raw materials from the black mass generated from used lithium-ion batteries from electric vehicles and waste from battery production, and return these metals to battery production.

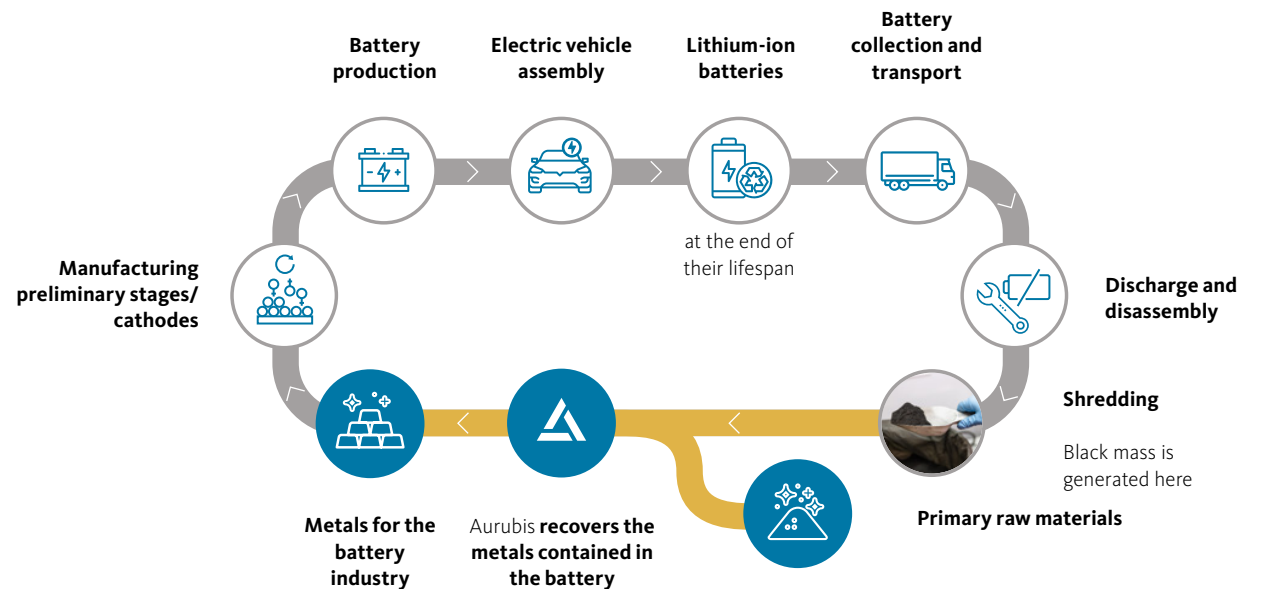
Black mass, a mixture created when lithium-ion batteries are dismantled and shredded, is broken down into its components and lithium, cobalt, manganese, and nickel are extracted in successive steps. Lithium would increase the number of metals produced by Aurubis to 21. After testing of our new hydrometallurgical process in a laboratory phase and successful patenting, in the pilot plant we will be testing the process on a larger scale, developing it further and collecting important data for the later construction of an industrial-scale plant.

Along with economic efficiency and material availability down the road, integrating the plant into the Aurubis smelter network is another central point. In addition to space requirements and cost, factors like the possible use of existing infrastructure and the optimal integration of metal flows will be taken into consideration in the selection of a suitable site.



Closing the loop

Aurubis recovers valuable metals from the black mass out of recycled battery from electric vehicles.



Innovative recycling of metals from residues

At the Belgian Beerse site, we are building a state-of-the-art recycling plant: ASPA (Advanced Sludge Processing by Aurubis). In the future, the hydrometallurgical ASPA facility will process anode sludge, a valuable intermediate product from electrolytic copper refining produced at the recycling sites in Beerse and Lünen. The new process will enable even faster extraction of more precious metals, such as gold and silver, but also tin, from the anode sludge. Total investment in the project amounts to € 33 million. Groundbreaking took place on December 15, 2022 and commissioning of the facility is scheduled for the second half of 2024.



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. We also took part in various environmental projects.

Since 2013 we have participated in the EU Organisation Environmental Footprint and Product Environmental Footprint projects, which seek to achieve an environmental balance in organizations and products. The goal of this collaboration is to develop, test, and possibly implement methods for determining the environmental footprint. In 2018, the two pilot projects we participated in were successfully concluded after the results were accepted by the official supervisory bodies. We are also leveraging our experience to further optimize our environmental footprint. We continue, for example, to be actively involved in advancing the industry rules for copper production.

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, back in 2016 we also joined the German Mobil.Pro. Fit® model project in collaboration with the B.A.U.M. e. V. environmental organization, 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. We have sponsored the “JobRad” bicycle leasing program at the site since 2021.

Since 2015, Aurubis has successfully participated in the Carbon Disclosure Project (CDP), which surveys companies about risks and opportunities related to the climate, as well as about CO₂ reduction potential. 2021 was the first year we took part in the CDP Water Security questionnaire, which deals with current and future water-related risks and opportunities. Initial participation involved an unassessed basic version of the questionnaire, and in 2022 we completed a full version, which was then assessed by the CDP. Aurubis' ambitions were awarded a B.

Environmental management organization

Chief Operating Officer for Multimetal Recycling Inge Hofkens 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. If an impacted site falls under another member of the Executive Board's remit, they are brought in.

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 all 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 are fundamentally 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. It has since been certified for all the areas mentioned. The IMS utilizes synergies, harmonizes processes, and improves management in these areas.

Furthermore, we determine key environmental protection factors (KPIs), 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 regularly trained on environmentally relevant topics.

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.

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 several years, we expanded the assessment to include the additional topics of biodiversity and nature conservation, along with water availability and water stress.

Fig. 1.4: Environmental management in the Aurubis Group

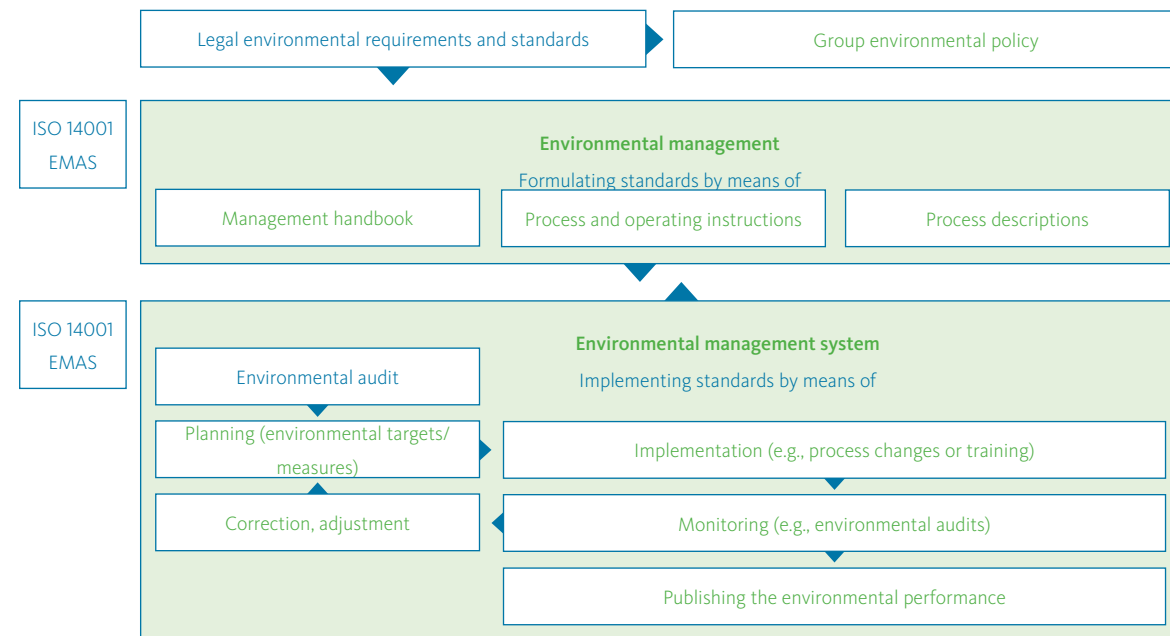


Fig. 1.5: Site certifications

Site	EMAS	ISO 14001	ISO 50001	ISO 45001	ISO 9001	IATF 16949	EfbV	WEEELABEX ³	Copper Mark
Hamburg, headquarters (DE)	x	x	x	x	x				x
Lünen (DE)	x	x	x	x	x		x	x	x
Pirdop (BG)		x	x	x	x				x
Olen (BE)		x	x	x	x				
Beerse, Metallo (BE)		x	x	x	x				
Berango, Metallo (ES)		x	x	x	x				
Emmerich, Deutsche Giessdraht (DE)		x	x	x	x				
Avellino (IT)	x	x	x	x	x				
Hamburg, E.R.N. (DE)		x	x	x	x		x		
Röthenbach, RETORTE (DE)		x	x	x	x				
Hamburg, Peute Baustoff (DE)		x	x	x	x ²				
Buffalo (US)		x	x	x	x	x			
Pori (FI)		x	x	x	x				
Stolberg (DE)		x	x	x	x	x			
Stolberg, Schwermetall (DE) ¹	x	x	x	x	x				

¹ Not majority-owned by Aurubis (50% stake).

² For the sale of iron silicate granules used to produce blasting abrasives.

³ WEEE LABEL of EXcellence.

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)

WEEELABEX: standards for the collection, sorting, storage, transport, preparation for reuse, treatment, processing, and disposal of waste electrical and electronic equipment

Copper Mark: quality seal for the copper sector for responsible copper production based on 32 internationally recognized sustainability criteria

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 achieve carbon neutrality through high innovative strength and competitiveness. We demonstrate that this aligns with our targets with our affirmation of the Science Based Targets initiative. We have committed to setting science-based CO₂ 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 CO₂ reduction projects through different energy efficiency measures for several years. Furthermore, we are working on making our energy input more flexible so that we can react to fluctuating availability and use more renewable energies. Shifting the electricity supply to renewable energies, the possible use of hydrogen as a reducing agent or ammonia 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 CO₂ – such as the Industrial Heat projects.

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 CO₂ emissions in the Group. Taking the entire value chain into consideration, over half of the CO₂ 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 CO₂ emissions in our society 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.

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 cannot 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, all sites are certified in accordance with DIN EN ISO 50001:2018.

Energy efficiency and reducing the use of fossil fuels

To prevent CO₂ 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 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. 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 CO₂ emissions outside of our plant, as well as on projects that contribute to the energy shift.



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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 CO₂ in the process. Aurubis is investigating where hydrogen can be efficiently and cost-effectively used 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 only forms water vapor, and not CO₂ as before. Ammonia is much easier to transport over longer distances than hydrogen. A trial delivery of ammonia from Abu Dhabi National Oil Company (ADNOC) to Aurubis via the Hamburger Hafen und Logistik AG (HHLA) will test the supply chain for ammonia as a fuel and its use as a replacement for natural gas in copper production.

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.

The Aurubis-1 solar park at the Pirdop site will optimize the smelter's external electricity consumption by 13,500 MWh per year. The electricity generated is equivalent to the annual needs of 4,200 households. Compared to coal-fired power generation, this will save over 7,000 t of CO₂ emissions per year – or over 225,000 t for the planned operating period.

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.



Celebrating the start of construction

of the solar park at the Pirdop plant with Prime Minister Kiril Petkov and Aurubis CEO Roland Harings on June 24, 2021

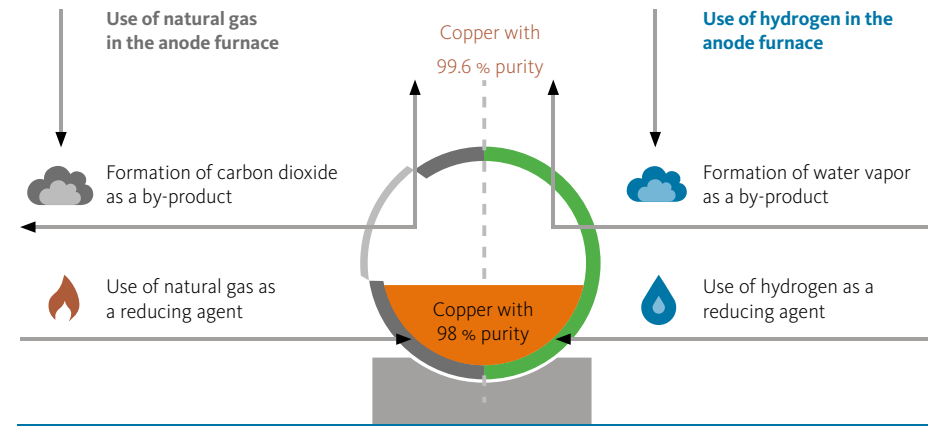


Hydrogen as an opportunity for energy-intensive industry

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.

In 2021, Aurubis successfully completed the series of tests for hydrogen use on an industrial scale in copper anode production at the Hamburg plant. The pilot project in which hydrogen and nitrogen were introduced in the production facility (anode furnace) instead of natural gas was successful. Initially, the current tests will gauge the reaction of the facility to the introduction of hydrogen and ensure that the individual production steps, which are highly sensitive in the energy-intensive metal production process, run smoothly. This could prevent 5,700 t of CO₂ in regular operations per year.

Fig. 1.6: Possibility of using hydrogen instead of fossil fuels



Kickoff

of the test series for the first use of hydrogen on an industrial level in the copper industry

Our successes

Successful participation in the CDP investor initiative since 2015

Aurubis has participated in the CDP investor initiative (formerly the Carbon Disclosure Project) since 2015. The CDP surveys companies about risks and opportunities related to the climate, as well as CO₂ reduction potential. CDP awarded Aurubis the distinction of Best Newcomer Germany (2015) and Index Leader MDAX (2016). Aurubis' ambitions were awarded an A- in 2022. The Sustainability Strategy and the transparent presentation of Aurubis' approach to the opportunities and risks of climate change contributed to the good performance. This distinction includes the copper products that contribute to increasing efficiency in applications, as well as the effective production processes, energy management, and investment in energy and CO₂ efficiency optimizations. For Aurubis, this award is proof of its innovation capacity and at the same time an incentive to keep up its efforts in CO₂ reduction and energy and resource efficiency.

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.



2021 VCI Responsible Care competition for the Hamburg plant

Aurubis AG won the Responsible Care competition of the German Chemical Industry Association (VCI) in 2021. As such, the association honored an innovative pilot project to decarbonize the copper process Aurubis started at its Hamburg plant in May 2021. For the first time, the multimetal company is using carbon-neutral hydrogen as a reducing agent for copper in the anode furnace, replacing the natural gas currently used in the process without a loss of quality. Following the success of these tests, tests were conducted with hydrogen derivatives (ammonia) in the wire rod plant in 2022 and 2023.



Responsible Care – ein Beitrag zur Nachhaltigkeitsinitiative Chemie³

Our flagship project – Industrial Heat from Aurubis

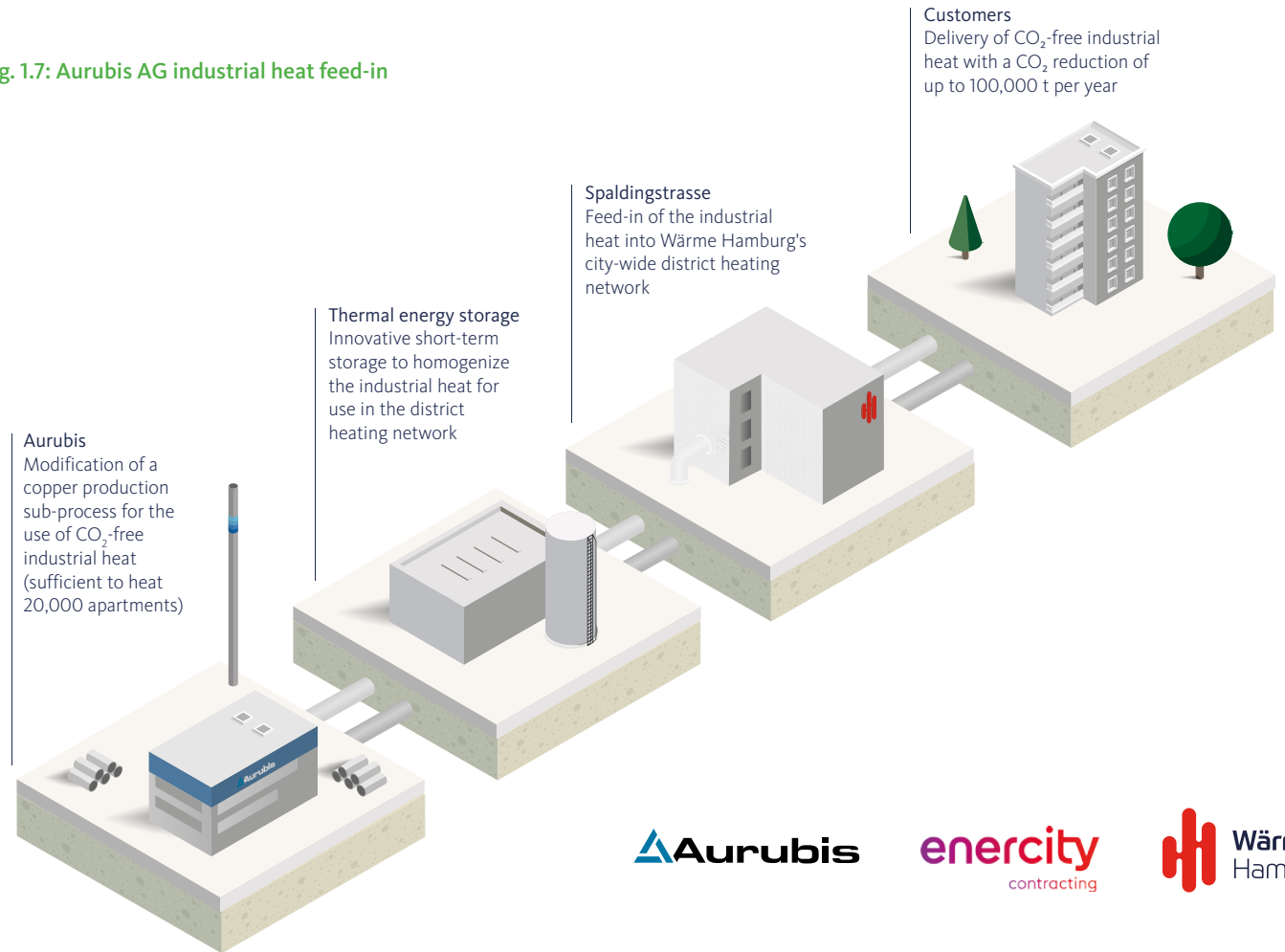
Now that the HafenCity has become the first quarter to be completely supplied with CO₂-free industrial heat, saving 20,000 t CO₂ emissions per year, during the 2023/24 shut-down, we will lay the groundwork for delivering even more heat to the city of Hamburg's district heating network.

As of the 2024/25 heating period, around 20,000 more households will be supplied with CO₂-free industrial heat. This is part of a heat supply contract that Aurubis and Wärme Hamburg signed in December 2021. The use of CO₂-free industrial heat in the Wärme Hamburg heating network will replace heat currently being generated from fossil fuels. This can save up to 100,000 t of CO₂ emissions in Hamburg every year starting in 2025. The planned heat supply represents the biggest use of industrial heat in Germany.

Calculations by the German Energy Agency (dena) show: Throughout Germany, companies could save up to 37 million t of CO₂ and roughly € 5 billion in energy costs if industrial heat were used consistently.

The following awards the project has received impressively demonstrate the flagship character of the climate alliance.

Fig. 1.7: Aurubis AG industrial heat feed-in



Responsible Care – ein Beitrag zur Nachhaltigkeitsinitiative Chemie³

VERBAND DER CHEMISCHEN INDUSTRIE e.V. WIR GESTALTEN ZUKUNFT.



Our raw materials – Responsibility in the supply chain

We take responsibility for sustainability standards, and not just in our own production processes and in our own actions, but in our supply chain as well. This is all the more important because we source raw materials from around the world. We systematically analyze the risks of our suppliers and supplier countries in view of possible risks regarding compliance with sustainability standards.

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 on the European and North American markets. Furthermore, we use copper scrap with high copper contents for cooling purposes in both of our primary smelters in Hamburg (Germany) and Pirdop (Bulgaria). Unlike primary raw materials, secondary raw materials are largely purchased on the basis of short-term supply contracts, which is customary for the market.

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 have participated in the United Nations Global Compact since 2014 and are committed to working towards implementing its ten principles related to human rights, labor standards, the environment, and anti-corruption. We have pledged to comply with the OECD Due Diligence Guidelines to promote responsible supply chains. As part of the Copper Mark

certification process at our sites in Hamburg, Lünen (both in Germany), and Pirdop (Bulgaria), we underwent audits in accordance with the Copper Mark criteria on human rights and labor and social standards. This audit verified our human rights approach to our business activities and in the supply chain. The audit feedback helps us continue to improve our approach.

To fulfill our due diligence obligation with regard to all of our material topics in the supply chain area, we implemented a Business Partner Screening system based on OECD guidelines. In our risk analysis, we consider both regional risks and the risks actually associated with the business activities of our business partners. The central issues here include anti-corruption, upholding human rights, occupational safety, and environmental and climate protection, as well as OECD obligations and third-party certification. The results of a media search are also

included in the screening. In the 2021/22 fiscal year, all procurement processes, including those for conflict minerals, were revised with a particular focus on supply chain due diligence. The new Responsible Sourcing Policy entered into force on October 1, 2022.

We expect our business partners to report substantiated suspicions of human rights violations, for example using our Compliance Portal, also referred to as the whistleblower hotline. Complaints about sites that are taking part in the Copper Mark process can also be submitted through the Copper Mark's grievance mechanism: secure.ethicspoint.eu/domain/media/en/gui/107757/index.html and aurubis.com/en/responsibility/whistleblower-hotline.

Fig. 1.8: Origin of concentrates and throughput for the Aurubis Group in 2020/21, in %

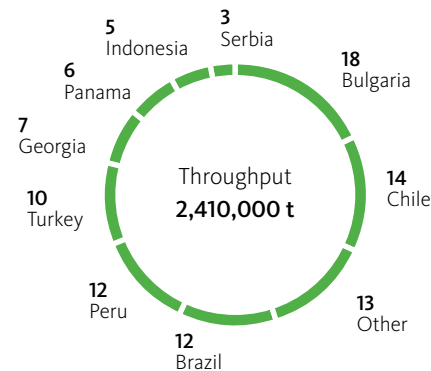
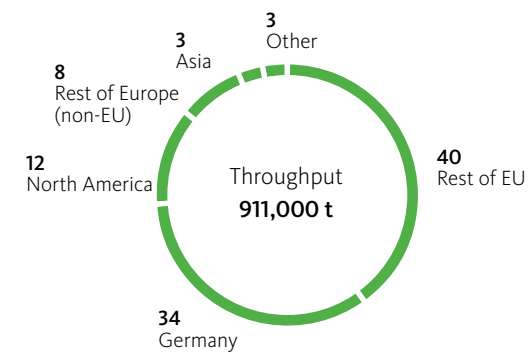


Fig. 1.9: Origin of recycling materials and throughput for the Aurubis Group in 2020/21, in %



Excluding FRP

Regulations and standards for responsible metal production

Since 2013, Aurubis' gold production has already been annually certified as conflict-free according to the standards of the London Bullion Market Association (LBMA). This certificate verifies that we carry out our due diligence processes in accordance with the OECD standards. This certification option has been available for silver since 2019, and Aurubis' silver production has been certified as conflict-free since then as well. Tin production at our Beerse and Berango sites has been certified as conflict-free in accordance with the Responsible Minerals Assurance Process (RMAP) standard since 2015. This standard is also based on the OECD standard for conflict minerals.

The regulatory audit of the German and Bulgarian sites for compliance with the due diligence requirements in accordance with the EU Conflict Minerals Regulation began in fiscal year 2021/22. This legislation makes due diligence and auditing obligations along the supply chain binding for EU importers of tin, tantalum, tungsten, and their ores, as well as gold.

The Aurubis plants in Hamburg, Lünen, Pirdop, and Olen were successfully audited in line with the Copper Mark due diligence standard for the responsible procurement of copper, lead, nickel, and zinc during fiscal year 2021/22. The Copper Mark published the standard, a more detailed version of the previous guidelines, at the beginning of 2022. It also helps fulfill the standards of the London Metal Exchange (LME). This standard is currently being reviewed by the OECD for conformity with its due diligence requirements, which is a prerequisite for recognition by the LME.

Indirect procurement

Procurement screens the main suppliers of fixed assets, services, consumables, and spare parts on behalf of the plants. The result includes a profile that, in the case of increased risk, leads to additional research. Based on this subsequent assessment, management makes decisions about contracts and possible related restrictions. For existing business partnerships, we regularly repeat the analysis depending on how the individual risk develops and on the dialogue that takes place. When sourcing capital goods, detailed environmental protection and safety requirements for the product or for the services to be provided are defined and taken into consideration as necessary. A similar process applies to sourcing energy.

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 assessed, 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.

Since 2022, risk analysis has also included the areas of biodiversity, water availability, and nature conservation. Opportunities are systematically analyzed as well. The reports for the Hamburg, Lünen, Pirdop, Olen, Beerse, and Berango sites were completed in September 2022. 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. The risk assessment is scheduled to be updated in 2023 and will include all production sites.

One opportunity is that Aurubis will substantially contribute 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 target of becoming carbon neutral well before 2050. In late 2019, we joined the UNGC initiative Business Ambition for 1.5°C, which requires the Group to set science-based emissions 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 [📄 2021/22 Annual Report](#). 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). For the first time as well, a separate climate risk report was included in the 2021/22 Sustainability Report. It was drafted in accordance with TCFD recommendations and reported on climate risks using generally accepted global

warming scenarios and, in particular, on the physical risks at our sites. 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 [📄 2021/22 Annual Report](#). 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.

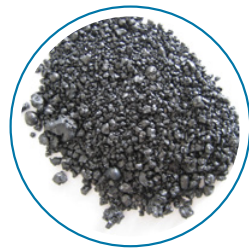
What does iron silicate consist of?

As the name suggests, it mainly consists of the mineral iron silicate, as well as silicates of aluminum and calcium. It may still contain non-ferrous trace metals primarily 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 granulate, similar to natural volcanic glass, e.g., obsidian



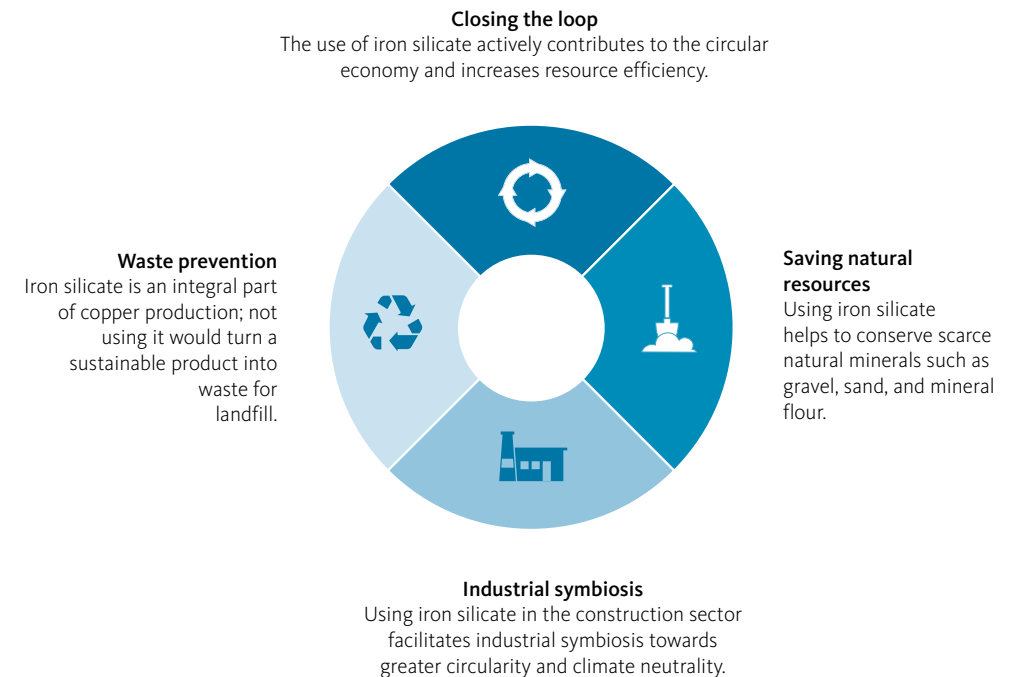
Iron silicate fines, similar to mineral flour

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





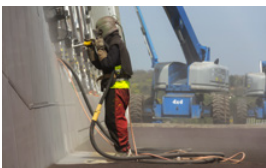
A long-lasting, sustainable replacement for natural building materials

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



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 tide and waves.	<ul style="list-style-type: none"> » Thinner stone layers and less excavation work » Stability through high dry bulk density, cubic particle shape, and optimal surface texture
Road construction		Anti-frost and gravel-bearing layer	<ul style="list-style-type: none"> » Very good load-bearing capacity » Frost resistance » Water permeability
Cement		Underlay for paving	<ul style="list-style-type: none"> » Ready-to-use source of iron » Decreases burning temperature and therefore fuel consumption
Concrete production		Versatile use as a substitute for natural aggregates and Portland cement	<ul style="list-style-type: none"> » Enhances workability in its fresh state, improves mechanical properties, enhances durability » Enables special types of concrete, e.g., radiation protection concrete, heavyweight concrete
Abrasives		Granulate used for blast cleaning	<ul style="list-style-type: none"> » Provides a perfect grit for blasting steel, stone, and concrete

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

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.



Project

DuRSAAM

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



Project

SOCRATES

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



Project

RECOVER

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



Project

GHRANTE

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

A new raw material for construction that saves natural resources: The first projects using iron silicate as a filler in cement have been realized in Bulgaria

Impressions from a number of constructions sites in Bulgaria that used cement with iron silicate as a filler. With this pilot project, we are pursuing the goal of offering and establishing a new, resource-efficient, and – close to our plants – locally available raw material: iron silicate from our copper production.



Floor slab

of a private house



Primary construction

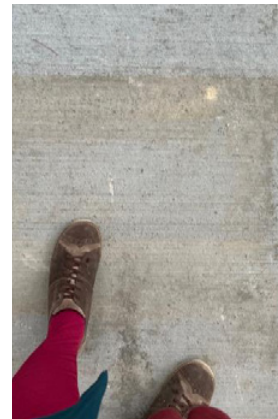
of a building



Supporting walls

Soil fortification

on a farm



Buildings

Biodiversity

We are actively involved in creating and maintaining good conditions for species conservation and biodiversity in our plants and their surroundings. We have recognized that protecting biological diversity is one of the greatest environmental challenge of our time, and adopted it as an additional dimension of our sustainable development. It has therefore been part of our environmental targets for a number of years and was included in our Company Guidelines on Environmental Protection at the start of 2023. We want to further expand and systematize our commitment in this area and our biodiversity management.

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: We take part in the Hamburg initiative UnternehmensNatur to promote biodiversity at our site there, for instance. 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.

Generally the options for promoting biodiversity are assessed for every construction or other type of project.

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

	Name	Type	Distance	Direction
Hamburg (DE)	Hamburger Untereibe	Natura 2000	200–600 m	Southeast
	Holzhafen	Natura 2000	600–1,000 m	East
	Heuckenlock/Schweenssand	Natura 2000	3,600 m	South
Pirdop (BG)	Tsentralen Balkan – bufer (nature conservation area)	Natura 2000	approx. 1,000 m	North
	Tsentralen Balkan – bufer (bird sanctuary)	Natura 2000	approx. 1,700 m approx. 2,300 m	North East
	Sredna gora ¹	Natura 2000	approx. 2,300 m	South
Lünen (DE)	In den Kämpen, Im Mersche, and Langerner Hufeisen	Natura 2000	< 2,000 m	Northeast
	Lippeaue	Natura 2000	< 5,000 m	Northwest
	Lippe-Unna, Hamm, Soest, Warendorf	Natura 2000	< 2,500 m	Northwest
Olen (BE)	Valleigebied van de Kleine Nete met brongebieden, moerassen en heiden	Natura 2000	approx. 1,000 m	
	De Vallei van de Kleine Nete Benedenstroom	VEN ²	approx. 1,000 m	North
	Het Olensbroek en Langendonk	VEN ²	approx. 1,000 m	North
Beerse (BE)	Eksterheide	Natura 2000	approx. 500 m	West
	Duivelskuil	Natura 2000	approx. 750 m	Southwest
	De Pomp-Poelberg	Natura 2000	approx. 1,000 m	Northwest
Berango (ES)	Ría de Mundaka-Cabo de Ogoño Marine Area	Natura 2000	approx. 3,500 m	North
	Ría del Barbadún	Natura 2000	approx. 10,000 m	Southwest

¹ 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.

² VEN: Vlaams Ecologisch Netwerk (Flemisch Ecological Network).

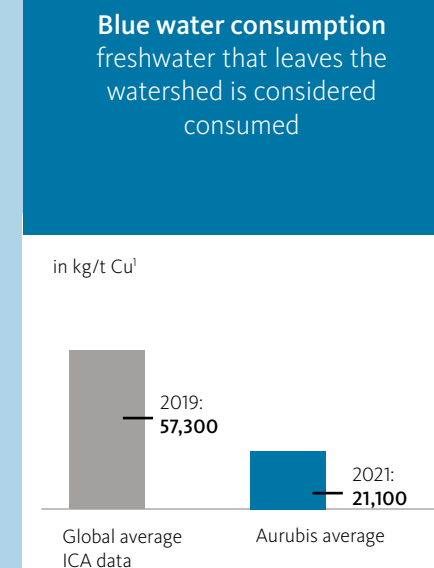
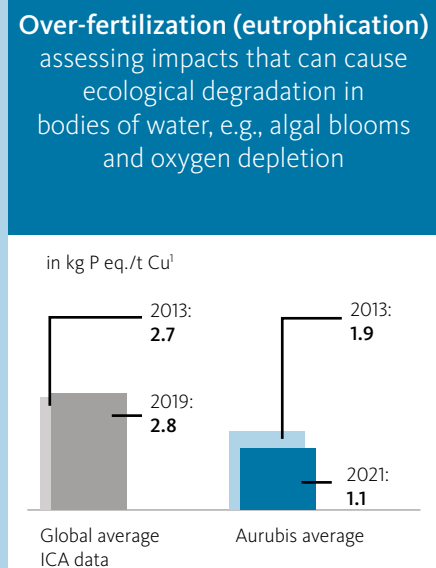
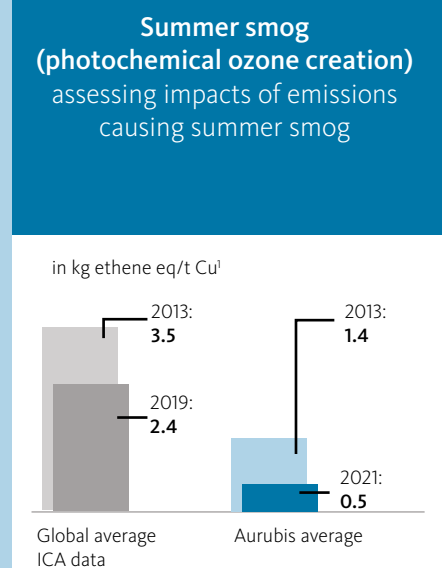
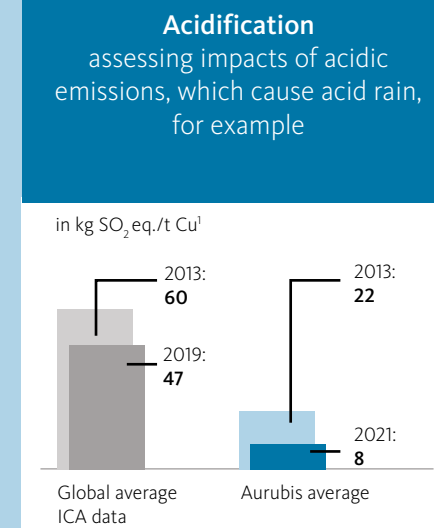
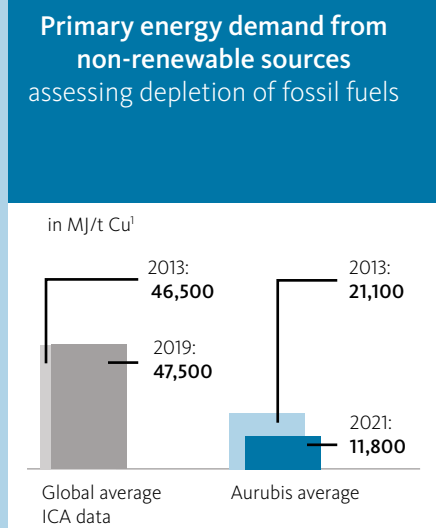
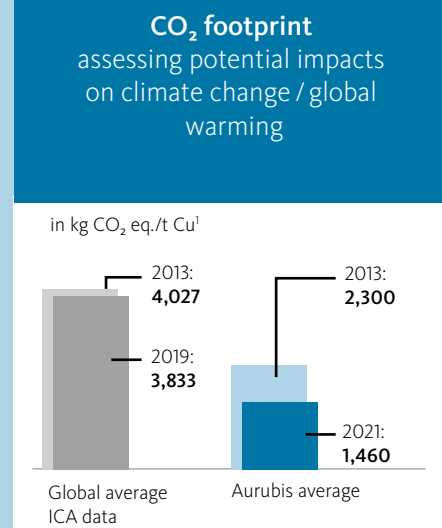
A comparison – Life cycle assessments for our metal products

The EU has introduced an ambitious industrial shift aimed at achieving a green and digital transformation. Copper, tin, silver, gold, and other metals number among the most important materials for this transition. Almost all green technologies, such as wind turbines, solar energy plants, batteries, network technologies, and hydrogen electrolyzers, require a larger quantity of metals. This means sustainable metal production is growing in importance.

Aurubis assumes responsibility for the global challenges of climate change, environmental protection, and resource conservation. Here our focus includes improving the environmental compatibility of products and promoting sustainability along the entire supply chain. We have continued to advance the life cycle assessments of our products. In addition to updating the environmental profile of our core product, the copper cathode, we have also completed life cycle assessments for gold, silver, and tin along with our wire rod and continuous cast shapes copper products based on 2021 data.

The life cycle assessments included all the activities required for manufacturing the products from the cradle to the plant gates. These include ore mining, smelting and refining, transport, energy consumption, and auxiliary materials. The studies were undertaken in accordance with the 14040 and 14044 ISO standards for life cycle assessments. The impact categories were selected to cover a wide range of environmental impacts and were each determined using a well-established scientific approach.

Results from the life cycle assessment for copper cathodes¹



¹The diagrams show the industry's global average results for reference years 2013 and 2019 (left bar) and the Aurubis average results for copper production in 2013 and 2021 (right bar). Results in keeping with the CML impact assessment method.

The environmental profiles of the Aurubis products were tested by TÜV NORD CERT in accordance with the DIN EN ISO 14040:2021 and DIN EN ISO 14044:2021 standards. The results support what the Tomorrow Metals by Aurubis label stands for. The ecological footprint of Aurubis copper cathodes has considerably decreased even more in all the impact categories assessed. In 2021, the CO₂ footprint was 35 % lower than in 2013. At the same time, the CO₂ footprint is more than 60 % lower than the current global industry average for copper cathodes from the International Copper Association.

The results from all the other products assessed also underscore Aurubis' pioneering role. Our silver and gold CO₂ footprints are both more than 50 % below the global industry average. Our recycling and the efficiency of our metal recovery contribute decisively to our positive results. In fiscal year 2019/20, the recycling content of Aurubis silver and gold was 58 % for silver and 27 % for gold.

The values for tin are even better with a CO₂ footprint at 76 % below the global average from the International Tin Association. Aurubis manufactures tin bars completely from secondary raw materials.

Data sheets on the life cycle assessments of our products are available at: aurubis.com/en/responsibility/environment-energy-and-climate/ecological-footprint-of-our-products/environmental-profiles-of-our-products

CO₂ FOOTPRINT OF COPPER CATHODES

in kg CO₂ equivalent per t copper cathodes

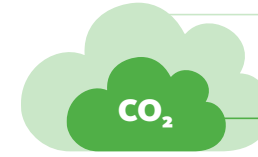


3,833
Global average
(reference 2020)

1,460
Aurubis copper
(reference 2021)

CO₂ FOOTPRINT OF TIN

in kg CO₂ equivalent per kg tin



6,632
Global average¹
(reference 2020)

1,570
Aurubis tin²
(reference 2021)

CO₂ FOOTPRINT OF SILVER

in kg CO₂ equivalent per kg silver

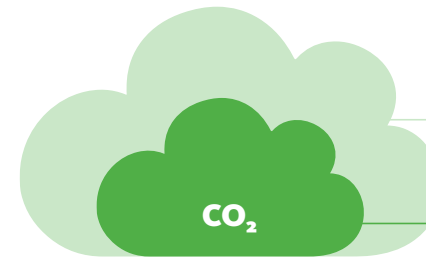


448
Global average³
(reference 2021)

209
Aurubis silver⁴
(reference 2021)

CO₂ FOOTPRINT OF GOLD

in kg CO₂ equivalent per kg gold



36,400
Global average⁵
(reference 2019)

16,200
Aurubis gold⁴
(reference 2021)

¹ International Tin Association, Life cycle assessment of average tin production.

² Aurubis with support from Sphera, report: Life Cycle Assessment of Tin, Oct. 2022; results in keeping with the CML impact assessment method (CML 2001, update August 2016).

³ Ecoinvent.

⁴ Aurubis with support from Sphera, report: Life Cycle Assessment of Silver and Gold, Oct. 2022; results using the environmental footprint impact assessment method (EF 3.0).

⁵ World Gold Council, Gold and climate change: Current and future impacts.

How we achieved this: Improvements through the continual implementation of environmental and climate protection measures

The targeted improvements were only possible through considerable investments in environmental measures that achieved ambitious environmental standards. In environmental protection, Aurubis also develops innovative and energy-efficient technologies that often set new standards worldwide.

Emission reduction

One approach we have taken to reducing emissions in air is the innovative gas purification plant installed at our primary smelter in Pirdop (Bulgaria). The plant uses a modern process known as Sulfacid that is unique in both Bulgaria and in the entire copper smelting industry.



Energy-efficient technologies

We have also invested in energy-efficient and low-carbon technologies at all Aurubis Group sites, implemented energy-saving measures, supported the switch to renewable energies, and as such enabled decarbonization. This includes the Industrial Heat project, for example, implemented at the Hamburg plant to use the waste heat from our production processes for district heating. The project has made the HafenCity East the first quarter close to our Hamburg plant that is now almost exclusively supplied with CO₂-free industrial heat.



Expanding recycling capacities

Expanding Aurubis' recycling capacities and the acquisition of recycling specialist Metallo also contributed to improving our ecological footprint. With the recycling facilities in Beerse (Belgium) and Berango (Spain), Aurubis has considerably expanded the recycling of secondary materials, which results in an even smaller footprint in the LCA results.



Improve recovery of multimetals

Aurubis' efforts to transform raw materials into marketable products as completely as possible are also contributing to shrinking our overall footprint. Aurubis will continue to build on this strength in order to further cement our position as the most efficient and sustainable integrated smelter network in the world. This network also includes a metallurgic infrastructure that enables improved multimetal recovery.

All these measures have allowed us to reduce direct emissions of pollutants like sulfur dioxide and dust along with greenhouse gases. At the same time, we have expanded our recycling activities and increased the efficiency of our metal recovery. This is reflected in the improved results of our life cycle assessments.



Tomorrow Metals by Aurubis: We are ready for the future – are you?

With the Tomorrow Metals label, Aurubis emphasizes the strong Group-wide focus on sustainability. This label is our promise to our customers and all our stakeholders that our entire product range is manufactured and delivered using only the highest ecological and social standards – today and in the future.

Tomorrow Metals by Aurubis is more than just a pure pledge of sustainable and responsible conduct. The label is supported by four pillars that comprise reliable KPIs.

- » Aurubis has invested more than € 780 million in environmental protection measures since 2000, successfully reducing dust emissions to air by 97 % and metal emissions to water by 89 % in copper production across the Group, among other achievements.
- » Aurubis is determined to keep shrinking its CO₂ footprint, thus contributing to the 1.5° goal of the Paris Climate Agreement. Compared to 2018, the Group aims to cut its Scope 1 and 2 emissions by 50 % and Scope 3 emissions by 24 % per ton of copper output by 2030. Today, Aurubis already produces copper with less than half the CO₂ per ton compared to international competitors.

» Currently, Aurubis' copper cathodes contain about 44% recycling material. To further promote the circular economy of metals, the Group will build on its plans to continue expanding its recycling capacities in the future as well – currently, these capacities amount to one million tons per year.

» We are aware of our responsibility. When selecting business partners, Aurubis ensures that, among other aspects, criteria regarding sustainability and compliance are reviewed, evaluated continuously, and documented.



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.¹

In the future, our new specific reduction targets and the associated reporting of specific emissions will no longer be based on copper output, but rather on a multimetal indicator – the copper equivalent [Achievements and successes in environmental protection](#). The closing of the target timeframe of the 2018–2023 Sustainability Strategy, now integrated as interim targets in the 2030 Aurubis Group Strategy, marks the final reporting of our specific emissions based on copper production.

This year, reporting on additional environmental KPIs will still be based on copper production to represent medium- and long-term trends.

» We have invested more than € 780 million since 2000 and about € 380 million since 2012 in measures to improve environmental protection throughout the Group.

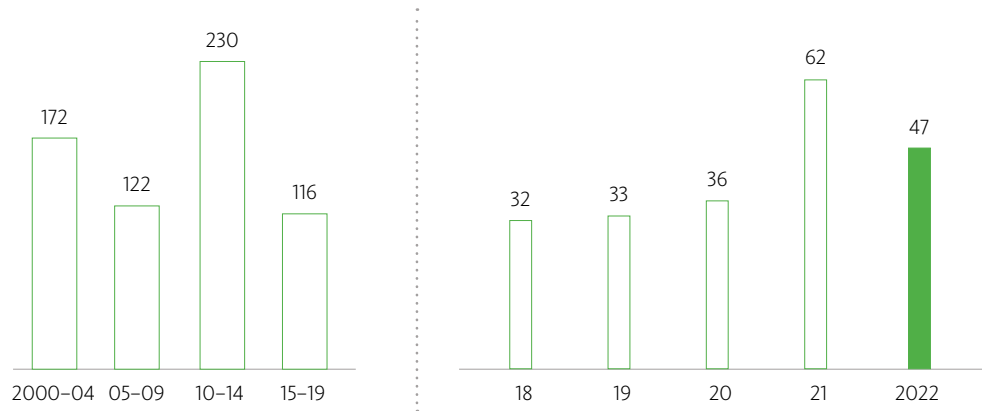
At 0.19 t of CO₂ per ton of copper output, emissions from fuels were at a low level in 2022. Product-related emissions have been reduced by 40 % since 2000 [Fig. 1.13](#).

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 97 % 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 43 % [Fig. 1.14](#).

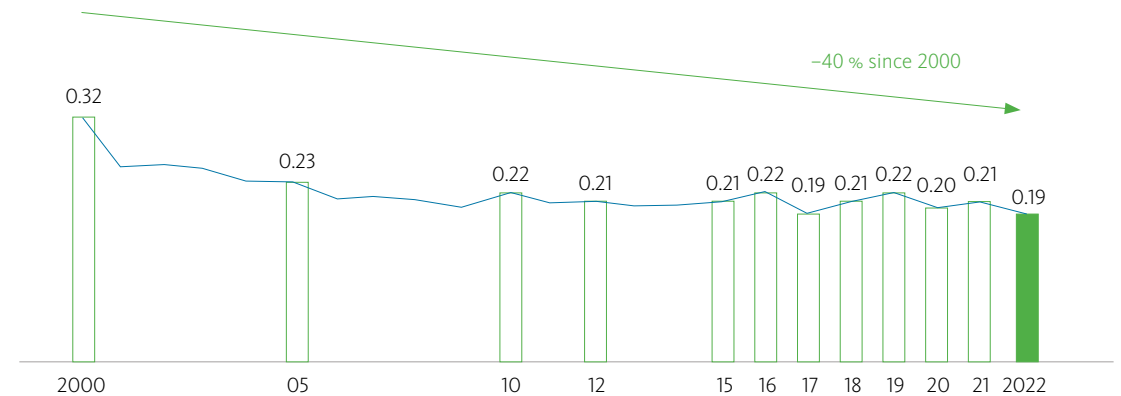
¹This report may include slight deviations in the totals due to rounding. Some of the data is preliminary since it hadn’t been validated externally as of the editorial deadline.

Fig. 1.12: Capital expenditure for environmental protection in the Aurubis Group*
in € million



* 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 Aurubis sites in Beerse and Berango have been included since 2020. The data relates to environmental investments per fiscal year. Single years are provided for readability, for example 2022 for fiscal year 2021/22.

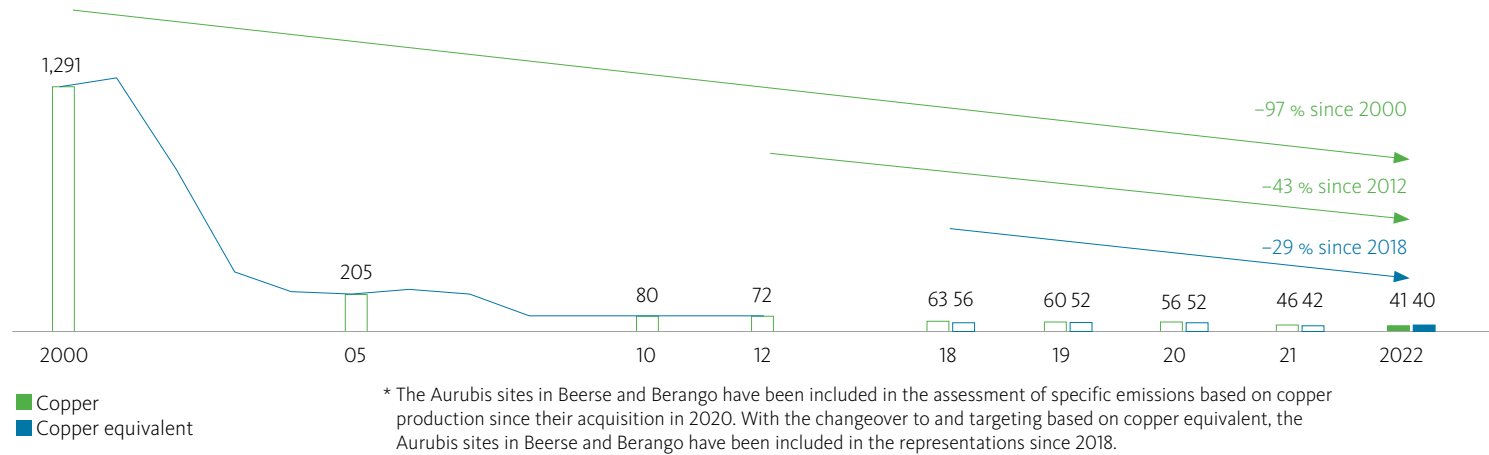
Fig. 1.13: CO₂ emissions from fuels in Aurubis Group copper production*
CO₂ emissions in t/t of copper output



* The Aurubis sites in Beerse and Berango have been included since 2020.

Fig. 1.14: Successful reduction of dust emissions in Aurubis Group copper/multimetal production

Dust emissions in g/t of copper output and in g/t of copper equivalent



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.

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 88 % since 2000 [Fig 1.15](#).

Fig. 1.15: Sulfur dioxide emissions in Aurubis Group primary copper production

SO₂ emissions in kg/t of copper output

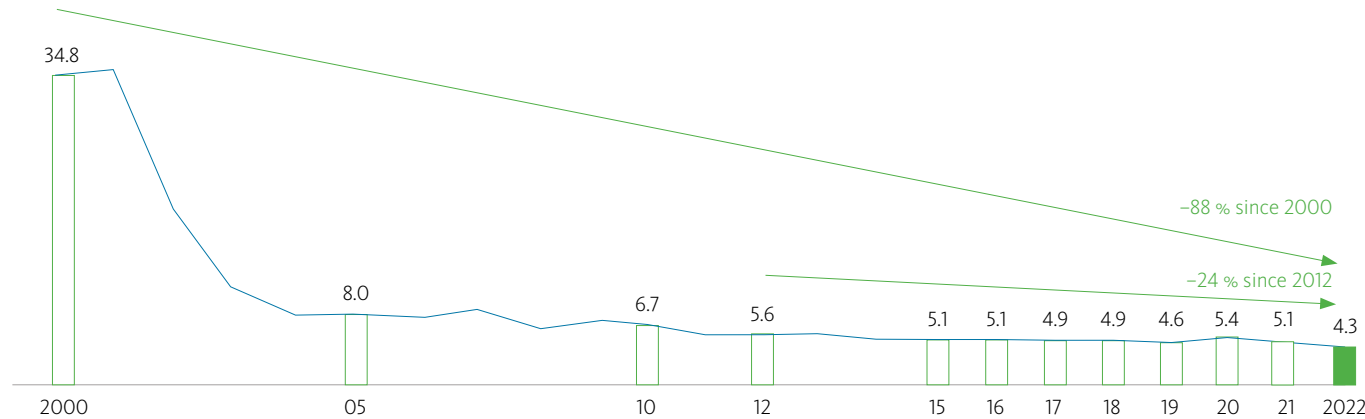
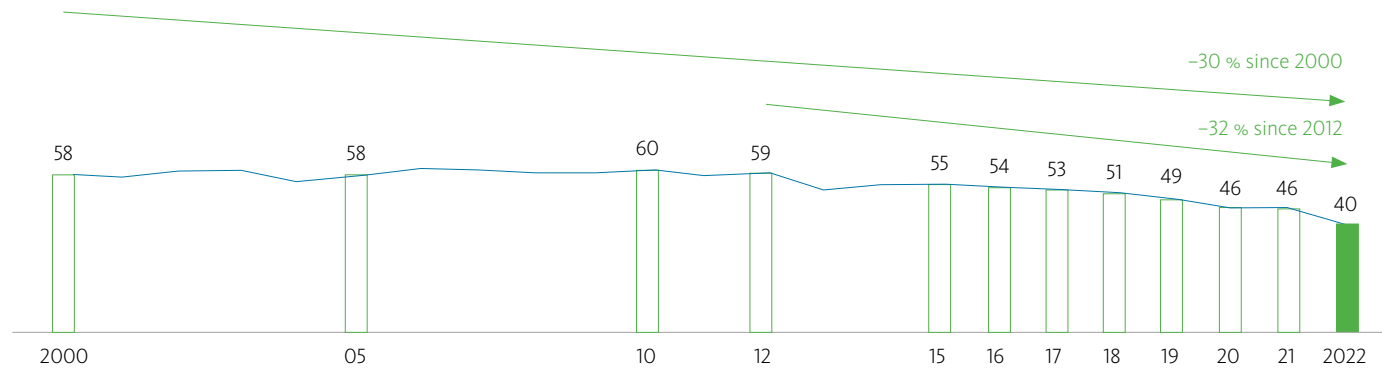


Fig. 1.16: Water withdrawal in Aurubis Group copper production*

Water withdrawal in m³/t of copper output



* The Aurubis sites in Beerse and Berango have been included since 2020.

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 conserve potable water resources.

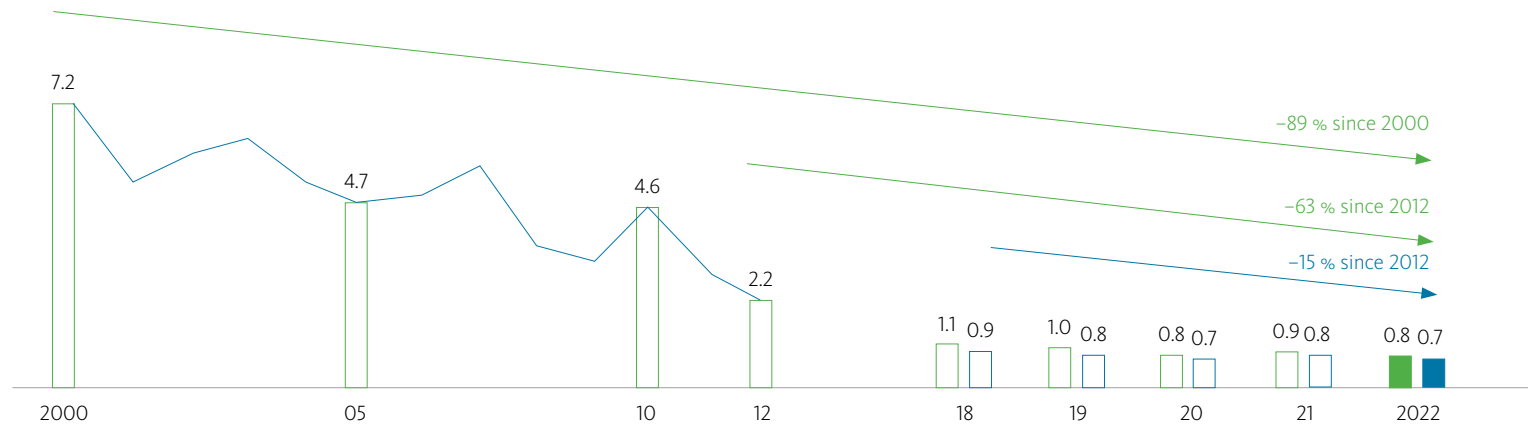
Compared to the reference year 2012, water withdrawal per ton of copper output was reduced by 32 % [Fig. 1.16](#).

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 0.8 g per ton of copper output since 2000. This is a decline of 89 %.

Compared to the reference year 2012, metal emissions to water per ton of copper was reduced by 63 % [Fig. 1.17](#).

Fig. 1.17: Metal emissions¹ to water in Aurubis Group copper/multimetal production*

Metal emissions to water in g/t of copper output and in g/t of copper equivalent



* The Aurubis sites in Beerse and Berango have been included in the assessment of specific emissions based on copper production since their acquisition in 2020. With the changeover to and targeting based on copper equivalent, the Aurubis sites in Beerse and Berango have been included in the representations since 2018.

¹ KPI includes the following metals: Cu, As, Cd, Hg, Pb, Ni, Zn.

■ Copper
■ Copper equivalent

At a glance – Environmental KPIs for the Aurubis Group¹

	Unit	2018	2019	2020	2021	2022
Emissions to air						
Dust	t	103	93	102	86	77
NO _x	t	842	769	863	820	877
SO ₂	t	4,859	4,154	5,424	5,212	4,789
Water consumption						
Total water withdrawal	million m³	80.5	71.0	78.3	77.9	70.7
Water withdrawal by source						
Surface water	million m ³	76.6	67.7	74.6	74.2	67.4
Rainwater	million m ³	0.4	0.3	0.6	0.6	0.6
Groundwater	million m ³	0.6	0.5	0.6	0.7	0.4
Municipal water	million m ³	2.6	2.1	2.2	2.1	2.0
Other	million m ³	0.3	0.3	0.3	0.4	0.3
Total water discharge	million m³	77.0	66.1	71.9	70.3	66.4
Water discharge by destination						
Surface water	million m ³	75.6	64.7	70.5	69.1	65.3
Municipal wastewater system	million m ³	1.4	1.3	1.3	1.2	1.1
Wastewater to third parties	million m ³	<0.1	<0.1	<0.1	<0.1	<0.1

¹ These KPIs include all production sites that are majority-owned by Aurubis (>50 %). The Aurubis sites in Beerse and Berango have been included since 2020.

Some of the data is preliminary since it hadn't been validated externally as of the editorial deadline. The table may include slight deviations in the totals due to rounding.

	Unit	2018	2019	2020	2021	2022
Waste						
Hazardous waste	t	46,886	48,659	50,970	50,543	47,361
Landfilling	t	34,032	36,429	36,473	36,653	36,333
Disposal (thermal)	t	81	123	370	1,254	159
Thermal utilization	t	447	391	441	445	659
Recycling	t	10,457	8,731	11,638	10,338	8,035
Storage	t	1,846	1,682	1,899	1,417	257
Internal utilization/recycling	t	24	1,303	149	436	1,919
Non-hazardous waste	t	43,255	46,992	81,705	41,984⁴	38,740
Landfilling	t	2,134	1,739	17,491	4,439 ⁴	2,731
Disposal (thermal)	t	717	682	624	583	643
Thermal utilization	t	472	590	435	950	802
Recycling	t	32,947	38,354	57,068	34,970	33,828
Storage	t	128	89	133	211	71
Internal utilization/recycling	t	6,857	5,537	5,955	832	664
Construction waste	t	46,558	122,503	17,887	28,554	126,730
Energy and CO₂						
Primary energy consumption ¹	million MWh	1.75	1.69	1.72	1.85	1.72
Secondary energy consumption ²	million MWh	1.89	1.78	2.00	1.94	1.81
Total energy consumption	million MWh	3.64	3.47	3.72	3.79	3.53
Direct CO ₂ emissions ³	kt CO ₂	522	503	540	558	523

¹ Including energy consumption for on-site vehicle traffic.

² Including electricity for oxygen generation.

³ Excluding CO₂ emissions from vehicles in line with the emissions trading system.

⁴ KPI was corrected after the fact.

Some of the data is preliminary since it hadn't been validated externally as of the editorial deadline. The table may include slight deviations in the totals due to rounding.

Consolidated Aurubis AG Environmental Statement 2023

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 AG 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 m² in Peute, an industrial inland harbor area in the Veddel district. Following reconstruction after World War II, the production facilities were continuously expanded and steadily modernized. Today, Aurubis AG's Hamburg site is one of the world's most state-of-the-art primary and secondary copper smelters and has an authorized production capacity of 450,000 t of copper cathodes each year. A total of 2,614 personnel are employed at the Hamburg site, including 160 apprentices (as of April 2023).


The individual production sectors at Aurubis AG in Hamburg are divided into three plant areas  **Fig. 2.1**. Plant North is mainly comprised of the administrative buildings, the workshops, sampling, 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 contact acid plant (KAWO), 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 buildings

Processes at the Hamburg plant

Copper production is based on the use of primary raw materials (copper concentrates) and secondary raw materials (recycled materials, including electrical and electronic scrap).

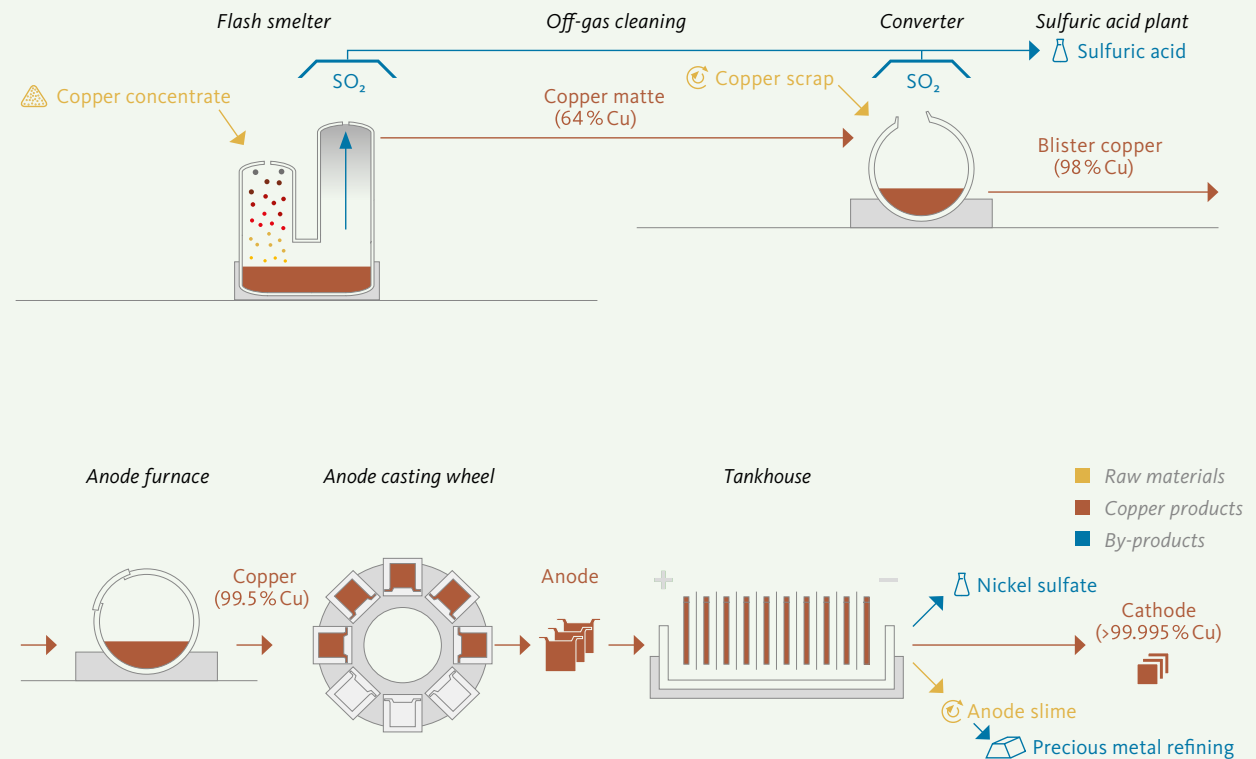
In the primary copper smelter, copper anodes (with a copper content of about 99%) are produced from the primary raw material, copper concentrates, in multi-step pyrometallurgical processes. The metals in recycling materials can be drawn out in each step of the existing processes. The sulfur in the primary 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. These products 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)  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 copper 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 recovered in metallic form or as metal compounds.

Fig. 2.2: From copper concentrate to cathode



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

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

Environmental protection organization at the Hamburg site

As the operator of facilities requiring a permit in accordance with Section 52b of the Federal Immission Control Act (BImSchG) and Section 53 of the Circular Economy Act (KrWG), the Aurubis AG Executive Board or an appointed member of the Executive Board is responsible for compliance with environmental protection regulations.

All environmental protection issues are coordinated, organized, and monitored in the Environmental Protection department to support the different business sectors. The department appoints officers for the fields of immission protection, water pollution control, waste, accidents, and harmful substances.

The integrated management system for occupational health and safety, energy, quality, and the environment

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 AG 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 was 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.

The quality management system for the entire Hamburg plant is certified in accordance with the ISO 9001 standard.

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

Tasks of the environmental management system

The environmental management system is responsible for maintaining and improving our environmental performance. Targets and measures are defined, and their implementation monitored accordingly. Situational evaluations form the basis for decisions about the type, extent, suitability, and execution of environmental protection measures.

The Hamburg Environmental Protection department tracks changes in legal requirements, reviews their effects on the different areas of our company, and ensures that our facilities are operated in conformity with the law. Because of the high complexity of the legal standards and requirements that have to be applied, the existing legal register has been supplemented by a web-based EHS software.

The general IMS handbook governs procedures that apply to the Aurubis AG Hamburg and Lünen sites. The integrated management system handbook for the Hamburg plant describes the site-specific procedures. The EMAS environmental management system also helps implement the Aurubis Group's defined sustainability targets at the Hamburg site

 [see aurubis.com/sustainabilitystrategy](https://www.aurubis.com/sustainabilitystrategy).

Management review 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 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 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, about € 340 million has been invested in environmental protection in the Hamburg plant since 2000. With total capital expenditure of more than € 1.4 billion in the same period, environmental measures account for approximately 26 % of overall capital expenditure on average. Among other things, dust emissions have been reduced by about 49 % compared to the year 2000 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  Fig. 2.3.

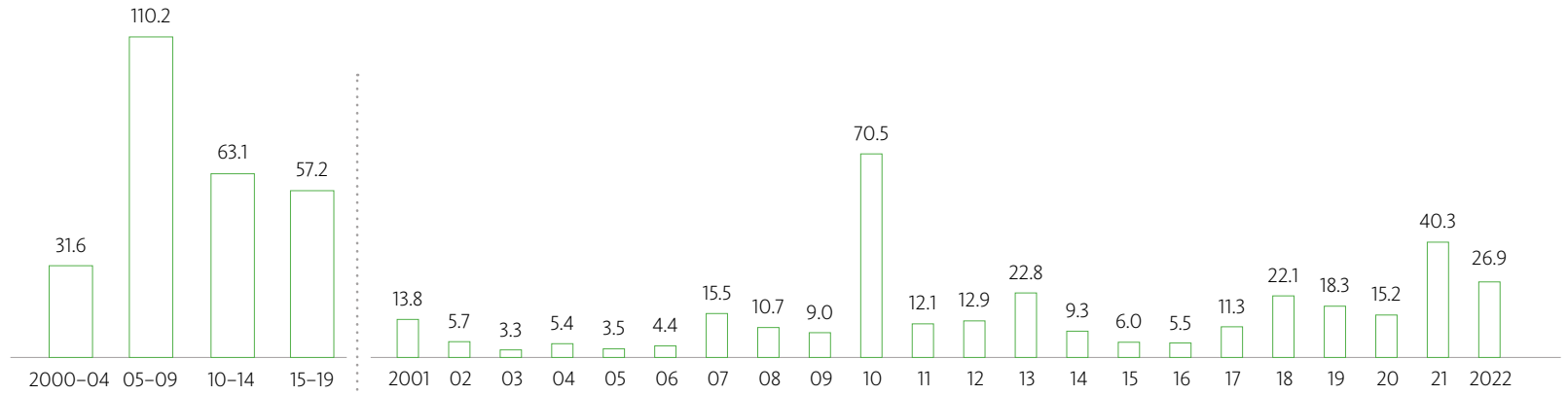
When compared worldwide, Aurubis Hamburg holds a top position in environmental protection that extends beyond staying up to date with the state of the art. Additional improvements require higher and higher capital expenditure for the same level of reduction and the development of modern technologies. The objective of plant management is to continue improving the plant's environmental performance and the expansion of its top position in environmental protection.

Air – Emissions

It is crucial for Aurubis AG to develop innovative technologies for air pollution control and to enter new technical territory in the process. About 70 % of the remaining metal emissions from the Hamburg production site come from fugitive sources, the majority of which stem from hall ventilation facilities.

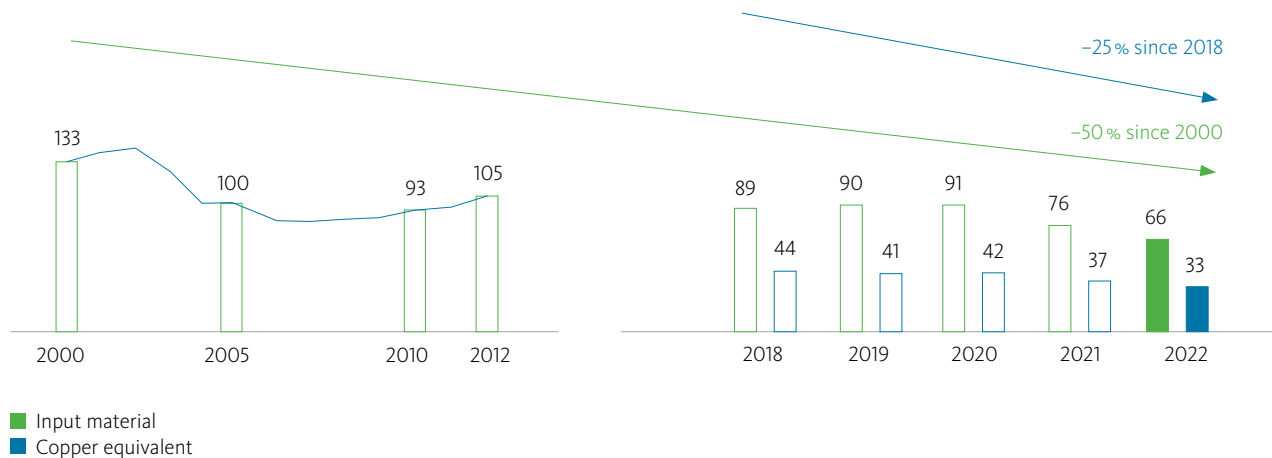
The Hamburg site emissions were further reduced in 2022. Additional investments in air pollution control were made in both primary and secondary copper production in 2021. The first part of a large-scale investment to continue reducing fugitive dust emissions in primary copper production started up in October 2021.

Fig. 2.3: Investments in environmental protection measures at the Hamburg site*
in € million



*The data relates to environmental investments per fiscal year. Single years are provided for readability, for example 2022 for fiscal year 2021/22.

Fig. 2.4: Dust emissions at the Hamburg site
Dust in g/t of copper output and in g/t of copper equivalent



■ Input material
■ Copper equivalent

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 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 fallen by around 88 % since 1990 and by about 50 % from 2000 to 2022 [Fig. 2.4](#).

[Achievements and successes in environmental protection](#)

Copper is the main metallic substance in the dust at the Hamburg production site. Specific copper emissions have been reduced by about 83 % since 1990 and by roughly 41 % since 2000. The already low level was further reduced when the new emission capture equipment in primary copper production was commissioned, resulting in the changes from the previous year [Fig. 2.5](#).

Specific lead emissions have been reduced by approximately 95 % compared to 1990 and by around 71 % since 2000. The commissioning of the emission capture equipment in primary copper production has had a positive effect here, too, and has resulted in further reduction [Fig. 2.6](#).

Fig. 2.5: Copper emissions at the Hamburg site

Copper in g/t of copper output

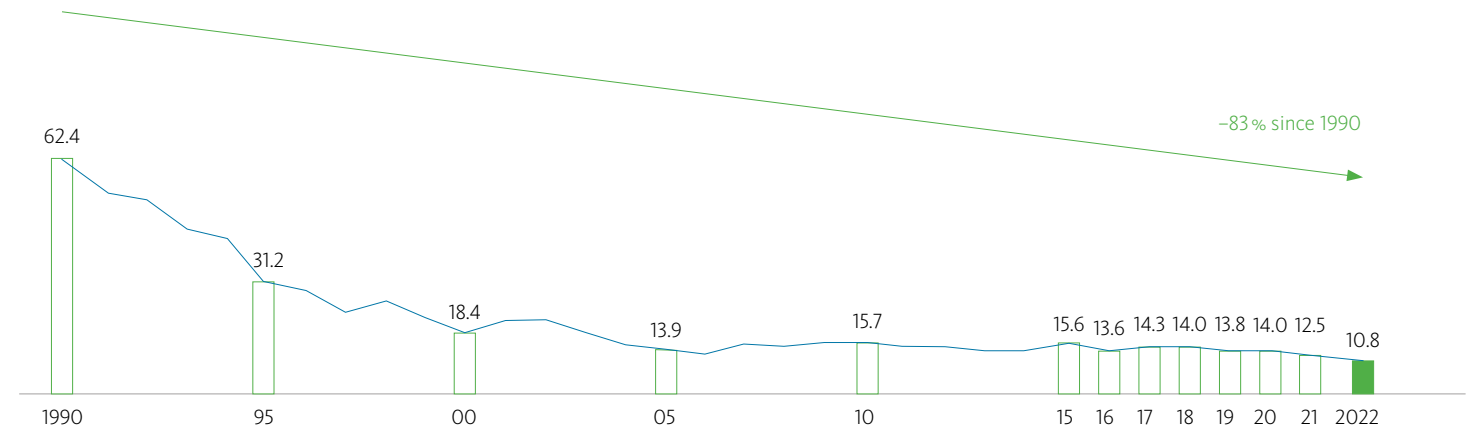


Fig. 2.6: Lead emissions at the Hamburg site

Lead in g/t of copper output

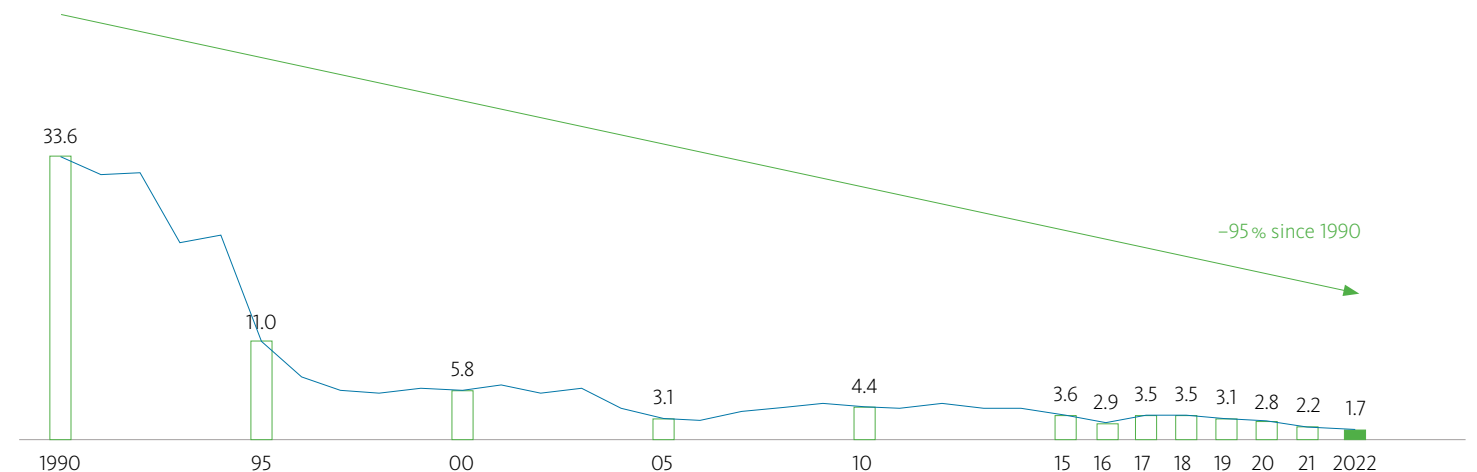
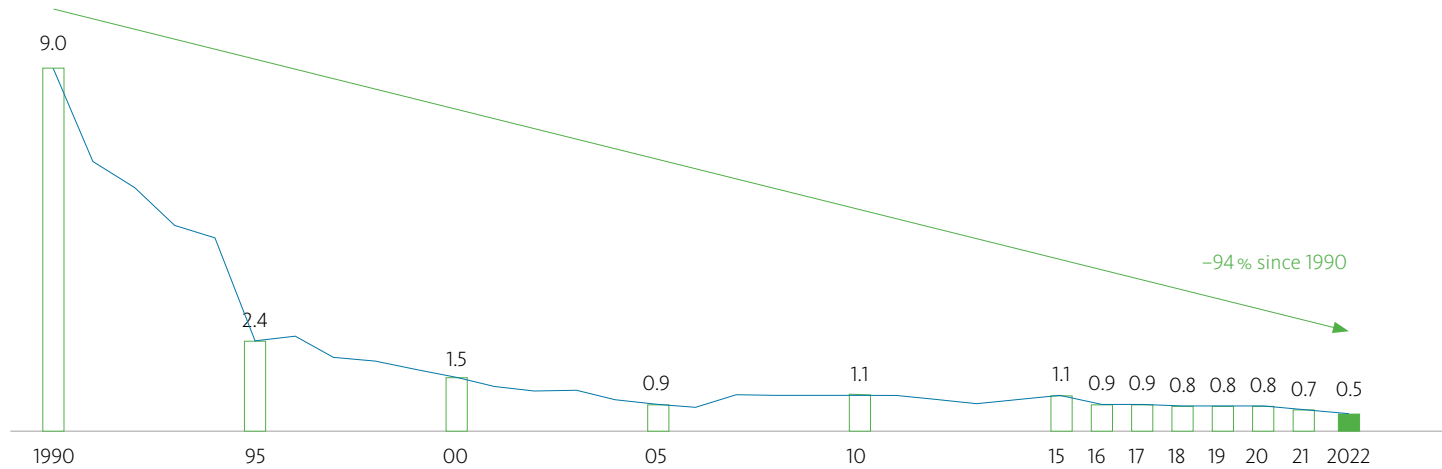


Fig. 2.7: Arsenic emissions at the Hamburg site

Arsenic in g/t of copper output



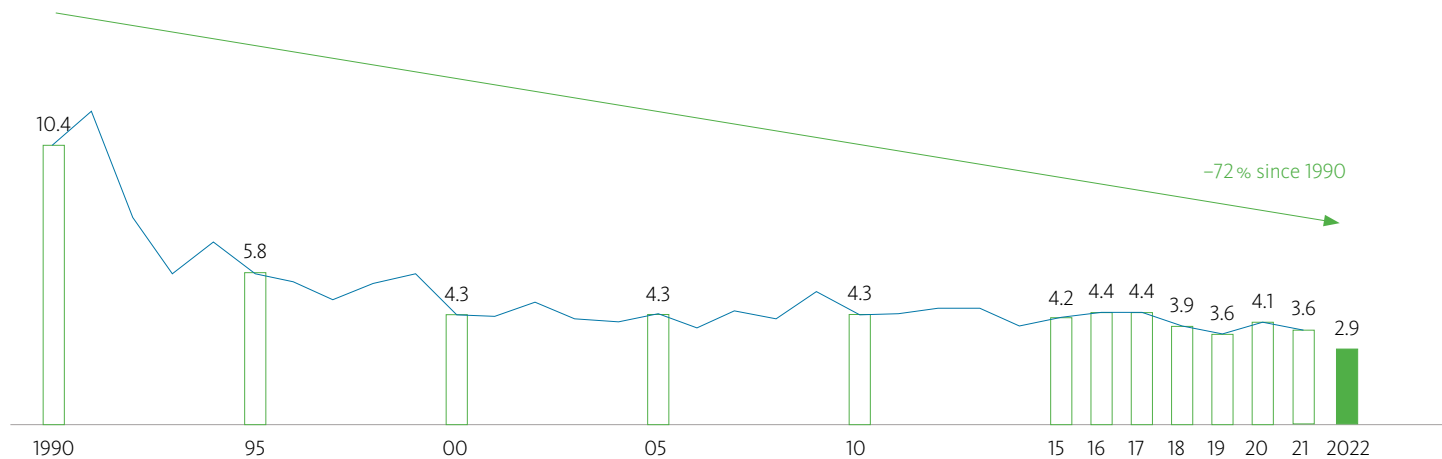
Arsenic is a natural component of copper concentrates. Specific arsenic emissions have been reduced by about 94 % since 1990 and around 65 % since 2000 in various steps of the copper refining process, further reducing the already low level of emissions here, too [Fig. 2.7](#).

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 approximately 72 % since 1990 and by about 32 % since 2000 and are at a low level [Fig. 2.8](#).

As a primary copper smelter, Aurubis AG's Hamburg site continues to be a forerunner in reducing specific sulfur dioxide emissions.

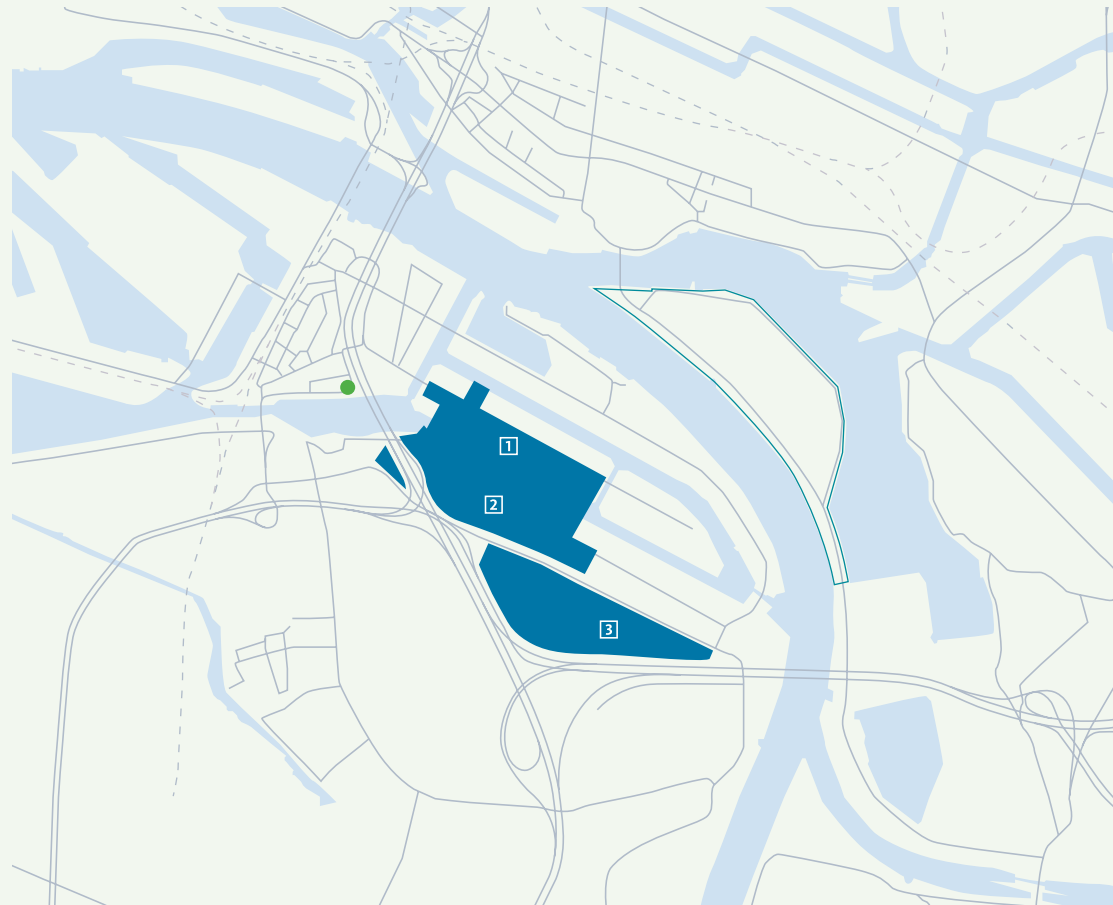
Fig. 2.8: SO₂ emissions at the Hamburg site

SO₂ in kg/t of copper output



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 2022. 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



1 Plant North 2 Plant South 3 Plant East

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 results of the suspended particulate recordings taken by the Hamburg environmental authority indicate continued low levels. 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.

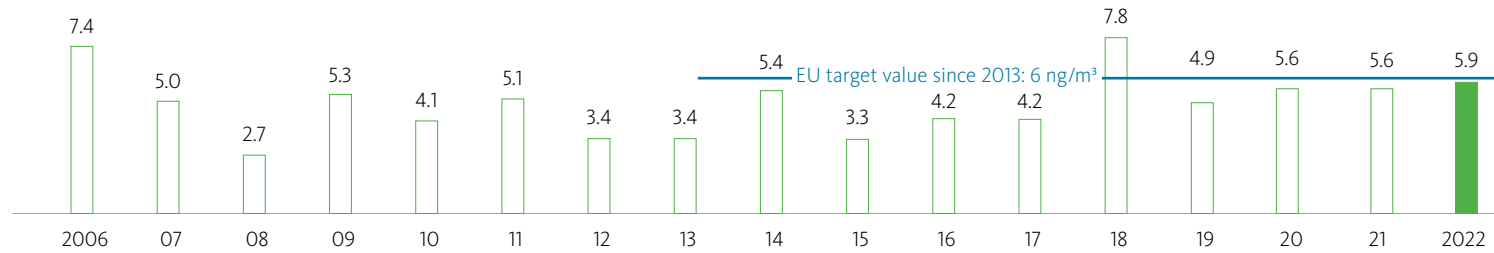
Due to extensive investments in emission reduction, the immission situation has improved continuously since the 1990s. Limit values for air pollutants in the ambient air haven't been exceeded in the area surrounding Aurubis AG's Hamburg site for many years.

The value measured for arsenic at the Veddel measuring station was below the target level (a yearly average of 6 ng/m³) in 2022. Aurubis' goal is to reduce its contribution to the immission values related to particulate matter in the ambient air through additional measures in order to ensure that immission values stay below the limit in the long term, even in the case of declining climate conditions and increasing aridity.

To continue reducing the site's immissions into the surrounding area, a project to capture fugitive emissions from the primary smelter production hall as needed began in 2020. An innovative and highly efficient system will close the roof openings, extract the air, and filter an adjustable amount at a rate of over 1,000,000 m³/h. The project has an investment volume of over € 100 million. The first stage was commissioned in October 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.

Fig. 2.10: Low immission values (arsenic) at the Veddel measuring station¹

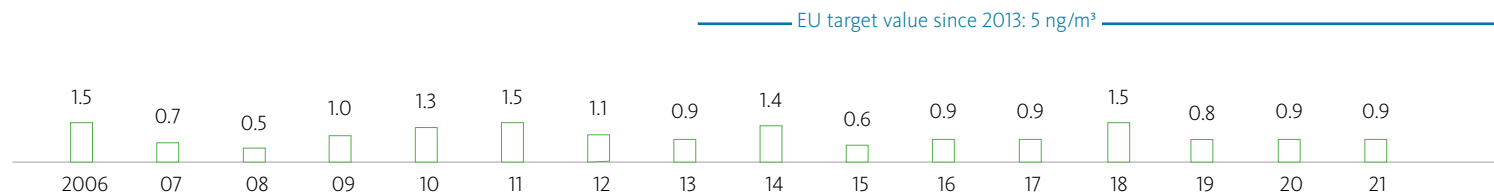
Arsenic immissions at Veddel measuring station in ng/m³



¹ Data published by the State Ministry for the Environment, Climate, Energy, and Agriculture.

Fig. 2.11: Low immission values (cadmium) at the Veddel measuring station²

Cadmium immissions at Veddel measuring station in ng/m³



² Data published by the State Ministry for the Environment, Climate, Energy, and Agriculture. Official results for 2022 aren't available yet.

1 gram (g) = 1 billion nanograms (ng)

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

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.

The metal loads connected to direct discharge, which are related to production volumes, were at 1.5 g/t and therefore within the range of the last few years. This KPI has decreased by more than 30 % since 2000 due to investments and process improvements. Minimizing the wastewater volume and load is a criterion in project implementation. The standard achieved today has made it possible to exploit minimization potential to the highest degree possible. The proportion of heavy metals discharged by Aurubis AG's Hamburg plant in the Elbe's total load is currently less than 0.1 %.

An inspection was carried out in 2022 with the goal of optimizing the rainwater treatment plant's process parameters to reduce discharged metal loads by 10 % with the appropriate adjustments. These modified process parameters are being tested for the first time in 2023. The roadmap for further reducing metal loads and cooling water volumes within the

scope of the Sustainability Strategy is scheduled to be completed in 2023. The entire Group plans to reduce the metal loads directly discharged with wastewater by another 25 % by 2030, with the participation of the Hamburg plant.

In this way, we are contributing to the national water strategy in Germany. The intention is to continue developing sustainable water resources management and to secure good water conditions in the long term.

Indirect discharge and potable water

The declining long-term trend for the discharged wastewater load is also reflected in indirect discharge into 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 %.

Most (85 %) 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 facilities and is discharged indirectly after use.

The consumption of potable water has declined by over 40 % since 2000. Potable water for the most part hasn't been used to produce steam since 2002. Recirculated condensate and available canal water, mainly as a supplement, are used to conserve resources.

Conserving water resources is part of the company guidelines. This applies to potable water in particular. This target also aligns with the national water strategy: The action program includes the development of water infrastructure adjusted to climate change.

All development projects are evaluated with respect to their resource requirements, which are adapted as necessary.

Cooling water

In 2022, cooling water was managed without any disruptions or negative impacts on the water balance. All of the limits for discharge temperature, temperature increase, heating of water, and heat input were maintained. Further limiting the volume of cooling water by 2030 is a part of the Sustainability Strategy.

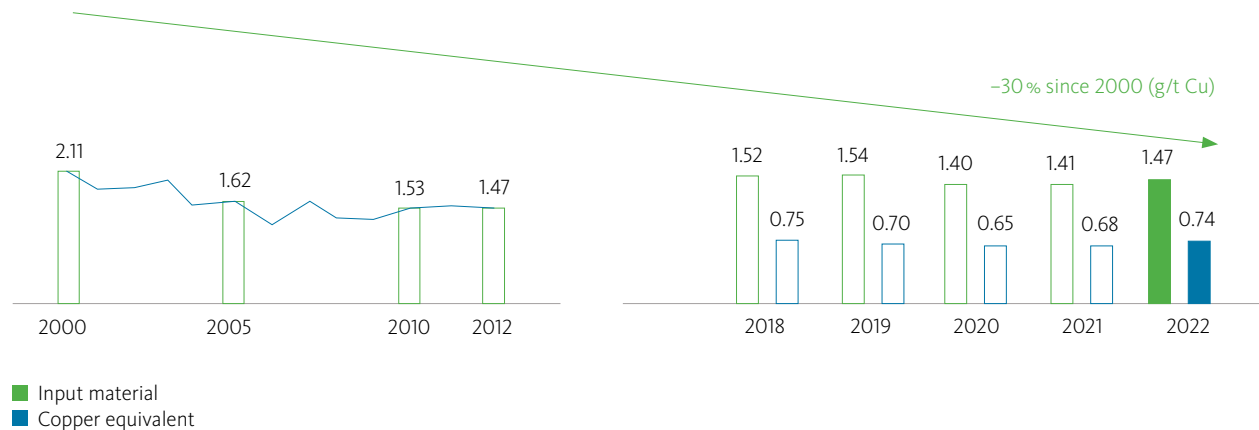
As in the previous year, over 60 % of the precipitation was used as cooling water prior to discharge in 2022.

Facilities handling substances hazardous to water

At the Hamburg plant, Aurubis AG 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 (AwSV). During the technical audits carried out in 2022, the TÜV once again found no safety-relevant deficiencies whatsoever. Keeping the plants in proper technical order plays a key role in protecting the soil and groundwater.

The Aurubis plant in Hamburg is a TÜV-certified specialist company in accordance with the German Federal Water Act (WHG). TÜV recertified Aurubis as a specialist company under the WHG in 2021.

Fig. 2.12: Metal emissions in water at the Hamburg site since 2000
Metal emissions in g/t of copper output and in g/t of copper equivalent



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 remediation is required from an official point of 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 was also 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 were no noise complaints in 2022.

Waste

A total of 117,530 t of waste was received and recycled at the Hamburg site in 2022, of which 6,331 t were classified as hazardous waste. A total of 3,602 t of this came from other countries and was registered.

Overall, 9.9% of the waste received was used as a slag former (e.g., spent abrasives, sand, and excavation residues), and 90.1% was used for metal recovery (dust, slimes, slags, and precious metal-bearing sweeps). The use of metal-bearing secondary raw materials decreased slightly due to the maintenance shutdown in spring 2022.

In 2022, about 1.28 million t of input materials were processed at the Hamburg site. During processing, 12,313 t of production-related waste accumulated, which was disposed of in an environmentally sound manner  Fig. 2.13. The conversion of raw materials into products thus remained at a high level. Of the entire volume, 4,114 t was directed to recycling and 8,199 t to external disposal. This corresponds to a recycling rate of

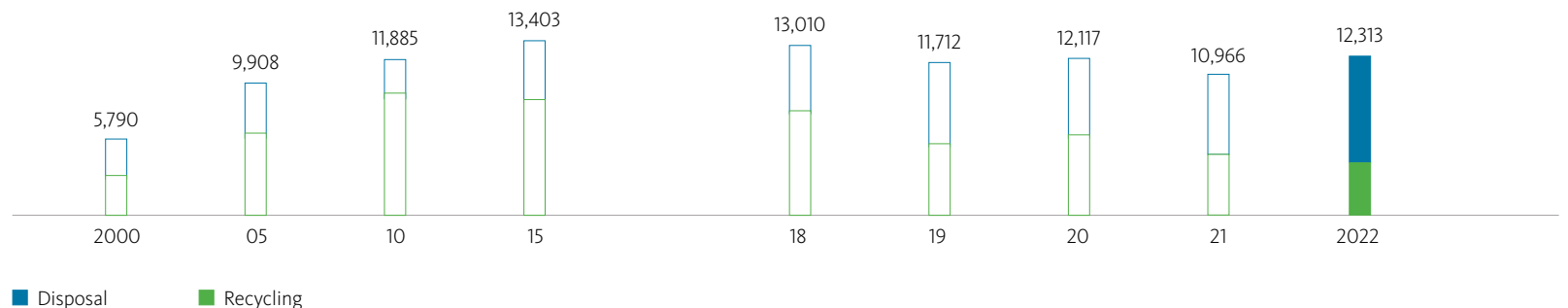
approximately 33%. Most of the waste that is disposed of is slimes from off-gas cleaning, as well as washing fluid and emulsions.

A total of 33,527 t of olivine pyroxene rock from the secondary smelter (RWN) and 4,410 t of slag material from the primary smelter (RWO) couldn't be marketed as a product and were taken to landfills. In the process, more than 87 % of the volumes were recycled for use as landfill construction material. The slightly higher volume of waste that had to be disposed of is due on the one hand to an increase in the washing liquid that accumulated due to cleaning personal protective equipment (PPE) during the 2022 maintenance shutdown and, on the other, a significant reduction in inventories of slimes from the off-gas cleaning facilities at the end of the year.

Due to various construction activities to modernize the site, 56,598 t of construction waste accumulated during the past year. The volume of construction waste increased fivefold compared to the previous year.

With an output of 480,665 t of refined copper for 2022, the specific waste level is 25.62 kg/t of product (compared to 22.38 kg/t in 2021).

Fig. 2.13: Disposal methods for production-related waste at the Hamburg site
in t/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 1,187 GWh of energy at the Hamburg site in 2022. With an annual copper output of 480,665 t, this amounts to specific energy consumption of approximately 2.47 MWh/t of copper output. This figure is lower than in previous years (2021: 2.54 MWh/t). It 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 (2022: 1.6 GWh). Aurubis uses 100 % of the landfill gas captured at the former Georgswerder landfill, though the supply volume from the landfill is continuously declining.

Viewed over the medium term, 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 and the commissioning of new facilities, such as the ridge turret suction system in the secondary smelter and in the primary smelter (Project RDE), which increases energy requirements due to the operation of the suctioning and filter equipment. In 2022, good ongoing plant capacity utilization and optimizations reduced specific energy demand by approximately 3 % compared to previous years.

Taking a longer-term view, specific energy consumption has been significantly reduced at the Hamburg production site in the last few decades, falling by 46% compared to 1990. It has even been possible to reduce fuel-related specific CO₂ output by 70 % since 1990. The reason for this is the strongly reduced use of particularly CO₂-intensive fuels, especially coal.

Fig. 2.14: Energy consumption at the Hamburg site
in MWh/t of copper output

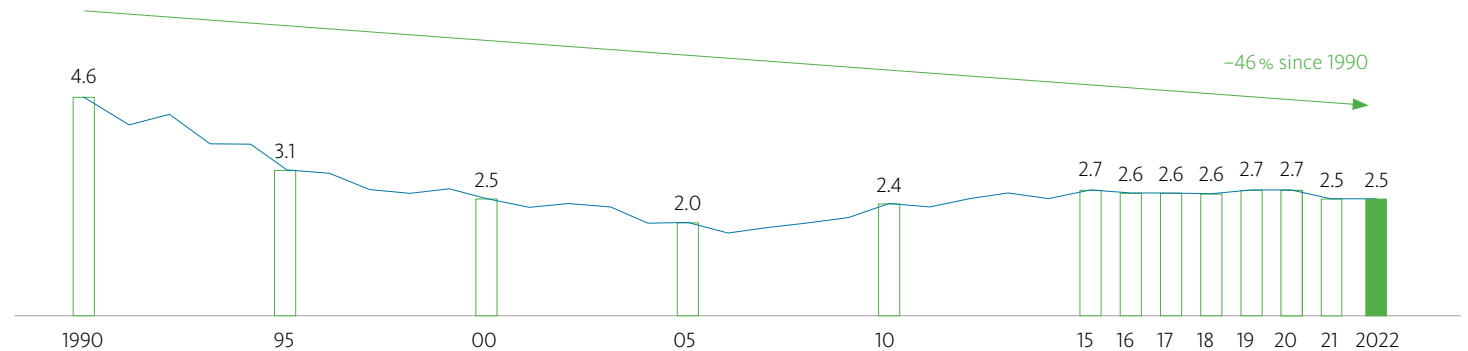



Fig. 2.15: Breakdown of energy consumption at the Hamburg site



With an output of 480,665 t of copper output in the calendar year, specific CO₂ emissions from fuel amounted to 0.25 t CO₂/t of product in 2022  Fig. 2.16. This corresponds to 119,133 t of CO₂.

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

- » For natural gas: GasCalc calculation program, Version 2.6, published by SmartSim GmbH
- » For all other fuels: German Emissions Trading Authority (DEHSt) data, last reviewed in January 2023

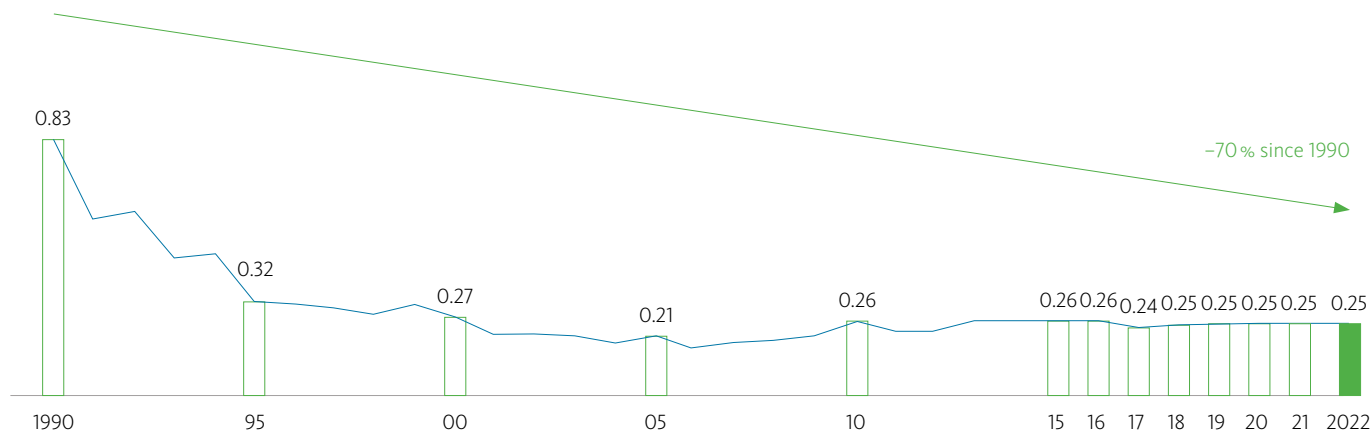
When it comes to maintenance measures and new investments, engines and other energy-consuming equipment with as high an energy efficiency class as possible are used.

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 renewable energies to be used instead of fossil fuels to generate a heat output of 10 MW at the site. This reduces the load on the energy grid at the same time.

The power-to-steam plant allows us to respond to energy use with greater flexibility. We continuously monitor the economic and political environment of the energy economy and energy supply, which allows us to respond more quickly and with greater flexibility. A task force is created in special situations like the current war in Ukraine to minimize the impact on our operations.

Fig. 2.16: CO₂ emissions from fuels at the Hamburg site
in t CO₂/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. With 68 % of the steam required generated from residual heat, very little was produced from fossil fuels in 2022. The reduced percentage is due to the planned maintenance and repair shutdown FSH22 in primary copper production, which lasted for several weeks.

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 5.4 GWh of electricity was produced from waste heat in 2022, or approximately 1 % of total electricity consumption.

Fig. 2.17: District heating pipeline route from the Aurubis plant to HafenCity East



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. Aurubis' production facilities also use up to 40 million kWh. Aurubis and enercity each invested about € 21 million. The project was funded by the German Federal Ministry for Economic Affairs and Energy.

The heat is CO₂-free. It occurs 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 CO₂ annually. The Elbe River benefits as well, as recovering the heat reduces the consumption of cooling water by about 12 million m³ per year.

The German Energy Agency honored the joint project with the 2018 Energy Efficiency Award in the Energy Transition 2.0 category as a flagship project. Furthermore, the project received 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.

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 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, carbon-neutral district heating per year to supply the city. The two Industrial Heat projects will be able to reduce CO₂ by a combined 120,000 t per year as of 2025. The associated supply contract was concluded with the municipal supplier of district heating, and construction has kicked off.

Direct CO₂ emissions – Emissions trading system

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

Registered CO₂ emissions amounted to 154,826 t for 2022. Nearly 80% 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.


Indirect CO₂ 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 CO₂ emissions, which, as indirect CO₂ emissions at Aurubis, fall under indirect environmental effects. In 2022, these indirect CO₂ emissions totaled 260,245 t (pursuant to the German electricity grid's preliminary emission factor for 2022; source: BDEW).

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

Climate protection agreement with the Hamburg Senate to reduce CO₂

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 CO₂ by 32,000 t each year  Fig. 2.18.

With the agreement to reduce CO₂ by an additional 12,000 t, Aurubis also participated in the follow-up agreement for the period from 2013 to 2018.

Aurubis reduced CO₂ by roughly 12,569 t by the end of 2018. The city isn't planning an additional follow-up agreement. Nevertheless, additional reduction potential was identified and accompanying measures have been implemented. The site committed itself to implementing energy saving projects between 2019 and 2024 that lead to additional savings of 10,000 t of CO₂ each year, resulting in an additional reduction of 7,697 t of CO₂ per year by the end of 2022.

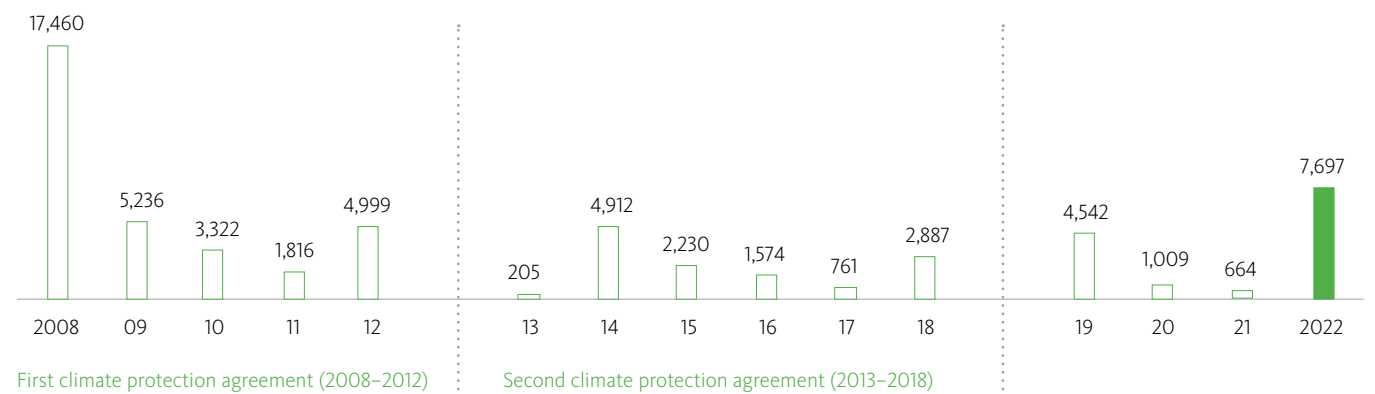
Aurubis participates in the IVH Energy Efficiency Network of Hamburg Industry. The network serves to create a best-practice dialogue, leading to a mutual innovation boost. The identified potential is coordinated with Hamburg's central climate office.

Our support of the Science Based Targets initiative also demonstrates the Group's tireless efforts to reduce greenhouse gases. We have committed to setting science-based CO₂ reduction targets based on the Science Based Targets 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 aim is to reduce the CO₂ emissions associated with fossil fuels and electricity (Scope 1 + 2) by half throughout the Group by 2030. CO₂ emissions resulting from processes, transport, supply chains, etc. should be reduced by 24 % by 2030 (Scope 3; reference year: 2018).

One of the first important steps was to test the use of hydrogen in primary copper production. The use of ammonia in copper processing is also being tested.

Fig. 2.18: Annual CO₂ reduction at the Hamburg site in the context of the Hamburg Climate Protection Concept
First and second climate protection agreement, in t of CO₂/year



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 2022:

- » Lead refinery
- » Chemical plants
- » Hazardous materials storage
- » Rod plant
- » Continuous casting plant
- » Cracking plant
- » Central wastewater treatment plant
- » Precious metal production
- » Tankhouse, Plant East
- » Energy management
- » Contact acid plant, Plant East
- » Secondary smelter (RWN)
- » Primary smelter (RWO)
- » Selenium facility/SO₂ storage
- » Top-blown rotary converter south
- » Sampling

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. There were no accidents and no disruptions that had to be reported.

Indirect environmental aspects

Indirect environmental aspects 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 the section "A comparison – Life cycle assessments for our metal products" in the Group portion of this Environmental Statement, which provides detailed information about our supply chain management.

Transporting hazardous materials

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

In the 2021/22 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 67% are shipped by inland vessel, about 20% by truck, and 13% 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 2022 in order to maintain this high safety standard.

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. The green areas surrounding the plant premises with bushes and trees serve as a refuge for many bird and insect species and should be preserved. 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.

The plant has its own tree registry. Wherever possible, new plants and greenery are integrated into project planning. Because of the limited possibilities within the plant premises, Aurubis promotes biodiversity outside of the plant boundaries as well. For instance, we support the preservation of insects through educational work carried out by knowledgeable nature conservation associations at schools. A vehicle referred to as the Bombus is used for this purpose. The Bombus (Latin for bumblebee) is a converted environmental mobile that has been a fixed component of the environmental education work of the German Association for the Protection of Forests and Woodlands for 15 years. With its unique, boxy shape, the VW bus provides a great deal of space for exhibits and documents for different programs and offers.

Action days are regularly planned for company staff as well. For example, preserving biodiversity will be a focus topic at the Aurubis Summerfest 2023. In addition to catering and musical acts, activities for children are planned, such as building insect hotels and designing gardens in harmony with nature to encourage insects to inhabit them.

Today, emissions at the Hamburg site have already reached a point where there is no negative impact on ecologically sensitive conservation areas. This is especially true when it comes to the acidification of soils and plants and the eutrophication of bodies of water. Aurubis' ecological footprint is improving continuously. The Hamburg plant significantly contributes to this success, providing important support to preserving biodiversity.

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.

We continue to be proud of the fact that our plant is one of 13 peregrine falcon territories in Hamburg. In 2022, we once again successfully welcomed the offspring of a breeding pair of this still-rare bird of prey. We continue to preserve the territory by maintaining the nesting aid and keeping the direct flying environment free. Nestlings, which can injure themselves during their first attempts to fly, are given expert assistance by falconers if needed and are released in the plant again.

Furthermore, the plant is a breeding area for a number of songbird species, such as the black redstart. Possible nesting areas in various niches of production buildings' facades are maintained if possible. The proximity to bodies of water provides food sources.

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_x, resulting from individual transport.

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 40 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 2022, a bike service station with an air pump was also installed at the north parking lot and can be used by all employees.

In order to promote electric vehicles, a total of 150 charging stations were set up at the employee parking lots on Hovestrasse and the Muggenburger Hauptdeich. E-mobility for internal plant traffic is also being emphasized.

Due to the voluntary environmental and climate protection measures it implemented in 2022 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 adopted. 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. A flood protection drill was carried out in 2022.

A new, state-of-the-art sulfur dioxide storage area was commissioned in September 2022. Unloading processes are now carried out in a fully closed room that can be suctioned off. Likewise, the storage tanks are placed in a closed room that can be suctioned off as well. The tanks and pipelines have a double-wall design for an especially high level of safety. On top of that, the sulfur dioxide storage area uses modern, automated process technology made for the hazard potential at hand. The appropriate safety distance from any operations requiring protection was considerably reduced.

As part of the large-scale shutdown in May 2022, a comprehensive evacuation drill was successfully carried out involving all of the commissioned external companies.

Environmental Program

The targets set in the context of the Environmental Statement 2022 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 2023. The results are presented in the following Environmental Program.

Target	Planned measures	Degree of implementation/date
Reducing emissions		
Securing the target level for fine particulates, 20VE (6 ng/m ³), at the Veddel measuring station for 2023	Operating the ridge turret suctioning and implementing flow optimizations Continuously monitoring the effectiveness of the ridge turret suctioning Capex planning for expanded ridge turret suctioning	First stage of ridge turret suctioning has been operated successfully since late 2021. Flow optimization is being implemented
Availability of 92 % (days in the year) for roof sprinkler in the primary smelter (RWO) for 2023	Organizational monitoring by the operator	In implementation
Climate protection and energy optimization		
Cutting 10,000 t of CO ₂ from 2019 to 2024	Saving natural gas and electricity through operational optimizations: visualizations and automation Installing energy-efficient equipment: engines, pumps, compressors Building new, efficient air compressors Reducing compressed air leakages Modernizing lighting: using LED Thermal insulation measures Reducing the use of coke	From 2019 to late 2022, individual measures cut 7,697 t of CO ₂ . In addition, the use of excess heat in the project Industrial Heat Stage 1 prevents up to another 20,000 t of CO ₂ /year The project Industrial Heat Stage 2 is currently being implemented, which will prevent the emission of up to 140,000 t of CO ₂ /year after commissioning

Target	Planned measures	Degree of implementation/date
Decarbonization – reducing CO ₂ emissions from Scope 1 and 2 by 50 % in total by 2030	Developing a roadmap for decarbonization projects for implementation by 2030	In implementation
	Trials for ammonia co-firing in the rod plant	In implementation
	Test with a hydrogen burner in the rod plant	
	Test of a plasma burner for the rod plant	
	Engineering for poling with fossil-free fuels in the anode furnace	
	Reviewing the use of high-temperature heat pumps in electrolyte treatment	
Water pollution control		
Reducing cooling water uptake volumes	Optimizing temperature regulation	
10 % reduction in metal emissions compared to calendar year 2020 for a rainwater treatment plant	Reducing AWO metal emissions	In implementation
	Improvement through optimizations of control circuits and online analysis	In implementation
Partnership for Air Quality and Low-Emission Mobility		
Promoting public transport	Achieving full use of bike boxes	Capacity currently at 85 % In 2022, a bike service station with an air pump was installed at the north parking lot
Promoting sustainable mobility	Enabling bike leasing (JobRad) for employees at the Hamburg site	Implemented in 2021. 177 bikes and 638 pedelecs are currently being leased
	Offering a car allowance (cash4car) as an alternative to a company car	A new car policy was adopted in 2021 and includes a cash4car option
Promoting e-mobility	Successive replacement of all fuel-driven vehicles within the plant with electric vehicles	Elimination of additional diesel vehicles planned
	Switching forklifts from combustion engine to electric drive	38 diesel forklifts were replaced by forklifts with electric drives in 2022

Target	Planned measures	Degree of implementation/date
Promoting biodiversity		
Promoting biodiversity at the Hamburg plant	<p>Routinely reviewing possibilities for designing plant surfaces “close to nature” within the scope of projects</p> <p>Maintaining territory for the peregrine falcon by taking care of its nest</p> <p>Planning an employee event with action days related to the topic of biodiversity</p> <p>Supporting biodiversity projects outside of Aurubis</p> <p>Maintaining greenery and trees in appropriate plant areas</p> <p>Continuously improving air quality contributes to improving biodiversity in the vicinity</p>	Collaboration with NABU in the UnternehmensNatur project continues
Plant safety		
Ensuring safety	<p>Drills for the alarm and danger prevention plan</p> <p>Installation of an additional alarm system for operational disruptions at the contact acid plant, rod plant, tankhouse, primary smelter (RWO)</p>	<p>Takes place every three years at the latest, most recently in November 2021. The port authority canceled the flood protection drill planned for all companies at the Port of Hamburg. Preparatory operating measures were carried out for updating the inventory and storage locations of hazardous materials in case of flooding</p> <p>Took place in 2022</p>

Target	Planned measures	Degree of implementation/date
Waste management		
Promoting the circular economy	Optimizing internal disposal logistics by minimizing internal transports	Took place in 2021
	Additional documentation of plastic pallets and vats for recycling substances	Took place in 2021
	Installation of a crushing and screening plant for fireproof linings and slag containing metal at the primary smelter (RWO) to promote the internal circular economy	Took place in April 2023
	Assessing the return of used disposable wood pallets for further use	Inspection took place in 2022. Marketing disposable wood pallets not possible so far
Continuous improvement of integrated management system		
Further development of an integrated management system (IMS) for the environment, quality, and energy as well as occupational health and safety	Start-up of ISO 45001	Initial surveillance audit pursuant to ISO 45001 took place in May 2022
	Continuing the implementation of the Aurubis Operating System (AOS) in the entire Hamburg plant	Ongoing
	Developing a complete process model for the Hamburg plant and an effectiveness and efficiency assessment based on process KPIs	In implementation
Information and training sessions for departmental heads and plant managers on environmentally relevant topics	Further developing information transfer regarding relevant operator obligations using an IT-supported legal and regulation management system	Legal and regulation management system and action management system have been implemented since 2021 (Quentic)
Plant tours by employees in the Environmental Protection department	Further developing the monitoring of plant operations with regard to environmental effects and compliance of Environmental Protection department with regulations using an IT-supported legal and regulatory management system	Environmentally relevant conclusions have been documented and measures have been monitored in an IT-supported legal and regulatory management system since 2021
Responsibility in the supply chain		
Key measures regarding responsible supply chains within the scope of the Sustainability Strategy 2018–2023 are documented in both the separate Non-Financial Report and the Sustainability Report		

Key figures for Aurubis AG, Hamburg site, in the 2022 calendar year

Developments in KPIs are explained in the text

Input	Unit	2020	2021	2022
Financial investments				
Investments in environmental protection	€ thousand	15,178	40,291	26,873
Other investments	€ thousand	89,611	76,243	168,520
Total investments	€ thousand	104,789	116,534	195,392
Raw materials				
Copper concentrates	t	1,299,405	1,229,523	1,000,836
Copper scrap/refining material	t	46,796	47,603	30,577
Other Cu-bearing raw materials	t	112,491	132,982	190,881
Precious metal-bearing raw materials	t	12,631	13,545	14,519
Lead concentrate, scrap, and waste	t	30,788	28,958	22,504
Other waste for recycling	t	7,052	6,062	4,202
Total TC/RC-earning raw materials	t	1,509,162	1,458,673	1,263,518
Operating supplies and materials				
Sand and additives incl. cyclone sand	t	124,589	126,704	99,281
Iron as an additive	t	14,096	16,398	16,618
Total input materials	t	1,647,847	1,601,775	1,379,417
Input material per t of copper	t/t Cu	3.6	3.3	2.9

Input	Unit	2020	2021	2022
Energy				
Electricity consumption	MWh	567,563	680,010	634,743
Additional electricity consumed to produce oxygen (informative) ¹	MWh	131,208	10,205	8,797
Natural gas	MWh	440,856	472,628	468,728
Coke	MWh	69,967	71,717	58,726
Other energy sources	MWh	15,385	15,866	15,507
Total energy consumption	MWh	1,224,980	1,250,426	1,177,705
Energy consumption per t of copper²	MWh/t Cu	2.7	2.5	2.5
Water withdrawal³				
River water	m ³	62,672,000	63,331,000	56,112,223
Potable water	m ³	373,000	359,000	366,685
Precipitation	m ³	365,000	378,000	373,000
Total water withdrawal	m ³	63,410,000	64,067,000	56,852,000
Water consumption (withdrawal) per t of copper	m ³ /t Cu	139	131	118
Area used at the Hamburg site				
Total plant area	m ²	871,000	874,000	874,000
Buildings and paved area	m ²	773,000 (equivalent to 89 %)	758,000 (equivalent to 87 %)	758,000 (equivalent to 87 %)

¹ The air compressors used to produce oxygen have been operated internally since 2021.

² Rounded to the first decimal point.

³ Figures rounded to the nearest 1,000.

Output	Unit	2020	2021	2022
Products				
Copper output	t	456,830	489,976	480,665
Sulfuric acid products as H ₂ SO ₄ (from exhaust gas cleaning, standardized to 100 % acid)	t	982,392	994,880	859,990
Iron silicate stone (incl. granules)	t	767,611	781,326	782,635
Silver, gold, and PGMs	t	1,476	1,099	1,273
Nickel sulfate	t	3,794	3,117	2,885
Other metal compounds	t	963	437	387
Lead	t	11,268	11,886	12,999
Total products	t	2,224,334	2,282,837	2,140,834
Waste				
Recycling	t	6,085	4,840	4,114
Disposal	t	6,032	6,126	8,199
Total recycling and disposal	t	12,117	10,966	12,312
of which hazardous waste	t	9,115	8,183	9,539
Waste per t of copper output	kg/t Cu	27	22	26
Waste per t of input material¹	kg/t	16	13	50
Construction waste (informative)	t	14,203	10,431	56,598.41
Total waste	t	26,320	21,397	68,911
Conversion into products	%	99.2	99.3	99.0

¹Including construction waste.

Output	Unit	2020	2021	2022
Emissions				
Dust ^{1,2}	t	41	37	31
Dust per t of copper	g/t Cu	91	76	65
Dust per t of copper equivalent	g/t Cu eq	42	40	33
Copper in g/t of copper output	g/t Cu	14	12.5	10.8
Lead in g/t of copper output	g/t Cu	2.8	2.2	1.7
Arsenic in g/t of copper output	g/t Cu	0.8	0.7	0.5
SO ₂	t	1,871	1,780	1,334
NO _x per t of copper	g/t Cu	424	383	331
Direct CO ₂ emissions (ETS, excluding diesel)	t	164,051	163,347	154,826
of which CO ₂ from fuels	t	115,999	124,131	119,133
CO ₂ from fuels per t of copper	t/t Cu	0.25	0.25	0.25
Direct CO ₂ emissions (diesel for vehicles)	t	3,513	3,539	3,584
Indirect CO ₂ emissions from electricity consumption (incl. oxygen production) ³	t	519,731	512,292	472,272
Metal discharge in water	kg	637	689	707
Metal discharge in water per t of copper	g/t	1.4	1.4	1.5
Metal discharge in water per t of copper equivalent	g/t	0.65	0.68	0.74
Water discharge				
Direct discharge	m ³	60,402,855	59,136,370	55,455,605
Indirect discharge	m ³	42,403	37,851	37,937
Total water discharge	m³	60,445,258	59,174,221	55,483,542
Water discharge per t of copper	m³/t Cu	132	121	115

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

² Figure also includes dust from fugitive sources.

³ The supplier's CO₂ emission factor is taken as a basis.

Consolidated Aurubis AG Environmental Statement 2023

Lünen Site



The Lünen plant

Aurubis AG's Lünen plant is located on the southern edge of the city of Lünen, just one kilometer from the town hall, and is one of the world's largest copper recycling facilities.

The site 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. After the then-Norddeutsche Affinerie AG acquired the majority of Hüttenwerke Kayser shares in 2000, the plant was initially integrated into the company structure and expanded to become the Group's recycling center. Today Aurubis AG's Lünen site is one of the largest secondary copper smelters in the world, with a production capacity of 250,000 t of copper cathodes annually. On the 316,000 m² plant grounds, about 650 employees (including roughly 40 apprentices) produce copper anodes, copper cathodes, iron silicate sand, and a number of co-products.

The processes at the Lünen plant

The site in Lünen is a multimetal recycling site capable of processing highly complex raw materials in its own smelting and refining processes. Thanks to its options for flexibly using secondary raw materials, the Lünen plant can handle materials with complex compositions, such as pre-processed electronic scrap, old cars, and ashes from waste incineration in addition to traditional materials like copper and alloy scrap, slimes, and industrial residues. The recycling process used in each situation depends on the consistency and chemical composition of the raw materials.

After the input materials are delivered (usually by truck), processing begins with sampling, followed by a material preparation step. Depending on quality and composition, the raw materials are crushed, then treated and separated in the material preparation plant or directly conditioned into input mixtures before undergoing a multi-stage metallurgical process.


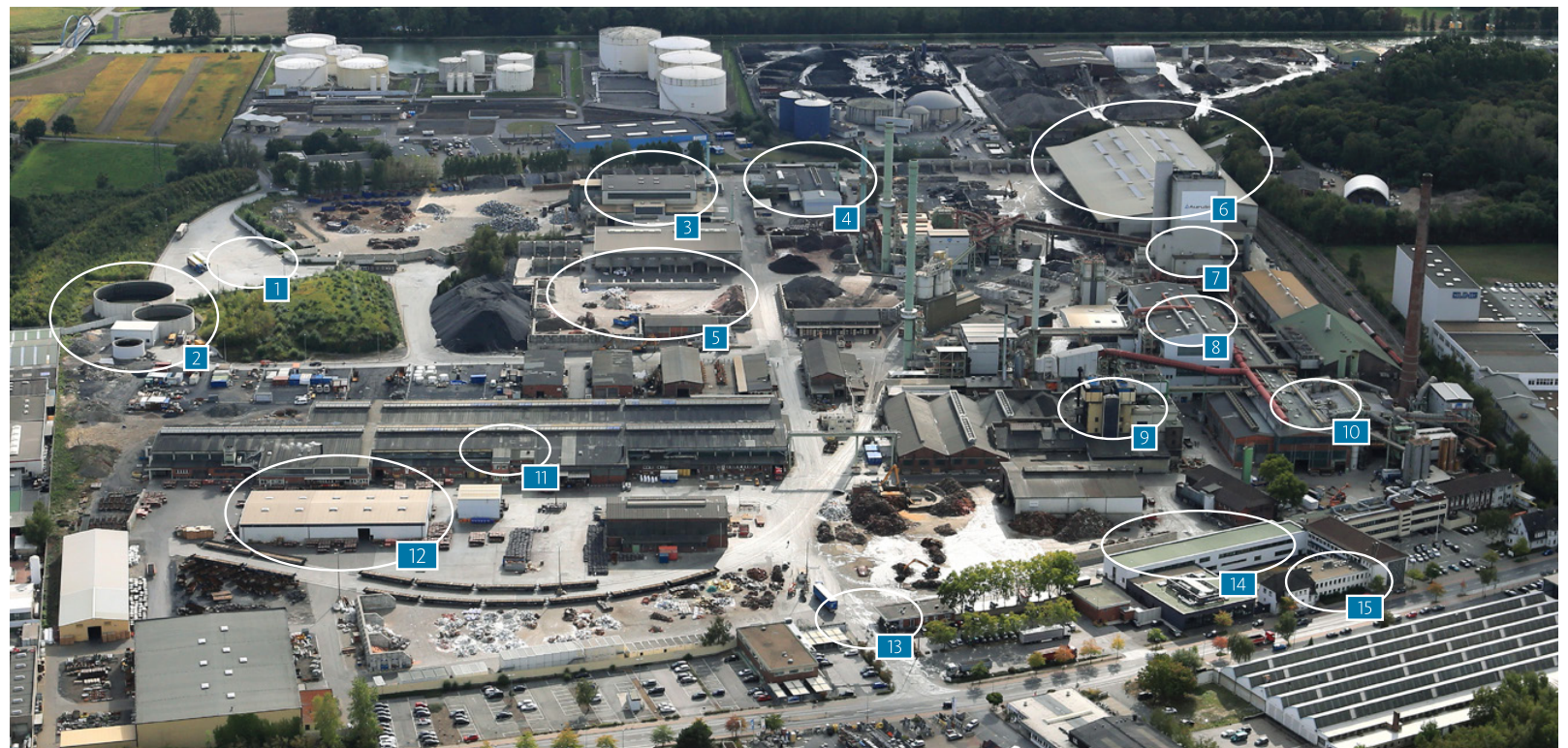
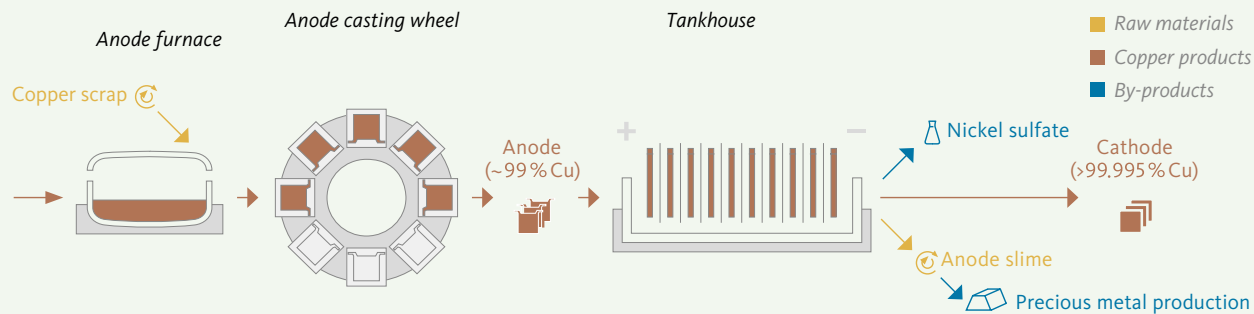
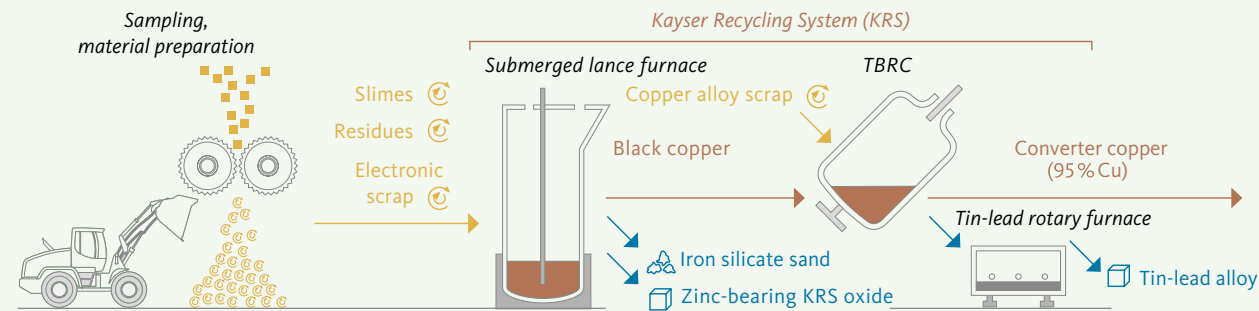
Pyrometallurgical processing starts in the Kayser Recycling System (KRS), which was commissioned in 2002 and gained a TBRC (top-blown rotary converter) in 2011 as part of the KRS-Plus project. The converter copper produced in the TBRC is refined together with copper scrap in the anode furnace and cast into copper anodes in a casting plant. These anodes are then refined electrolytically into copper cathodes – the site's final product. The tankhouse in Lünen processes anodes from other Aurubis sites as well  Fig. 3.2.

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

Fig. 3.2: Multimetal recycling at the Lünen site



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. At the Hamburg site, precious metals like gold and silver are recovered from anode slimes, together with a PGM¹ solution. 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. No process-related waste accumulates.

The integrated management system for the environment, quality, and energy

The Lünen site has been certified in accordance with the environmental management systems EMAS and ISO 14001 since 1997. The site's own environmental management system, together with the management systems for quality, energy, and occupational safety, comprise the integrated management system (IMS). The IMS includes the requirements placed on the Lünen plant as an end processor of electrical and electronic scrap (pursuant to the CENELEC standard TS 50625-5), a waste management facility (Circular Economy Act), and an initial treatment facility (Electrical and Electronic Equipment Law).

The external audits annually carried out as part of the IMS certification involve reviewing the environmental data, the fulfillment of legal provisions, and the effectiveness of the operating processes. Furthermore, the management systems' efficacy is assessed annually through IMS audits. The results of the company environmental audits and internal audits are compiled in reports and discussed with the plant managers during the Management Review. The managers evaluate how suitable, appropriate, and effective the management systems are and whether the requirements for the integrated management system are being implemented successfully.

¹ PGM = platinum group metal.

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 continuously. Environmental management includes the documentation of operational processes, the execution of 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 drives 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, supported by the ISO 50001-certified energy management system. This system depicts energy flows transparently and identifies possible optimization potential.

The management systems and organization of the IMS are described clearly and extensively in a handbook available to employees. Consequently, the IMS handbook and associated process and work instructions don't just address environmentally relevant issues and incident prevention, but also quality assurance measures, energy management, and occupational health and safety. This management handbook ensures 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 systems in Lünen support measures that fulfill the new Aurubis corporate strategy as well, which defines new and ongoing targets related to people, the environment, and the economy for 2030.

To guarantee compliance with these targets, uniform environmental KPIs are regularly established and reviewed for the Group, as well as verified by external auditors. Examples of these KPIs include specific metal emissions to air and water.

Environmental management organization


Aurubis AG operates facilities requiring a permit in accordance with Section 52b of the Federal Immission Control Act and Section 53 of the Circular Economy Act. As such, the company's Executive Board or an appointed Board member is responsible for compliance with environmental protection and radiation protection regulations.

Employees of the Lünen plant carry out the officer functions for:

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

A Group employee located in Lünen fills the role of hazardous materials officer. Corporate Environmental Protection centrally oversees the tasks related to implementing the European chemical regulations REACH and CLP (Classification, Labelling and Packaging). These tasks are laid out in the Corporate Environmental Protection Policy.

Environmental aspects and performance

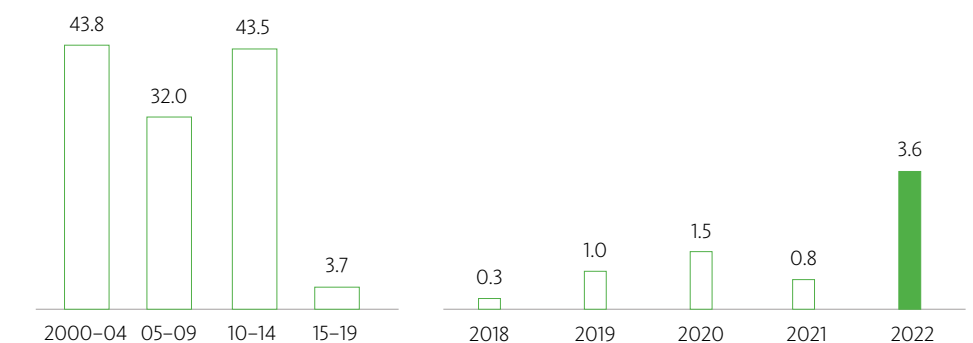
Investments in environmental protection measures continue to be of crucial importance in Lünen. Overall, around € 128.8 million was invested in environmental protection from 2000 to 2022  Fig. 3.3.

Following the acquisition of Hüttenwerke Kayser in 2000, Aurubis AG set new standards through extensive investment projects with new and improved facilities, such as the Kayser Recycling System (KRS) with an investment volume of about € 40 million.

The emission reduction concept for the period 2005 to 2009, which was agreed upon with the relevant governmental authorities, was initially estimated at around € 10 million and was later increased by further investments of € 25 million in additional measures (for instance, reducing dust emissions from KRS input materials in warehouse 4 and extensively paving storage areas).

Between 2015 and 2019, process optimizations were the primary focus at the Lünen plant. At the moment, more investments are planned for optimizing existing facilities (those used for input material storage and handling, for example) and to possibly build new ones, with the goal of achieving additional improvements such as reducing fugitive emissions.

Fig. 3.3: Investments in environmental protection measures at the Lünen site*
in € million



* The data shows the environmental investments for each fiscal year. Single years are provided for readability, for example 2022 for fiscal year 2021/22.

Air – Emissions

Emissions from directed sources (chimneys) are monitored with continuous measuring devices that transfer the emissions data. In addition to dust, substances like 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 emission limits for air pollutants are stipulated in the TA Luft (Technical Instructions on Air Quality Control), with the limits in the permit requirements for some facilities falling well below the TA Luft standards. 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. Emissions to air comply with the limit values in all of the permits, or fall significantly below them in some cases. The same applies to additional substances listed in the permits, such as 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. The difficulty in this regard is that the measured levels are already far below the detection limit in many areas, which could also be a reason for emission fluctuations in the calibration of the measuring devices. Because the emission level is already very low, significant reductions like those in the past can't be expected through individual technical measures anymore. The goal is to continue maintaining this very low level and to improve it wherever possible.

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 graphic presented here also incorporates the fugitive emissions including storage and handling. The dust emissions in 2022 were again at the same low level of the past several years [Fig. 3.4](#).

Due to the new specific reduction targets that were set for the entire Group as part of the revised Sustainability Strategy, specific emissions won't be reported based on the input material anymore, but based on a multimetal indicator – referred to as the copper equivalent. This approach and calculation method are described in detail in the Group portion of this environmental report in the section [Targets and successes in environmental protection](#).

Dust emissions in the Lünen plant are therefore being reported based on the new indicator for the first time, and are shown for the last five years. Until the end of the target timeframe of the original Sustainability Strategy 2018–2023 [Fig. 3.4](#), the emissions will also continue to be reported based on the input material volume.

The Lünen plant is working with increasingly complex raw materials. As technical devices become smaller and smaller, and the number of processing stages increases as a result, copper production is lower, but there are more by-products per ton of material input. As a result, the new multimetal indicator provides an optimal depiction of the Lünen plant and its complex input materials since it includes the value created from all metal categories.

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 buildings 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 was better dust-proofed and a roof section in the anode furnace casting area was equipped with a water sprinkler for dust abatement. In the future, drones will be used to measure fugitive emissions as needed.

Fugitive emissions in particular have been determined or calculated in accordance with the methods used at the Hamburg site since 2004.

The emission level in 2021 was determined by measuring emissions originating from the TBRC and then extrapolating this result to get the annual emissions. In 2022, the figure stagnated at a low level. The Lünen plant is already planning additional emission reduction measures connected with scheduled projects that were communicated to the governmental authorities in early 2023.

Emission measurements

using a drone at the Lünen plant



Fig. 3.4: Dust emissions at the Lünen site

Dust emissions in g/t of input material and in g/t of copper equivalent

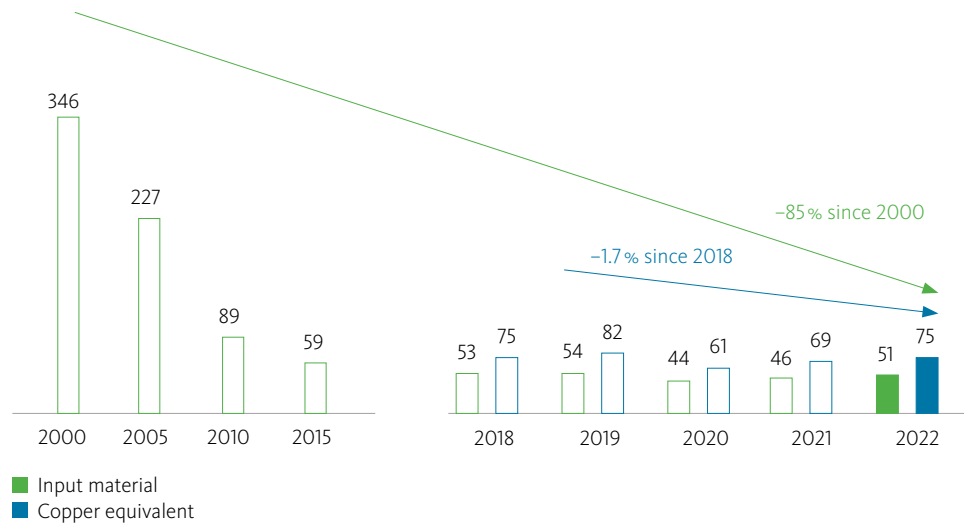


Fig. 3.5: Copper emissions at the Lünen site

Copper in g/t of input material

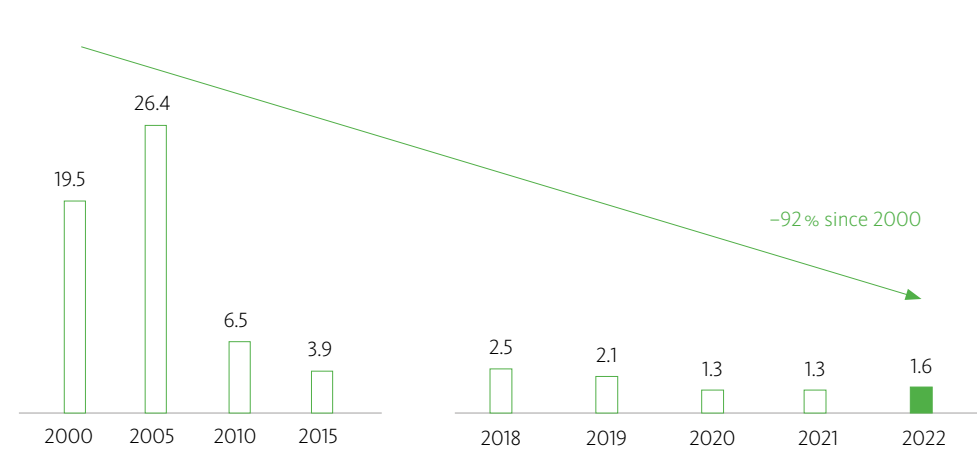


Fig. 3.6: Lead emissions at the Lünen site

Lead in g/t of input material

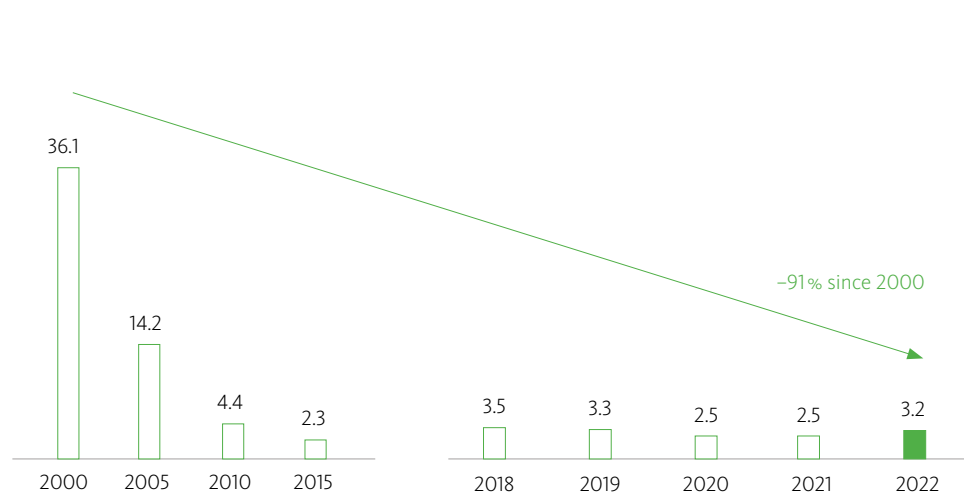
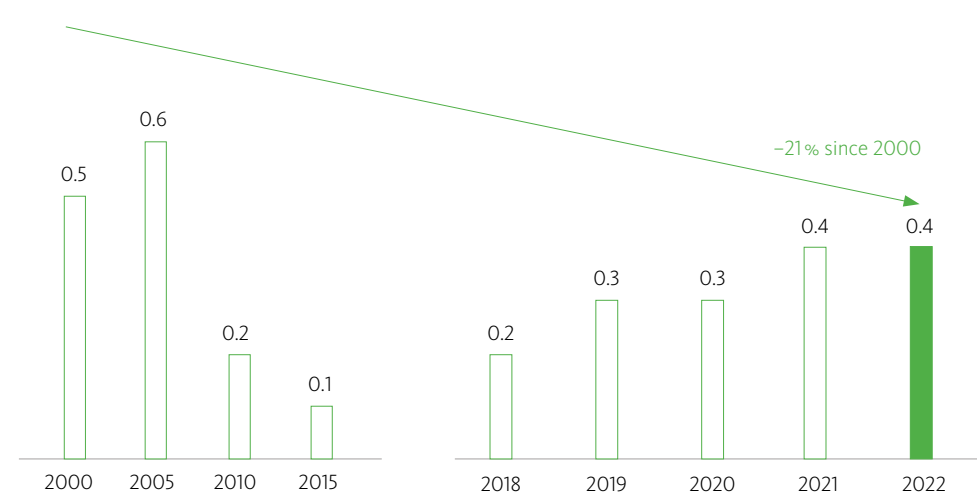



Fig. 3.7: Arsenic emissions at the Lünen site

Arsenic in g/t of input material



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 11 “Bergerhoff” measuring points in the area surrounding the Lünen plant  Fig. 3.8.


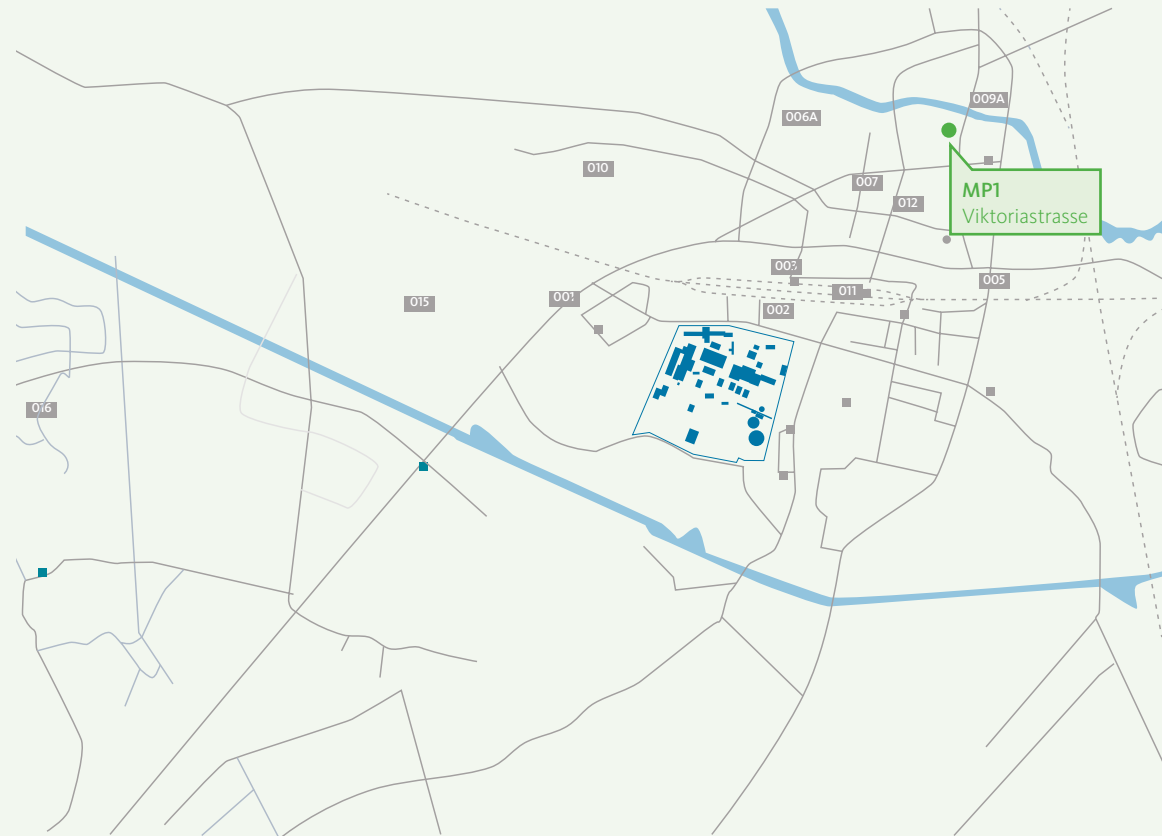
The closest LANUV measuring station for recording concentrations of particulate matter (PM10) is located on Viktoriastrasse (northeast of the plant). The position corresponds to that of the plant’s calculated immission maximum  Fig. 3.9.

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



“Bergerhoff” measuring 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 the last ten years, there has been a significant reduction in dust immissions, primarily dust components. While isolated deposition values of the TA Luft were exceeded in some cases, the distribution of the deposited substances resulted from a number of specific emission parameters, such as meteorological conditions and properties of the substances, so immissions and depositions can't be directly attributed to individual emitters. With regard to the immission situation in the Kupferstrasse industrial area, Aurubis communicates with the relevant governmental authorities and the other companies on site to identify and implement suitable reduction measures. Consequently, the Lünen plant reassessed the situation in an open dialogue with the authorities in early 2023 and planned additional emission reduction steps in conjunction with the TBRC 2 project, including closing the roof of the KRS building, installing an off-gas cleaning system for optimal suctioning within the scope of the project, cleaning and directing emissions through a directed source, closing the ridge turrets of the anode casting hall, and optimizing slag handling in the slag breaking area.

The measurements of air quality for suspended particulates and their components indicate that the levels are significantly and consistently below the limit values for both PM10 and lead, as well as below the EU target values for arsenic, cadmium, and nickel [Fig. 3.10–3.13](#). The LANUV measuring point at Niedraden is listed for comparison; it serves LANUV as a reference measuring point without industrial impact.

The LANUV measuring program, which investigated leafy vegetables from small gardens in Lünen near the plant, was discontinued because the measurement values stabilized at a low level in 2020.

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, Viktoriastrasse, and Niedraden

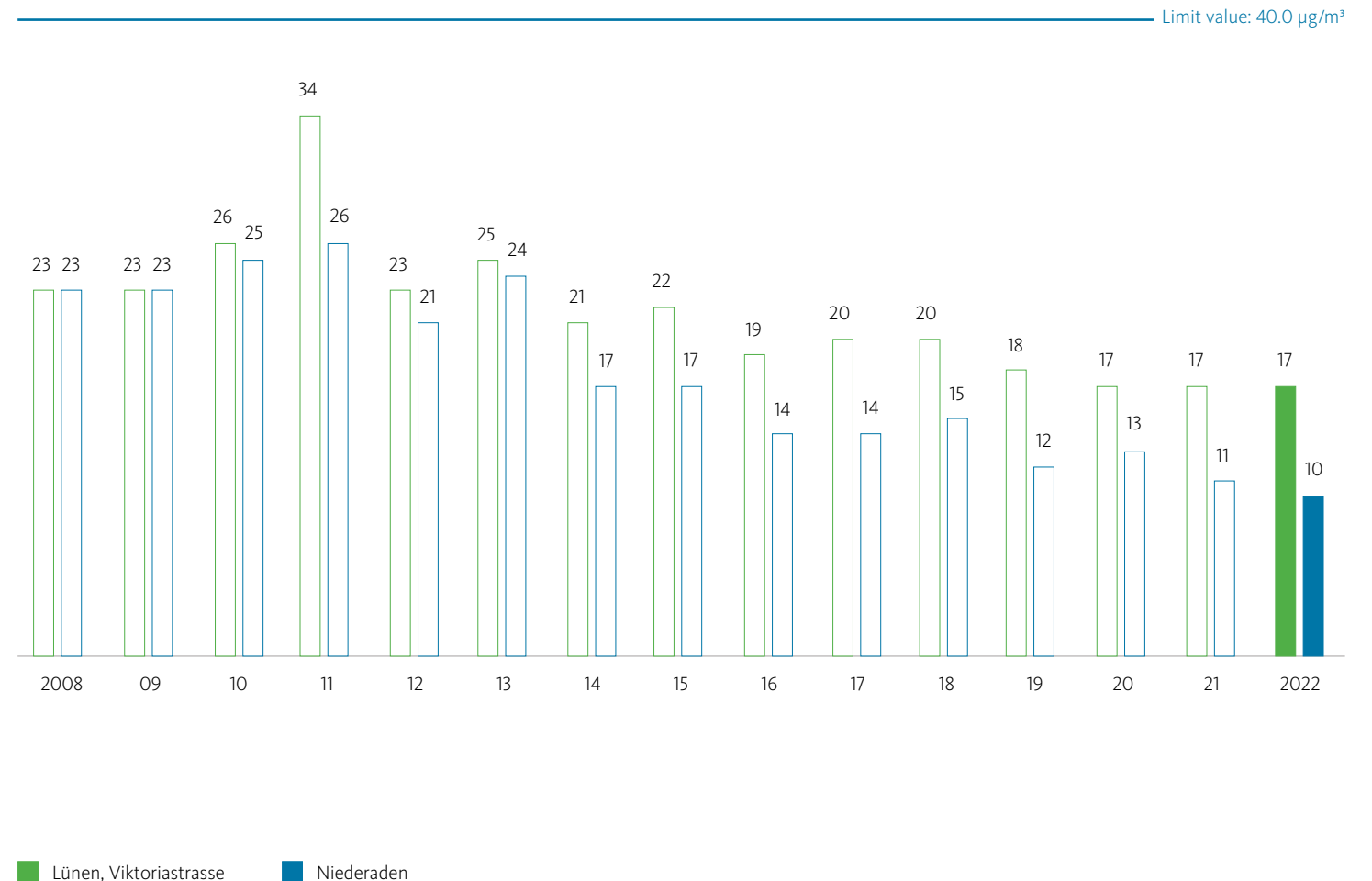
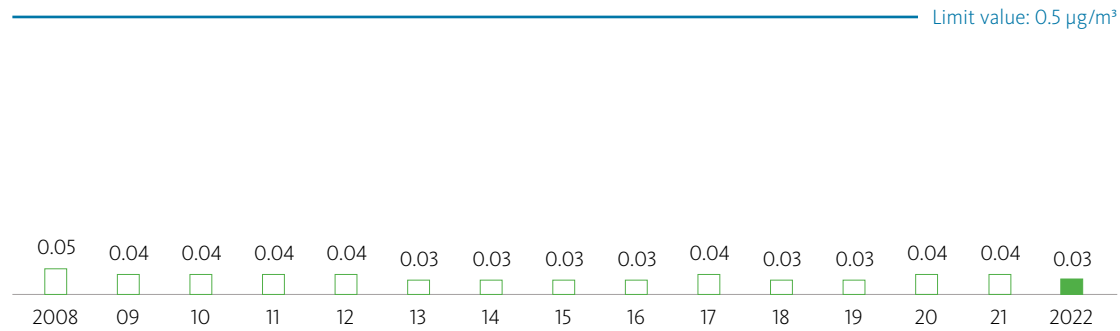
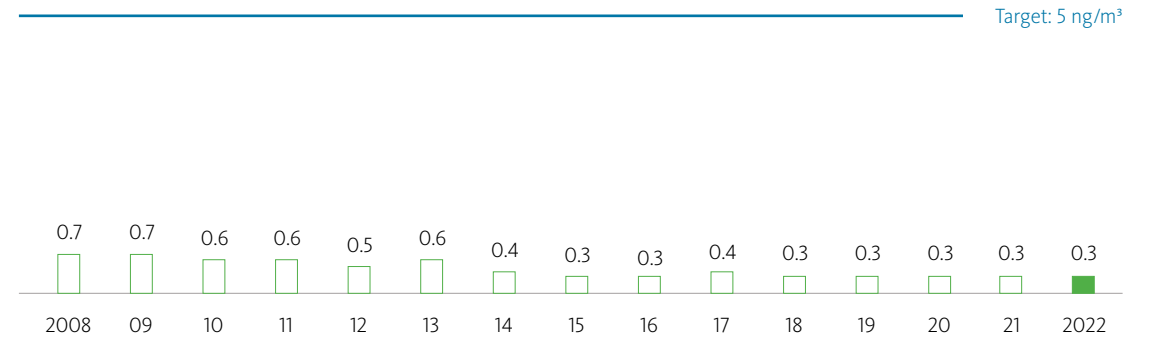
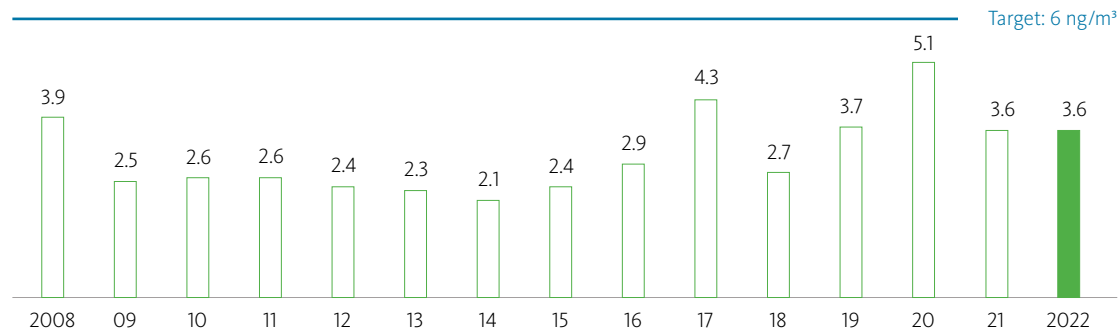
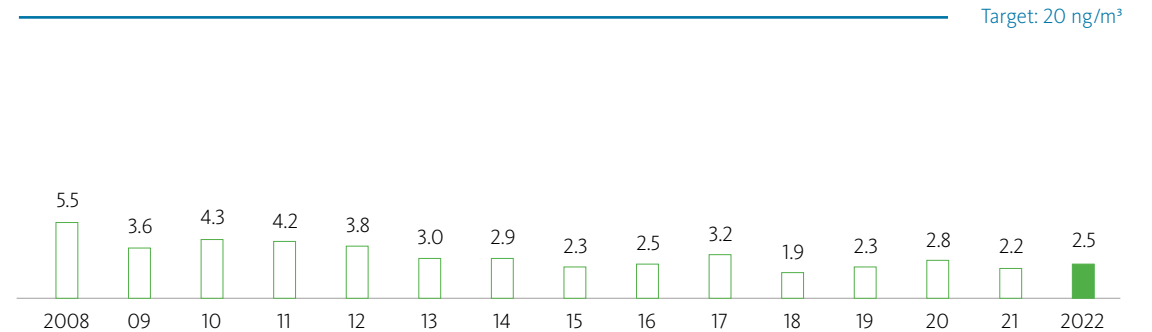


Fig. 3.10: LeadLead immissions in $\mu\text{g}/\text{m}^3$ **Fig. 3.11: Cadmium**Cadmium immissions in ng/m^3 **Fig. 3.12: Arsenic**Arsenic immissions in ng/m^3 **Fig. 3.13: Nickel**Nickel immissions in ng/m^3 

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 conserve water resources as much as possible, the Lünen site operates a facility for rainwater retention, treatment, and utilization, 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 consumption from the public water network has decreased accordingly. In 2022, more than 170,000 m³ of process water was used for internal purposes. Overall, the rainwater-use project has significantly surpassed the projected quantities. In 2022, water consumption and wastewater discharge were at a good level similar to the past years [Fig. 3.14](#). There were no notable incidents in 2022 that had any significant impact on the site’s water consumption. Water withdrawal and release depend on different factors, however, including weather-related factors (e.g., precipitation volumes and evaporation) and production-related factors (e.g., increased evaporation in production processes and measurement deviations), and can fluctuate as a result.

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.

Fig. 3.14: Water consumption at the Lünen site

Water consumption in m³/year

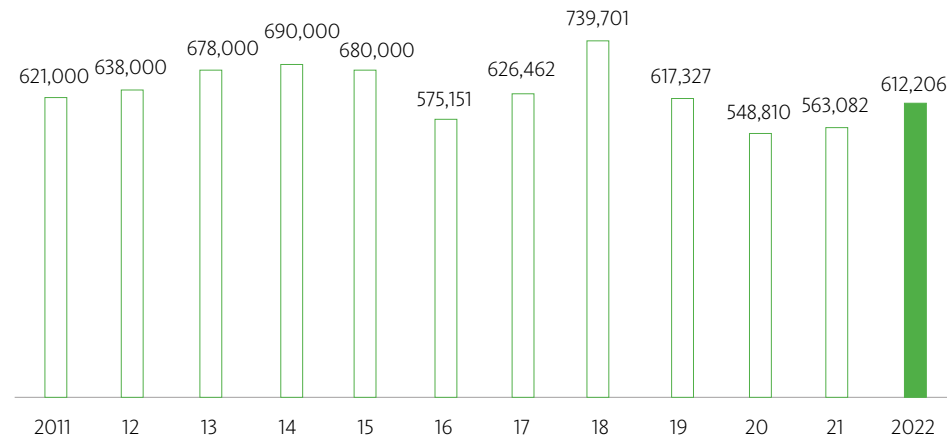
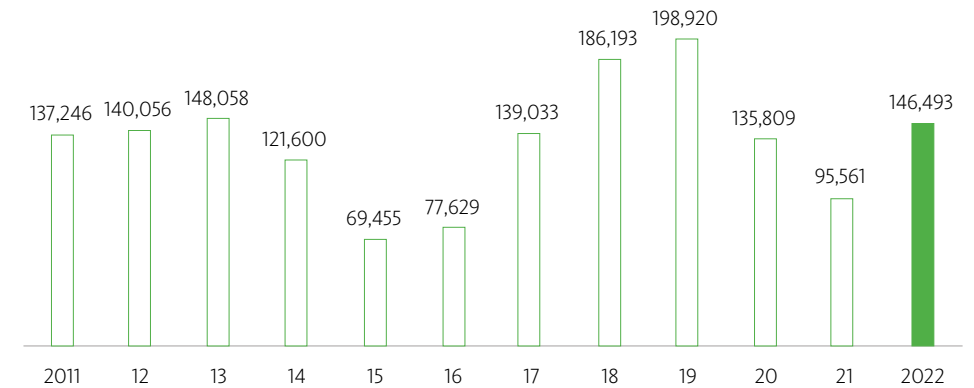


Fig. 3.15: Wastewater discharge at the Lünen site

Wastewater discharge in m³/year*



* The wastewater discharge from the rainwater retention has been recorded since 2017; as a result, the 2015 and 2016 figures are substantially lower than in comparable years.

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 damage, 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. An alternative concept is being drafted and will be finalized in 2023.

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 use the remediated water in a similar way to sensibly combine remediation with further resource conservation.

Soil – Preventative measures

For decades now, preventative measures have been developed in order to eliminate future contamination of 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 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 goal is to ensure that any additional noise pollution in the area, as defined by the TA Lärm regulation, is only 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.

There were multiple noise complaints in 2022. For those that were attributed to sources on the Aurubis plant premises, the sources were immediately remedied. No limit values were exceeded in any measurable way. No more complaints have been received since June.

Over the course of 2022, three complaints were submitted regarding dust. With extensive research and analyses, the Aurubis plant premises were ruled out as a source. Two of the three complaints were communicated directly through the district government. The research and analysis results were conducted and communicated with the local government as well as with those who lodged the complaints.

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 Kämpfen, 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 FFH¹ assessments in order to identify possible impacts on biodiversity. In smaller projects in the plant and in the neighborhood, we continue to take active steps to promote and preserve biodiversity – for example, by planting greenery on plant surfaces that aren't in use (noise protection wall) and setting up nesting sites on buildings and chimneys.

Waste

The waste from the Lünen plant is mainly due to packaging from delivered materials, construction measures, and spent potlining from the KRS, anode furnaces, etc. The externally marketed contingents from 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 after processing. In the meantime, sorting in the facility has become nearly homogeneous, making it possible to deliver all contingents completely as raw material for recycling to the respective industries for several years now.

A total of 372 t of hazardous waste accumulated in 2022, mainly spent furnace lining material. All of this waste was sent for recycling.

¹ Flora Fauna Habitat Directive (EU Habitats Directive).

Fig. 3.16: Waste generated at the Lünen site

	Unit	2018	2019	2020	2021	2022
Non-hazardous waste	t/year	5,467	4,842	19,712	8,944*	5,206
Hazardous waste	t/year	362	458	402	329	372
Construction waste	t/year	3,234	9,639	3,015	14,638	58,349
Total waste volume, including construction waste	t/year	9,063	14,939	23,129	23,911	63,725

* Changed after the fact (residues transferred to other Aurubis sites).

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 0.1 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. With around 6.5 GWh of internal power generation in 2021, the turbine capacity was far below the 10 GWh from 2020, which was primarily the result of damage to the waste heat boilers.

Developments and background on the use of primary energy sources:

- » At 495 GWh, the plant's total energy demand in 2022 was below the 500 GWh threshold and around 10 GWh below the prior-year level. The main influencing factors:
 - » A 10 GWh reduction in electricity demand due to the ongoing renovation of the tankhouse
 - » A 13 GWh reduction in heavy fuel oil consumption
- » Continued high input of energy-intensive, complex raw materials such as shredder materials and residues

The electricity required 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 339 GWh in 2022, the primary energy input is around 3 % lower than the five-year average of 349 GWh. At about 154,000 t, direct CO₂ emissions fell below 160,000 t again. According to the reporting methods pursuant to DEHSt standards, the organic components in the raw materials still contribute more to the site's CO₂ emissions than the main energy source, heavy fuel oil.

Energy demand in 2022 reflects the following developments:

1. The fundamentally positive trend in process-related primary energy needs in the smelting operations continues. Anode output in Lünen was approximately 199,000 t, around 4 % higher than the average anode output from 2018 to 2021.
2. The project to refurbish the tankhouse started in April 2019. The first 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, the 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. Refurbishment resumed again in 2021.

Copper cathode output rose from about 149,900 t in 2021 to 156,700 t. At the same time, in 2022 roughly 10,000 t of converter copper and around 17,000 t of copper anodes, or about 15 % of the copper output (2021: 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. 3.17: Energy consumption¹ at the Lünen site

	Unit	2015	2016	2017	2018	2019	2020	2021	2022
Primary energy consumption	MWh	404,317	390,734	391,679	360,990	337,970	352,437	352,519	339,461
Secondary energy consumption	MWh	161,167	155,212	165,117	164,593	155,067	163,553	153,145	155,021
Total energy consumption	MWh	565,485	545,946	556,796	525,583	493,036	515,990	505,664	494,482
Energy consumption per ton of copper output	MWh/t Cu	3.04	3.05	2.89	2.73	2.79	2.83	3.00	2.69

¹ Calculated using DEHSt (German Emissions Trading Authority) standards.

Fig. 3.18: 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. 3.19: Direct CO₂ emissions at the Lünen site

	Unit	2015	2016	2017	2018	2019	2020	2021	2022
Direct CO ₂ emissions	t/year	174,549	176,067	186,544	169,415	163,572	162,166	164,854	156,794
Biogenic CO ₂	t/year	0	480	324	300	295	313	379	334
CO ₂ subject to DEV 2020 ¹	t/year	171,858	173,202	183,839	166,918	161,113	159,739	162,276	154,294

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

Fig. 3.20: Energy consumption at the Lünen site

in MWh/t of copper output

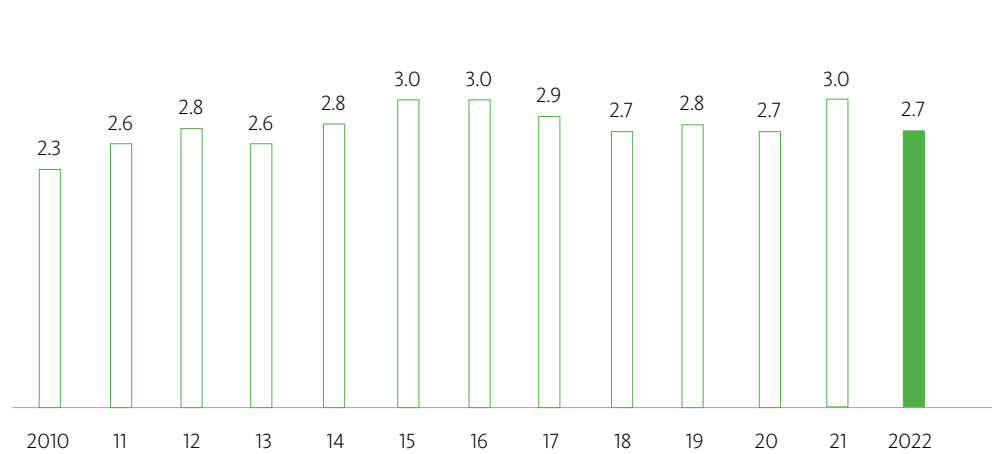
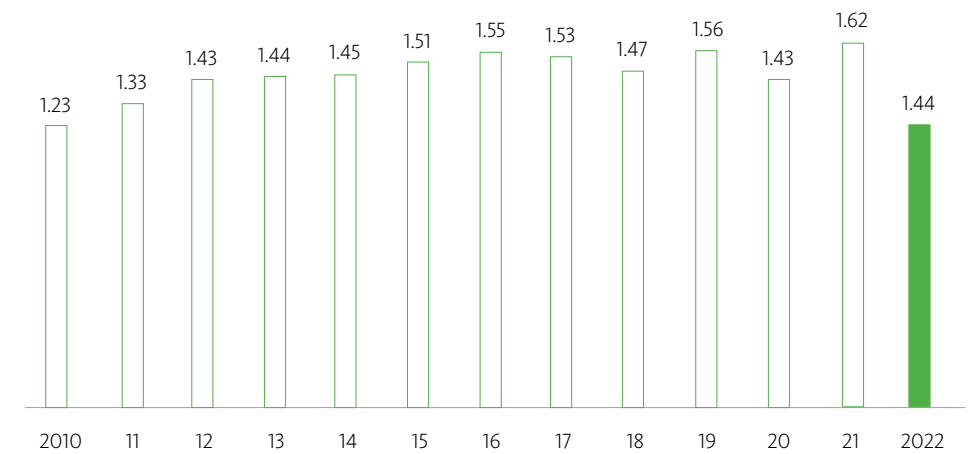


Fig. 3.21: Direct CO₂ emissions at the Lünen site

in t CO₂/t of copper output



Audits and inspections by governmental authorities

The following environmental inspection was carried out by the relevant governmental authorities in 2022:

- » IED¹ plant inspection, focus of the inspection: air (emissions and immissions), implementation of the 42nd German Federal Immission Protection Ordinance on Legionella & Waste Flows, December 19, 2022

The inspection was completed without any deviations. The reports are 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 quantity of anodes delivered to the plant and the cathodes delivered from the plant by train increased significantly.

¹ Industrial Emissions Directive.

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 revised regularly and is adjusted and expanded to reflect the results of hazardous incident inspections. The hazardous substances register indicates the locations of these

substances in the plant as well as potential incident scenarios.

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 definition of the Hazardous Incident Ordinance at the Lünen plant during the reporting period.

Environmental Program

The targets set in the context of the Environmental Statement 2022 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 2023. The results are presented in the following Environmental Program.

Target	Planned measures	Degree of implementation/date
Air pollution control		
Concept for better dust control in storage areas throughout the entire plant	Setting up new Legio walls, boxes with slanted roofs, semi-automatic water sprinklers with the help of central technical containers and various water sprinklers and misting machines	The concept was developed and presented to the governmental authorities. Implementation is planned for the period between 2023 and 2025
Reducing emissions and improving odor immissions in the plant surroundings	New filter in sampling with extraction ring in the sampling hall	The filter will be commissioned in 2023
Water pollution control		
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 and the water usage concept to prevent unused process water from being discharged was developed (January 2023). A schedule of the preliminary inspections is being drawn up. Next steps: » Pump trials » Testing the treatment procedures
Waste management/polluted areas		
Renaturation of the internal, defunct blast furnace slag (HOS) landfill	The historical HOS landfill is being dismantled and disposed of externally, eliminating the complex process of securing and cultivating the landfill on the plant premises.	The concept for the dismantling and disposal at external landfills continues to be fleshed out with the support of external consultants (March 2023)
Energy optimization		
Enhancing energy efficiency	Developing an assessment basis that takes the following aspects into account: <ul style="list-style-type: none"> » Form of energy » Raw material structures » Raw material availability » Raw material composition (complexity) » Price volatility 	The ENPIs are reliable and sound. In the coming years, standards-based assessment benchmarks will be introduced for the entire process in order to better monitor sustainable development
Development of a steam storage facility for optimized use of steam	The goal of steam storage is to minimize energy losses and optimize the supply of process steam for the boilers and plant facilities	The project is in the engineering phase and is scheduled to be budgeted and tendered this year

Key figures for Aurubis AG, Lünen site, in calendar year 2022

Developments in KPIs are explained in the text

Input	Unit	2020	2021	2022
Raw materials				
Recycling raw materials	t	328,521	350,855	336,862
Blister, etc.	t	12,661	15,938	12,549
Copper anodes from other Aurubis sites	t	21,556 ¹	0	5,394
Bleed	t	39,546	45,482	44,582
Total raw materials	t	386,476	392,414	399,387
Input material/t Cu output	t/t Cu	2.12	2.33	2.17
¹ Changed after the fact.				
Operating supplies and materials				
Oxygen	million m ³	44	43	32
Rhine sand	t	23,820	17,879	16,746
Limestone	t	3,646	2,154	1,205
Energy				
External power sources	MWh	153,478	146,595	147,930
Internal power sources	MWh	10,075	6,549	7,502
Natural gas, oil, coal	MWh	352,437	352,519	321,977
Total energy consumption	MWh	515,990	505,664	494,482

Input	Unit	2020	2021	2022
Water withdrawal/uptake				
Potable water	m ³	548,810	563,082	612,206
Precipitation	m ³	126,640	128,636	149,568
Other sources (e.g., raw materials)	m ³	33,746	39,547	36,412
Total water uptake	m³	709,169	731,265	798,186
Water consumption/t Cu cathode output	m³/t Cu	3.7	4.3	4.3
Area used				
Total plant area (incl. south plant entrance)	m ²	316,000	316,000	316,000
Buildings and paved area	m ²	252,784 (equivalent to 80 %)	252,784 (equivalent to 80 %)	252,784 (equivalent to 80 %)

Output	Unit	2020	2021	2022
Products				
Copper products sold (cathodes, anodes, and blister)	t	182,424	168,332	184,070
KRS oxide	t	20,327	22,841	22,667
Iron silicate sand	t	177,179	173,904	160,615
Other (tin composite, nickel sulfate, etc.)	t	21,087	23,428	21,679
Total products	t	401,017	388,505	389,031
Waste				
Recycling	t	4,442	9,261 ¹	5,569
Disposal	t	15,672	0	0
Waste/Cu output	kg/t	110	55	30
Waste/input material	kg/t	52	24	14
Construction waste	t	3,015	14,638	58,349
Total waste	t	23,129	23,911	63,927
Emissions				
CO ₂ (direct emissions)/Cu output	t CO ₂ /t Cu	0.89	0.96	0.84
Dust/Cu output	g/t	93	107	110
Dust/copper equivalent	g/t	61	69	75
SO ₂ /Cu output	kg/t	5.4	6.5	5.5
NO _x /Cu output	kg/t	1.8	1.8	1.7
Water discharge				
Wastewater (indirect discharge)	m ³	135,000	95,000	146,000
Water discharge/Cu output	m ³ /t	0.74	0.57	0.80

¹ Changed after the fact (residues transferred to other Aurubis sites).

CERTIFICATE



IHK Hannover als EMAS-Registrierungsstelle
für die Industrie- und Handelskammern
in Norddeutschland

Aurubis AG


Hovestr. 50, 20539 Hamburg
Kupferstr. 23, 44532 Lünen

Registration-No.: DE-131-00035

Date of first registration: 1st November 2005

This certificate is valid until: 19th May 2026

This organisation has established an environmental management system according to Regulation (EC) No. 1221/2009 and EN ISO 14001:2015 (sections 4 to 10) to promote the continual improvement of environmental performance, regularly publishes an environmental statement, has the environmental management system verified and the environmental statement validated by an independent and accredited verifier, is registered under EMAS (www.emas-register.de) and therefore is entitled to use the EMAS-Logo.

 **IHK** Industrie- und Handelskammer
Hannover
Chamber of Industry and Commerce


Dr. Mirko-Daniel Hoppe

Hannover, 21st June 2023



TÜVNORD

ENVIRONMENTAL VERIFIER'S DECLARATION ON VERIFICATION AND VALIDATION ACTIVITIES



in accordance with the
**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)

The signing environmental verifier Ralph Meß, licensed for the scope "NACE-Code 24.44 - production and initial processing of copper", declares, to have verified whether the whole organisation as indicated in the environmental statement of the organisation

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Aurubis AG
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44532 Lünen
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with registration number D-131-00035 meet(s) 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 in the version amended by regulation (EU) 2017/1505 and regulation (EU) 2018/2026 are fulfilled (EMAS).

By signing this declaration, I 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 organisation 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, 19.05.2023


Ralph Meß
Environmental Verifier
DE-V-0300

TÜV NORD CERT
Prüf- und Umweltgutachtergesellschaft mbH
Registration number: DE-V-0263

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Imprint

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LAYOUT

domin kommunikationsdesign

PHOTO CREDITS

Aurubis AG

EDITORIAL DEADLINE

This report describes calendar year 2022. Current events were included up to the editorial deadline of May 2023.

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

aurubis.com

Metals for Progress

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