



Environmental Protection in the Aurubis Group  
and consolidated Aurubis AG Environmental Statement 2017  
Hamburg and Lünen Sites





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Dear readers,

Our modern world would be unthinkable without metals. Windmills couldn't turn; telephone calls couldn't be made, and electric cars couldn't move. Metals have been used by humans in some way for thousands of years. Today, they are a permanent feature of our day-to-day existence and an indispensable component of all future technologies.

Whether considering the raw materials we use or the energy we need for processing them, when handling precious resources, we have taken "environmental protection" and "efficiency" seriously for some time. These leading principles have become the essential pillars of our sustainability strategy. In our entire value chain from raw material to product, we act according to these ideals.

Copper, in particular, represents resource efficiency par excellence for it can be recycled repeatedly without losing any quality. In our facilities we use thousands of tons of copper scrap and electronic scrap every day. We extract high-purity copper from the scrap. It's possible that this exact copper we're extract was also used thousands of years ago in a tool in the Bronze Age – just like many other metals and metal compounds that we produce in the form of marketable products. This is sustainability in practice.

No raw material is ever wasted at Aurubis. Our discard rate is well under one percent. To accomplish this in as efficient and environmentally compatible a way as Aurubis does, extensive expertise is needed – for the individual metals but also for the various metallurgical preparation processes.

We have summarized this expertise and the diversity of the metal world in which we operate in our new Vision 2025:

**Passion for Metallurgy. Metals for Progress.  
Together with you.**

These three sentences express our identity. Metallurgy is our main area of expertise. Passion represents our motivation to not just stand still but to develop our expertise further. Metals are our contribution to progress. We'll achieve this not just through our focus on copper. By 2025 we intend to also produce additional metals of the future. We are developing new solutions through collaborations with our business partners. Together with all employees as a team, we commit ourselves every day anew to improvement.

Of course, this includes continuously improving our environmental and resource protection. Today, Aurubis is a world leader in these areas, and we are proud of this. But instead of resting on our laurels, we will work systematically to become even cleaner, more efficient and more sustainable.

In the following pages of our Environmental Statement 2017, we would like to share with you the latest developments in environmental and resource protection. We encourage you to view this document as an invitation to a dialogue – our environmental team is always happy pleased to answer your questions.

Sincerely,



**Jürgen Schachler**  
Chairman of the  
Board Products



**Dr. Stefan Boel**  
Executive Board Member  
for Business Unit Copper



# Company Profile and Business Model

## The Aurubis Group

Aurubis AG is an integrated copper group whose main activities are copper concentrate processing, metal recycling and fabrication of a variety of copper products. Precious metals and specialty products complete our product range.

The company's headquarters, which is also home to key production facilities, is located in Hamburg, Germany. The Group's sites are primarily located in Western Europe, with larger production centers in Germany, Belgium and Bulgaria. Outside Europe, Aurubis also has a production site in the USA and a global sales and service network.

A total of 6,454 employees were working in the Aurubis Group worldwide as of September 30, 2016. Of this number, 56 % were employed at German sites and 44 % in other countries.

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

## Business Model and Group Structure

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

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

Aurubis' direct customers include companies in the copper semis industry, the electrical and electronics sector, the chemical industry and suppliers in renewable energies, construction and the automotive business.

Aurubis is oriented to growth and to increasing corporate value. The main focuses of corporate strategy are on expanding our leading market position as an integrated copper producer; utilizing growth opportunities; and practicing a responsible attitude when dealing with people, resources and the environment.

The Aurubis Group's organizational structure is oriented towards its underlying business model. The Group's organizational structure is made up of two operating Business Units (BUs): BU Primary Copper and BU Copper Products.

		2014/15	2015/16
Copper price			
LME settlement (Ø)	US\$/t	5,933	4,767
Revenues	€m	10,995	9,475
Operating earnings before taxes (EBT)	€m	343	213
Operating consolidated net income	€m	257	165
Capital expenditure	€m	112	143
Personnel expenses	€m	431	449



**Dr. Thomas Büniger:**

»It is important for us to make the environmental performance of Aurubis and its products measurable in order to uncover optimization potential and to model our multi-metal production.«

Fig. 1.1: **Organizational Structure**

Corporate Functions			
»Energy & Climate Affairs »Finance »Research and Development »Human Resources »IT »Investor Relations »Communications »Legal Affairs/Corporate Governance »Risk Management »Environmental Protection »Central Procurement and Logistics »Development »Public Affairs »Health and Safety and others topics			
Business Units			
<b>PRIMARY COPPER</b>		<b>COPPER PRODUCTS</b>	
This Business Unit is made up of the production facilities for processing copper concentrates and producing copper cathodes at the Hamburg and Pirdop sites. Furthermore, the precious metals division in Hamburg, which is centralized for the entire Group, is part of this Business Unit.		Business Unit Copper Products produces and markets continuous cast wire rod, continuous cast shapes, rolled products and specialty products. Organizationally, the product business is divided into the following Business Lines (BLs): Rod & Shapes, Flat Rolled Products, Bars & Profiles and Marketing Cathodes. Recycling is also part of this BU within the organization.	
<b>Main sites</b>		<b>Main sites</b>	
Hamburg (DE) Pirdop (BG)		Hamburg, Lünen, Stolberg, Emmerich (GER), Olen (BE), Zutphen (NL), Pori (FIN), Avellino (IT) und Buffalo (USA). Processing centers in the United Kingdom, Slovakia and Italy, as well as a global sales and distribution network, complete the product business.	
<b>Main activities</b>		<b>Main products</b>	
Processing of copper concentrate; Production of cathodes, sulfuric acid, iron silicate and other special products		Continuous cast wire rod, shapes, strip/foil, shaped wire, specialty profiles	
Revenues, €m	5,325	Revenues, €m	7,531
EBIT (operating), €m	154	EBIT (operating), €m	106
ROCE (operating)	16,4	ROCE (operating)	9,7
Employees, Ø	2.750	Employees, Ø	3,335

# Environmental Protection in the Aurubis Group

## Strategy

We ensure our leading position in environmental protection by steadily learning and improving. We assume group-wide responsibility for environmentally friendly production. It is self-evident to us that the impact of our business activities on the environment and humans should be kept as low as possible. Environmentally sound multi-metal production from primary raw materials such as iron concentrates and recycling form the foundation for a responsible and demand-oriented metal supply in Europe. By doing so, we are safeguarding our sites and creating the basis for future-oriented investments.

With our multi-metal recycling, we are ensuring that the material cycle for copper and other metals is closed. It is becoming more and more important to recycle products after their lifecycle is over. In the process, valuable raw materials are used efficiently, resources conserved and environmental pollution is avoided. We at Aurubis have created a new function for this, as well: Customer Recycling Solutions unites copper product sales and recycling raw material sourcing. In this way, customers become suppliers at the same time.

## Aurubis assumes responsibility for environmental and climate protection

Our strategy and our targets are established in the company guidelines and corporate policy on environmental protection; these are binding throughout the Group. The guidelines define areas of activity and responsibility, specify information and reporting requirements and establish the duties of Corporate Environmental Protection as well as cooperation with the local environmental protection officers and the managing directors and plant managers. This will ensure a uniform approach to environmental protection within the Group and in terms of public image. The Group headquarters will support the sites with expertise and technology transfer.

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



### Corporate environmental protection:

»Together with the environmental officers at the Aurubis sites, we are steadily improving environmental protection. By doing so, we are safeguarding our sites and the basis for future-oriented growth processes.«

Orhan Cekel, Dr. Karin Hinrichs-Petersen, Dr. Jörn Mühlenfeld,  
Jan Drzymalla, Daniela Cholakova, Nicole Hennings (from l. to r.)

As in previous years, our Environmental Statement 2017 is based on internationally recognized guidelines and reporting standards.

### Successes

In 2012 we established group-wide targets for environmental protection as well as specific targets for the individual sites for 2015. In addition, as a result of changed requirements for soil conservation with the entry into force of the German Industrial Emissions Directive, the aspect of "soil conservation" was addressed for the first time group-wide.

For example, the following measures, which contributed significantly to improvements in environmental protection, were implemented in order to achieve the established targets:

- » A new off-gas treatment plant was commissioned at the Bulgarian site in Pirdop. It has been in normal operation since March 2016 and contributes to reducing sulfur dioxide and fugitive emissions further.
- » In order to increase water quality, a water treatment plant for further reducing emissions to water was built at the Bulgarian site in Pirdop. With a capacity of 250 m<sup>3</sup>/h and multiple catch basins with a volume of 32,000 m<sup>3</sup>, the plant treats the site's surface water in particular.

» To reduce the use of city water in Lünen, a facility for rainwater retention, preparation and utilization was commissioned. The retained water is already being used as process water. The next step will be to review which other possibilities there are to use the water in the site's different processes.

» At the Hamburg site, the voluntary agreement with the city of Hamburg for the further reduction of emissions continued to be implemented in cooperation with the Authority for Urban Development and the Environment.

The group-wide environmental protection standards have been achieved in all areas; the targeted emission reductions were significantly exceeded.

Specific dust emissions for primary and secondary copper production have been reduced by 96 % compared to 2000 (target: 90 %). Similarly, a reduction of SO<sub>2</sub> emissions of 85 % was realized in the same period under review (target: 80 %). Consequently, when compared internationally, the Group is a forerunner in reducing specific sulfur dioxide emissions.

We have also made significant improvements in water pollution control. We have reduced metal emissions to water in copper production processes from 7.2 to 1.0 g per ton of copper output since 2000. This corresponds to a decline of 87 % (target: 70 %).

## Targets and Challenges

In the future as well, we will work systematically to become even cleaner, more efficient and more sustainable. For this we have updated the environmental targets and harmonized them with the sustainability targets. The thematic area of “Nature Conservation and Biodiversity” represents another complementary pillar of environmental targets.

The effectiveness of these targets and measures is reviewed continuously. Environmental management systems (in accordance with ISO 14001 in particular; as well as in accordance with the Eco-Management and Audit Scheme [EMAS] at Aurubis Hamburg, Aurubis Lünen and Schwermetall Halbzeugwerk, Stolberg, as well as other standards, such as ISO 50001) support their implementation and execution. Goals are recorded; deviations are evaluated, and corrective measures are initiated and monitored for their effectiveness.

Fig. 1.2: Environmental targets until end of 2018

### Climate protection

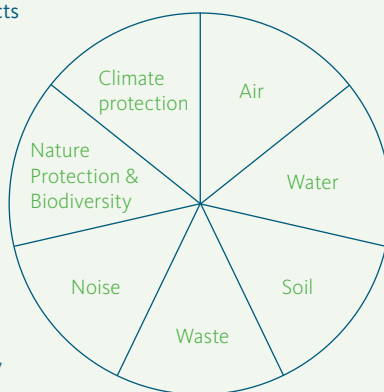
- » Target: Reducing CO<sub>2</sub> emissions by 100,000 t of CO<sub>2</sub> compared to 2012 through energy efficiency projects and heat recovery projects
- » Example: Use of industrial waste heat for district heating in Hamburg

### Nature Protection & Biodiversity

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

### Noise

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



### Air

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

### Water

- » Target: Reducing metal emissions to water in copper production by about 10% compared to 2012
- » Example: Optimising new rain water treatment system in Lünen

### Soil

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

### Waste

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



### Organization

The Chief Representative for Primary Copper, Dr. Thomas Büniger, and the Head of Corporate Environmental Protection, Dr. Karin Hinrichs-Petersen, are responsible for the strategic positioning of environmental protection in the Group. Environmental officers oversee the environmental protection duties at the individual sites under the technical supervision of Corporate Environmental Protection management.

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

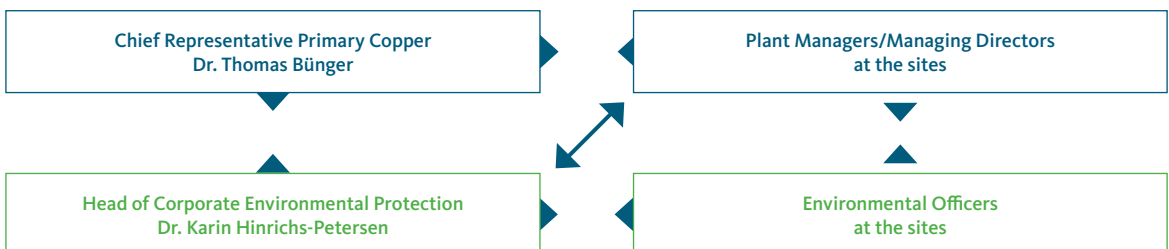
External auditors review and certify the key environmental protection factors, which are uniform within the Group, annually.

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

Emergency plans or alarm and danger prevention plans have been established at all sites 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 Policy also include the tasks to implement the European chemical regulation, REACH.

An integrated management system (IMS) was developed for Aurubis for the areas of environment, quality management and energy. A comprehensive handbook sets out the processes and responsibilities. On this basis, the Hamburg und Lünen plants have created management handbooks that apply to their own sites.

Fig. 13: Corporate Environmental Protection organizational chart



### Dialogue & Commitment

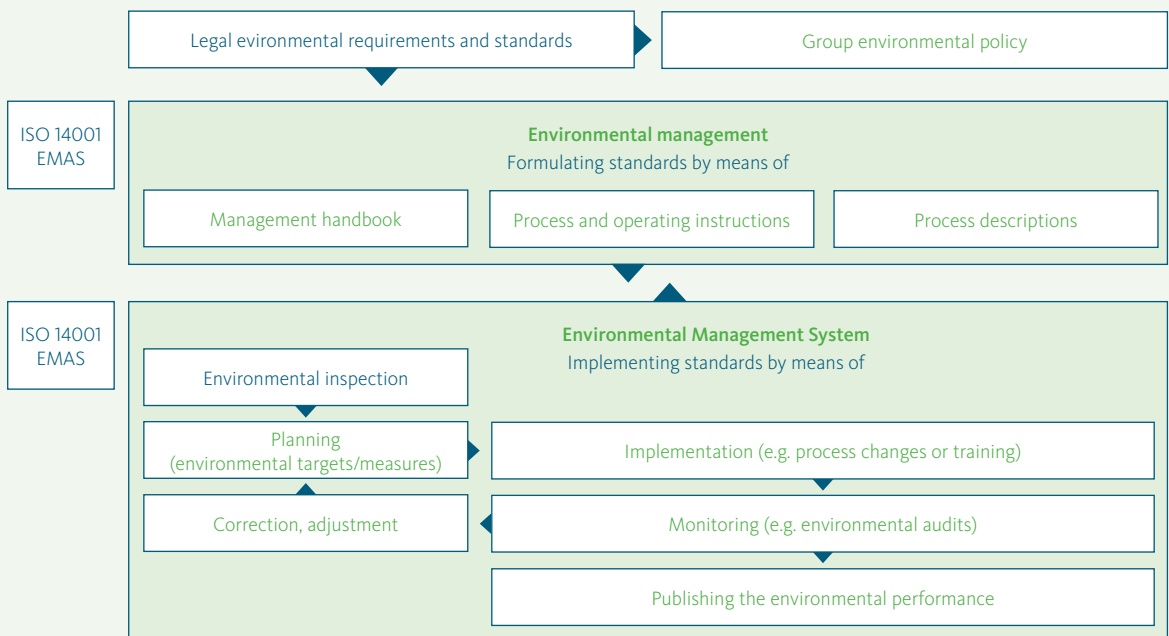
Aurubis continued to hold open dialogue with authorities and citizens across the Group in 2016. In addition, we've participated in various environmental projects:

For example, we are participating in the three-year testing and development phase of the European Commission's Product Environmental Footprint (PEF) in collaboration with the overarching European metal industry association Eurometaux and the European Copper Institute (ECI). The goal of this collaboration is to develop and test the

methods for determining the environmental footprint. On this basis, the European Commission is striving to create a single market for "environmentally friendly products" and "environmentally friendly organizations."

In Hamburg, we have been a member of the Environmental Partnership since 2003, and a member of the Partnership for Air Quality and Low-Emission Mobility, which is coordinated by the city of Hamburg. The goal of the latter partnership is to reduce nitrogen dioxide emissions, which are caused by transport in particular. For this purpose, we

Fig. 1.4: Environmental management in the Aurubis Group



also participated in the German model project Mobil.Pro. Fit® in collaboration with the environmental organization B.A.U.M. e. V. The goal of the project is to develop a sustainable and climate-friendly mobility concept.

In addition, we are participating with 22 national and international partners in the European research project FORCE – Cities Cooperating for Circular Economy. The goal of the project is to develop new concepts for waste avoidance and treatment for the material streams plastics, biomass, used electrical equipment and wood. As a

multi-metal recycler, Aurubis supports the project with its expertise for the purpose of improving the recycling of strategic metals (e.g. copper, gold, silver and lead) through the best possible collection and dismantling system for waste electrical and electronic equipment.

The employee suggestion system for Aurubis AG has been digitized. As a result, traceability and clarity are significantly improved, while processing time is expedited.

Fig. 1.5: Certifications by site

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

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

**ISO 14001:** standard for environmental management system guidelines

**EN ISO 50001:** standard for energy management system guidelines

**EN ISO 9001:** standard for quality management system guidelines

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

**Efb:** Waste Management Company (certificate in DE)

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

# Energy and Climate Protection

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

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

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

In addition to large projects to enhance energy efficiency – such as the steam turbines used to produce electricity from process waste heat at the Hamburg, Lünen and Pirdop sites – energy-conscious conduct and the participation of all employees are called for in particular. In order to raise awareness of these issues among employees, an Energy Day was organized at the Hamburg plant, for example. Moreover, energy training sessions also take place regularly.

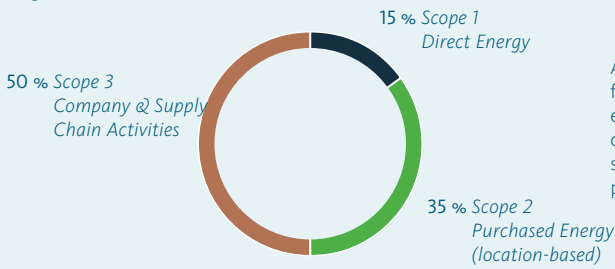
Aurubis holds a leading position in energy efficiency. However, as we increase productivity and efficiency, we are also reaching our technical limits. Efficiency enhancements that have already been achieved don't serve as a blueprint for future development because the more steps that have already been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

Energy consumption is the main source of CO<sub>2</sub> emissions in the Aurubis Group. The biggest CO<sub>2</sub> emitters in the Group are the German sites in Hamburg and Lünen. Currently, Aurubis systematically records the direct CO<sub>2</sub> emissions at the sites as well as the energy-related indirect emissions, for example, from purchased electricity.



Fig. 1.6: Aurubis Group CO<sub>2</sub> emissions – estimated

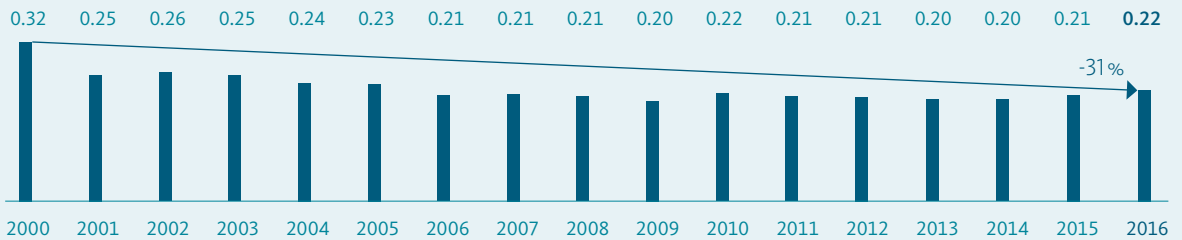
CO<sub>2</sub> emissions in t/t of copper output



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

Fig. 1.7: Fuel-related CO<sub>2</sub> emissions from Aurubis Group copper production

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



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

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





## Our Successes

### **BEST NEWCOMER GERMANY 2015 and Index Leader MDAX 2016: AURUBIS**

In 2015 and 2016, Aurubis participated in the Carbon Disclosure Project (CDP) investor initiative. The CDP surveys companies about risks and opportunities related to the climate as well as CO<sub>2</sub> reduction potential.

CDP awarded Aurubis the distinction of Best Newcomer in Germany in 2015. The sustainability strategy and the transparent presentation of Aurubis' approach to the opportunities and risks of climate change contributed to the good performance. This distinction includes the copper products that contribute to increasing efficiency in applications, as well as the effective production processes, energy management, and investment in energy and CO<sub>2</sub> efficiency optimizations.

For Aurubis this award is proof of its innovation capacity and at the same time an incentive to keep up its efforts in CO<sub>2</sub> reduction and energy and resource efficiency.

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

### **Energy Efficiency Award: AWARD FOR THE LÜNEN PLANT**

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

By using waste heat, e.g. converting it into electricity and using residual heat, the recycling center achieves the optimum energy recovery possible. The installation produces about 23 million KWh of electricity, which corresponds to about 14 % of the site's energy demand or the average energy demand of about 6,500 three-person households. It simultaneously manages to avoid using 14,000 tons of CO<sub>2</sub>.

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



### **Our Flagship Project**

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

In the contract, the partners agree to use industrial waste heat from the Hamburg Aurubis plant to provide energy-efficient district heating to Hafencity East. Aurubis achieves this by extracting heat that is formed when sulfur dioxide – a by-product of copper smelting – is converted to sulfuric acid. This industrial waste heat is nearly free of CO<sub>2</sub>, and utilizing it will avoid more than 20,000 t of CO<sub>2</sub> emissions per year. About half of this reduction results from the replacement of natural gas used to produce steam on the Aurubis plant premises, while the other half is saved by delivering the waste heat to enercity. In Hafencity East alone, about 4,500 t of CO<sub>2</sub> will be saved each year by the final expansion (target date: 2029). Aurubis will deliver the heat up to its plant boundaries. enercity Contracting Nord GmbH, a 100 % enercity holding located in Hamburg, will collect the heat, secure it and transport it further for use in the area that will benefit from the heat.

Aurubis removes the heat from what is known as the contact plant, in which the gaseous sulfur dioxide that accumulates in the process transforms into liquid sulfuric acid. It consists of three lines. About 160 million kilowatt hours (kWh) can be extracted from each individual line annually, for a total of nearly 500 million kWh. The heat from one line is sufficient to supply Hafencity East, which is why only one line will be converted initially. "We could deliver significantly more district heating for the city of Hamburg and thus cut up to 140,000 t of CO<sub>2</sub> each year," explained Jürgen Schachler, Chairman of the Board of Aurubis. "However, at the moment, the technical, financial and contractual foundations haven't been established yet. We are very interested in a solution and are intensively working on one." Jürgen Schachler added, "It is important to Aurubis and to me personally that we do everything to ensure that our company works in a way that conserves resources. According to our usual investment criteria, this project wouldn't be efficient for us." Nevertheless, the company has decided to pursue heat extraction, he explained. "However, it would be easier for us, and certainly other industrial companies, to opt for industrial heat extraction if corresponding incentives were established," the Aurubis CEO continued. "In the scope of emissions trading, we require certificates for each ton of CO<sub>2</sub> that we emit, but we don't receive any compensation when we reduce CO<sub>2</sub> emissions in households in this way."

The plan is for heat extraction to start up in April 2018. Until then, the contracting parties will carry out the construction work necessary to deliver the district heating for Hafencity East. Aurubis is investing roughly € 17 million to convert the facilities and move the heat pipeline to the plant boundary. Enercity Contracting Nord will lay a new heat transport pipeline (district heat line) from the transfer point at the Aurubis plant to Hafencity. A new power station near the heat line will balance out the industrial heat volume, which fluctuates depending on current operation, for the district heating supply. The investment costs for Enercity Contracting Nord's power station and heat transport pipeline amount to around € 16 million.

Aurubis will receive funding for about 30% of the investments from the German Federal Ministry for Economic Affairs and Energy (BMWi) via the Development Loan Corporation (KfW). A similar level of funding is planned for Enercity Contracting Nord from the European Regional Development Fund (ERDF) via the funding program of the city of Hamburg's Authority for the Environment and Energy (BUE), as well as the BMWi. The district heating agreement is one of ten case examples for the project "Flagships of Energy-Efficient Waste Heat Use" started by the German Energy Agency (dena).



Fig. 1.8: District heating pipeline route



# Data and Facts

## Emissions

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 85 % since 2000.

The construction of the new off-gas treatment plant in Bulgaria makes a considerable contribution to environmental protection. It utilizes a modern procedure, what is known as Sulfacid technology, which is unique in Bulgaria and in the entire copper smelting industry. The emission control facility helps reduce emissions to air even further.

Ozone-depleting substances don't play a significant role in copper production.

The dust emissions arising during copper production can contain metals and metal compounds. The consistent use of the best available plant techniques at a very high level of environmental protection has led to a 95% decline in specific dust emissions in primary and secondary copper production since 2000.

One of the main focuses in the 1990s was the use of state-of-the-art filter technologies for all directed emission sources, such as chimneys. Today, projects to reduce fugitive emissions have high priority. For example, fugitive emissions can arise in the areas of hall openings – such as gates, doors or ridge turrets – and during the 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.

We carried out a feasibility study about closing the ridge turrets in the Hamburg primary smelter to reduce fugitive emissions in the future. In the course of the investigations, potential for improving the flow within the hall were also identified. The concept has been agreed on with the responsible authorities. The first measures have been implemented and their effectiveness has been demonstrated in measuring campaigns. Additional steps are being reviewed for implementation in cooperation with the Authority for the Environment.

In addition, we are reducing the noise emissions of our sites. For this purpose, we regularly take measurements at all production sites and evaluate the effectiveness of the implemented measures.

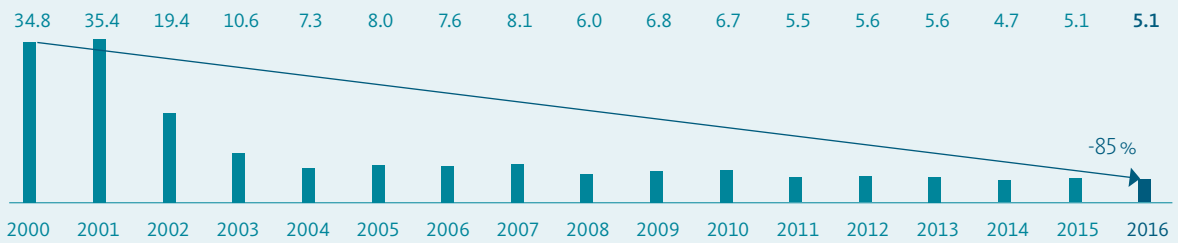
## Water Use and Water Pollution Control

We use water for the production processes and for cooling purposes. The sparing use of water resources is one of our corporate environmental protection targets. 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.

Aurubis used a total of 73.8 million m<sup>3</sup> of water in 2015 and 70.0 million m<sup>3</sup> in 2016 in copper production. Most was used indirectly as cooling water. We use river water wherever possible to conserve the natural potable water resources. The absolute potable water consumption was 1.2 million m<sup>3</sup> in 2015 and 1.1 million m<sup>3</sup> in 2016. We have reduced our specific potable water consumption in copper production by a total of 40 % since 2000. We achieved this reduction with more efficient facilities and

Fig 1.9: Specific sulfur dioxide emissions in Aurubis Group copper production

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



the use of rainwater. We have also further reduced metal emissions to water. Now it amounts to 1.1 gram per ton of copper output.

In November 2014 a new rainwater treatment plant was commissioned at our Bulgarian site in Pirdop. With a capacity of 250 m<sup>3</sup>/h and multiple catch basins, the plant treats the site's surface water in particular. In order to achieve a further reduction in metal emissions in water, the plant cleans the rain and drainage water from the four-square-kilometer premises. Where possible, some of the cleaned water is used in the production processes. This reduces potable water consumption and helps the environment. State-of-the-art technologies are used in the facility, in which we invested about € 6.3 million.

To reduce the use of city water in Lünen, a facility for rainwater retention, preparation and utilization was commissioned in 2014. The retained water is already being used as process water. Existing processes are routinely reviewed for the use of non-potable water.

As a result of the project, the process wastewater, sanitary water and precipitation have been fully separated. The site's sewer system was further modernized for this purpose.

### Waste

Effective waste management is one of the central pillars of industrial environmental protection for a resource-intensive company such as Aurubis.

In 2016, a total of about 103,500 t of waste accumulated in Aurubis' copper production processes. Almost half of it, or 45,500 t, originated from demolition work on our construction projects. A total of 42% of the remaining production-related waste – 58,000 t overall, comprising 38,000 t classified as hazardous waste and 20,000 t classified as non-hazardous waste – was recycled. In addition, a fine-grained material – known as fayalite – is being produced at the Pirdop site through the flotation process used there to recover the copper contained in copper smelter slag. Fayalite is being used, for example, as an additive for cement production. Furthermore, we are reviewing options for reusing fayalite and are marketing it more actively.

When transporting our products, we generally employ reusable pallets in order to avoid waste. We select recyclable material for packaging foil and straps.



Fig. 1.10: Successful reduction of dust emissions in Aurubis Group copper production

Dust emissions in g/t of copper output

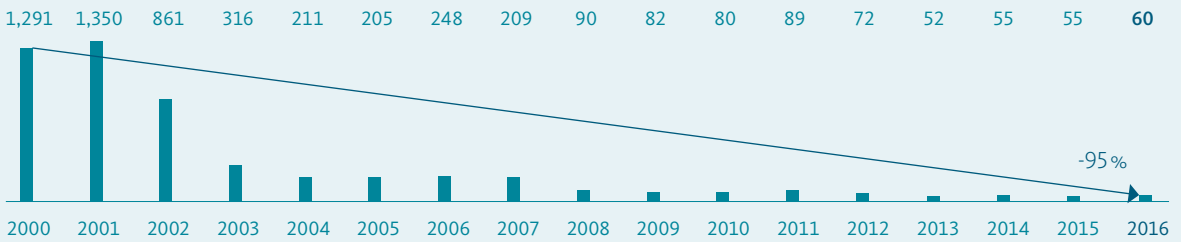
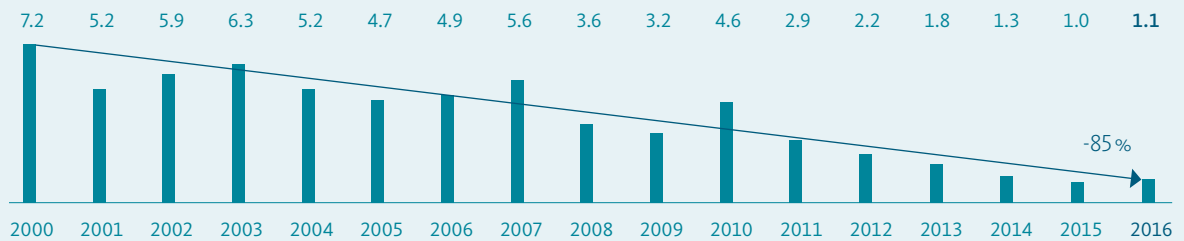


Fig. 1.11: Specific metal emissions to water in Aurubis Group copper production

Metal emissions to water in g/t of copper output



### Biodiversity

We do not use any land in protected areas with high biodiversity. Furthermore, we conserve the habitats of animals and plants with our water-preparation and waste-treatment methods. We protect the soil at our sites, for instance, with technical measures to combat the discharge of substances and liquids that are harmful to water. Due to long-time industrial use, soil contamination typical for industrial areas can appear on our plant premises, which we prevent from mobilizing and spreading with technical measures. If additional areas on our plant premises are used, we choose those that naturally have limited biodiversity.

We maintain greenery on our plant grounds and develop them wherever possible. We are also improving the habitats of animal and plant species with multiple campaigns. For instance, the initiative “Let’s make our plant greener” in Hamburg spurred the planting of trees and bushes on almost 5000 m<sup>2</sup> of the company premises. The Green Project campaign in Pirdop represents another example of this – we contributed to the reforestation of the region.

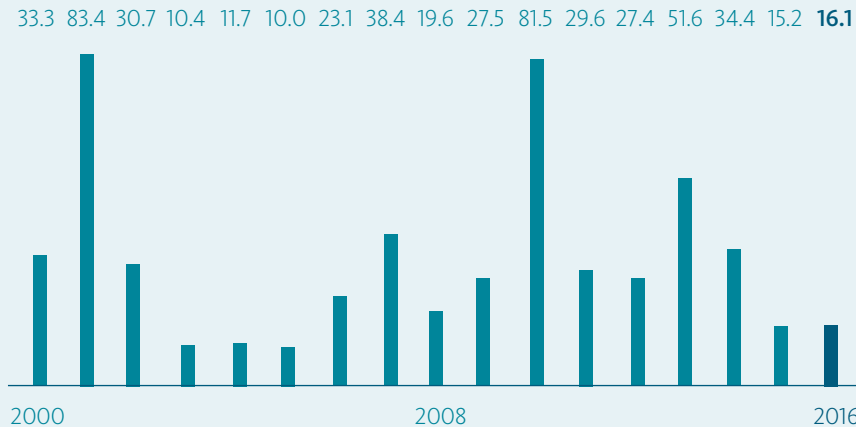
The initiative UnternehmensNatur (Company Nature) supports the promotion of biodiversity on plant premises. It includes partners from the Hamburg industrial sector, the Authority for the Environment, the Chamber of Industry and Commerce, and the Nature and Biodiversity Conservation Union (NABU). On the premises of the Hamburg plant, a peregrine falcon has staked out his territory and been living here since 2013.

# At a Glance

Fig. 1.12: Capital expenditure for environmental protection in Aurubis group copper production

in € million

» Over € 540 million has been invested in environmental protection measures in copper production since the year 2000.

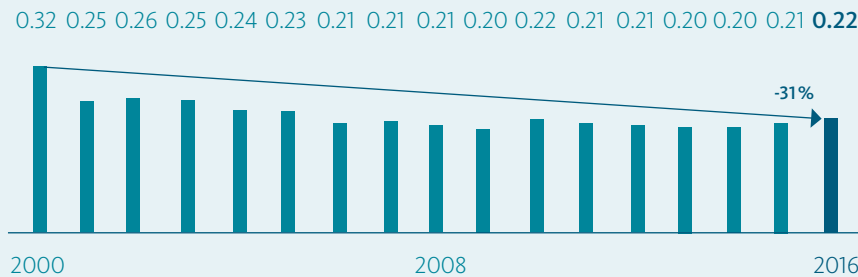


An average of about one-third of the Aurubis Group's total capital expenditure has gone to environmental protection measures over the years. Since 2000, more than € 540 million has been invested in environmental protection measures in copper production. By implementing these measures and operating state-of-the-art, innovative plant technologies, Aurubis holds a leading position in climate and environmental protection in primary and secondary copper production.

Today, only comparatively smaller improvements can be achieved with continued high capital expenditure on environmental protection because a leading international environmental standard has already been reached, and, for example, emission reduction is subject to technological limitations.

Fig. 1.13: CO<sub>2</sub> emissions from fuels in Aurubis Group copper production

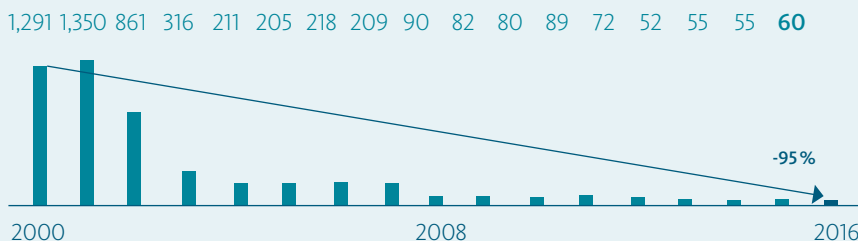
CO<sub>2</sub> emissions in t/t of copper output



At 0.22 t of CO<sub>2</sub> per t of copper output, specific emissions from fuels in copper production are at a low level. Product-related emissions have even been reduced by 31% since 2000.

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

Dust emissions in g/t of copper output

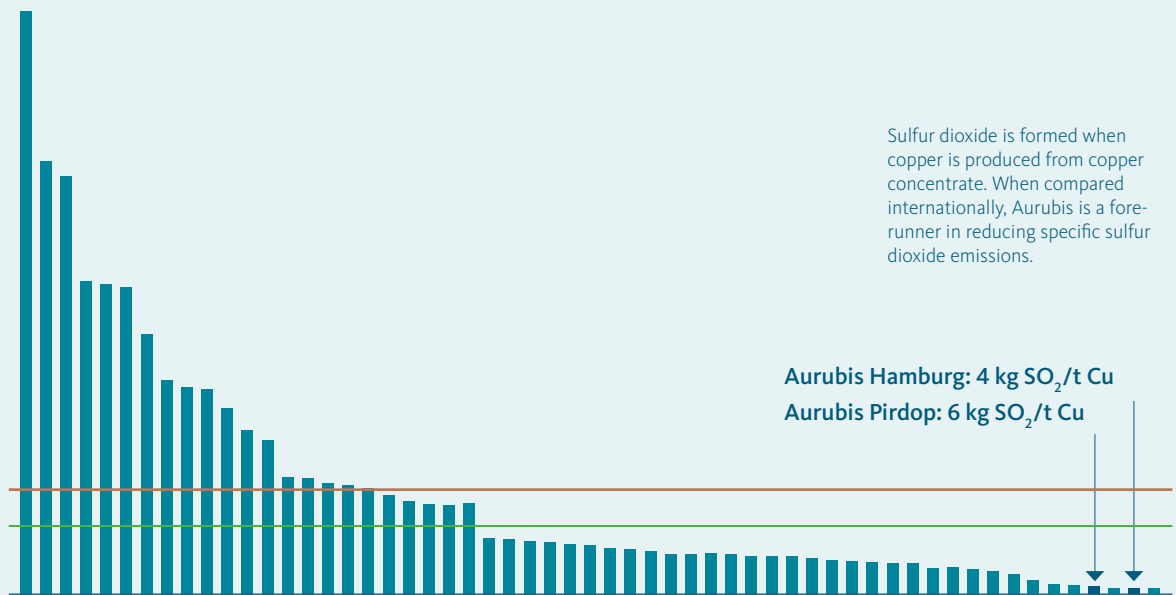


Specific dust emissions for primary and secondary copper production have been reduced by 95% compared to the reference year 2000.

Fig. 1.15: Highest environmental standard worldwide

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

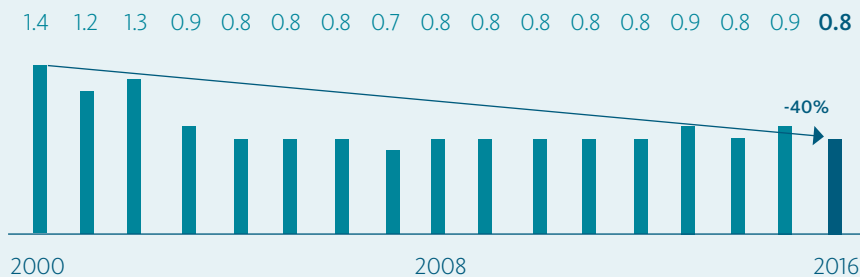
— Ø International copper smelters: 123 kg SO<sub>2</sub>/t Cu  
 — Ø European copper smelters: 75 kg SO<sub>2</sub>/t Cu



Source: Wood Mackenzie, 2017/certified data

Fig. 1.16: Specific potable water consumption in Aurubis Group copper production

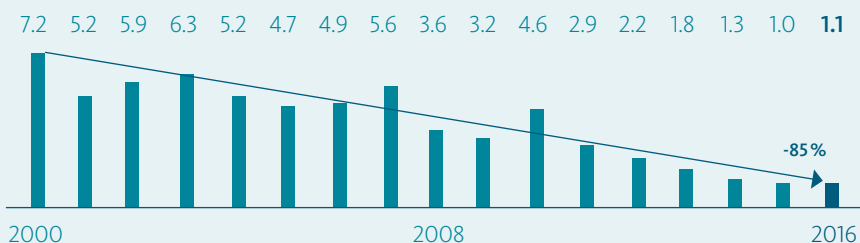
Drinking water consumption in m<sup>3</sup>/t of copper output



Aurubis uses river water wherever possible to conserve the natural potable water resources. It has been possible to reduce potable water consumption specifically in copper production by 40% since 2000. In addition to increased efficiency in the facilities, the use of rainwater was responsible for this.

Fig. 1.17: Specific metal emissions to water in Aurubis Group copper production

Metal emissions to water in g/t of copper output



In addition to reducing emissions to air, we have also made significant improvements in water pollution control. We have reduced metal emissions to water in copper production processes from 7.2 to 1.1 g per t of copper output since 2000. This corresponds to a decline of about 85%.



# Consolidated Aurubis AG Environmental Statement 2017

Hamburg Site





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

The plant was constructed in 1908 on an area of about 870,000 m<sup>2</sup> in Peute, an industrial inland harbor area in the Veddel district. Following reconstruction after World War II, the production facilities were continuously expanded and steadily modernized. Today, Aurubis AG's Hamburg site is one of the world's most state-of-the-art primary and secondary copper smelters and has an authorized production capacity of 450,000 t of copper cathodes each year. 2,296 personnel are employed at the Hamburg site, including around 180 apprentices (as of September 30, 2015).

The individual production sectors at Aurubis AG in Hamburg are divided into three plant areas (see Fig. 1.1). The North Plant (RWN) is mainly comprised of the administrative building, the workshops, the secondary copper smelter and precious metal production. The South Plant (WS) includes the sludge decomposition plant, the cracking acid cleaning facility, the wastewater treatment facility, the concentrate delivery area, the chemical plants and the casting lines in particular. The primary smelter sector includes the main primary copper production facilities: the RWO, the sulfuric acid production plants and the tankhouse. This section also houses the rod plant.

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



1 Casting lines 2 Secondary smelter/precious metals 3 Rod line 4 Tankhouse 5 RWO



Fig. 2.2: Aurubis, an integrated copper producer



Aurubis is an integrated copper producer that operates copper production and processing facilities at the Hamburg site (see Fig. 2.2).

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

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

Copper cathodes with a copper content of over 99.99% are produced from the copper anodes in the copper tank-house using electrochemical methods. The cathodes are

used to manufacture copper intermediates (continuous cast rod, copper shapes, copper powder). An iron-silicate stone, which is processed into quality-assured building materials and abrasives, is extracted from iron chemically bonded to copper concentrates by adding silicate-bearing materials like sand or other  $\text{SiO}_2$ -bearing materials.

Intermediates produced in pyrometallurgical and hydrometallurgical copper refining, such as flue dusts and slimes, are further treated in an electrothermal process, primarily in the secondary smelter's electric furnace. Both internal and external intermediates and recycling materials are deposited in a liquid copper or lead matrix in the process.

The refining of the matrix metals copper and lead in subsequent pyro- and hydrometallurgical processes (multi-metal production) serves to extract tramp metals such as zinc, nickel, antimony, selenium, tellurium and precious metals in metallic form or as metal compounds. Iron contained in the raw materials is also extracted in this process in the form of iron silicate by adding  $\text{SiO}_2$ -bearing materials.

These materials include sand from renovation measures, glass from screens and other types of technical glass.

The process off-gases from the electric furnace are cleaned in filter facilities. SiO<sub>2</sub>-bearing process gases are additionally conducted through a multi-step wet gas cleaning facility before the SiO<sub>2</sub> contained in the off-gas is converted into sulfuric acid in the double absorption contact acid plant previously mentioned.

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. The off-gases containing SO<sub>2</sub> and SeO<sub>2</sub> are cleaned in a flue gas scrubber and the SO<sub>2</sub> is processed into sulfuric acid in the contact acid plant. The selenium is discharged as moist selenium.

Primary materials with low amounts of sulfur and selenium, mainly precious-metal-rich bullion, are placed in a refining furnace and then cast into silver anodes. The refining furnace's off-gas is conducted through an off-gas treatment facility. In the precious metal smelter, precious metals (silver, gold, platinum group metals) are separated using hydrometallurgical procedures and then extracted as commercial products.

Pure copper is produced from the various raw materials after the smelting process in the tankhouse. The copper can be traded on the international metal exchanges. However, Aurubis only sells a small proportion of the copper cathodes on the exchange. Most of the cathodes are processed into copper products such as continuous cast wire rod, shapes, strip, sheet, foil, wire and profiles at the different Group sites. For this purpose, the copper cathodes are melted in natural gas-fired furnaces and cast or rolled and drawn into the shapes requested by the customer.

In the central sewage treatment plant (ZABA), process wastewater from different areas at Aurubis is treated chemically and physically. Polluted slimes are separated, drained and disposed of. Harmful substances are removed from the purified clear phase, which is directly conducted into the northern Elbe River pursuant to the provisions of the water law permit.

Precipitation from the plant premises, which are almost completely paved, are collected in internal sewer systems and purified chemically and physically in two treatment plants (south and east). The purified wastewater is conducted into the northern Elbe River pursuant to the water law permit or returned to the plant's process water supply as needed.

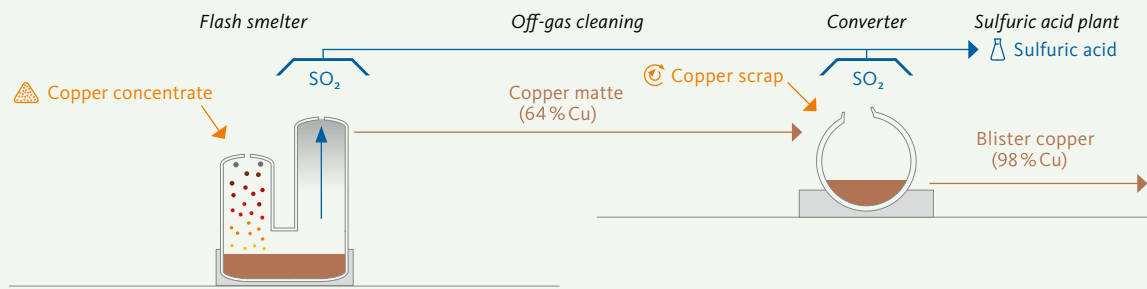
Non-ferrous metals such as copper are not used up but can be recycled as often as desired without a loss of quality, therefore fulfilling an important role in environmental and resource protection. Nearly all raw materials are transferred to marketable products at Aurubis Hamburg (see Fig. 2.3).

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

Aurubis has had an environmental management system at the Hamburg site since 2002, which is certified in accordance with ISO 14001 and EMAS. The annual TÜV review is a good opportunity for Aurubis to have its effective implementation of environmental protection and the resulting successes inspected and verified by an external third party.

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

Fig. 2.3: From copper concentrate to cathode



Quality management in accordance with DIN ISO 9001 has been established in Hamburg since 1996 for the following sub-areas: tankhouse, continuous casting plant, wire rod plant, contact acid plant (sulfuric acid production), lead plant, analytical laboratories and sampling. Its introduction is planned in the primary smelter (RWO) in 2017.

The initial certification of the Integrated Management System (IMS) is scheduled in May 2017 for the environment, quality and energy areas as one system. The goal is to take advantage of synergies since the environmental and quality standards now display an identical high-level structure and overlapping content after the revisions in 2015.

### Targets and Tasks of the Environmental Management System

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

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

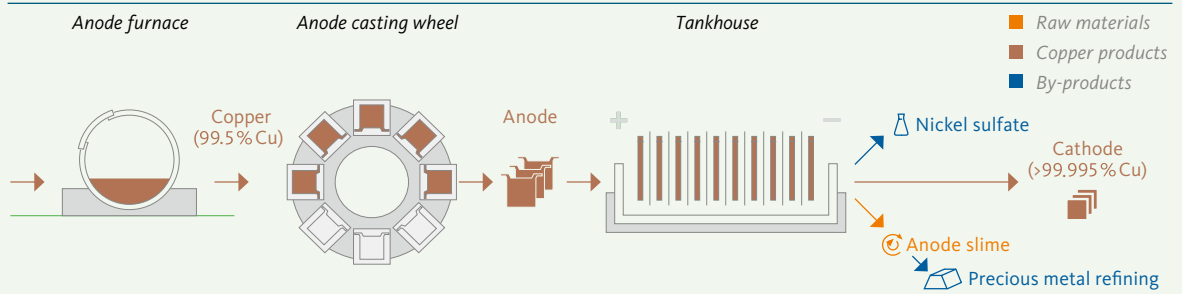
The systems and organization of IMS are described extensively and understandably in two handbooks available to

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

The environmental management system EMAS also helps in the implementation of the Aurubis Group sustainability targets, which were newly defined in 2013, at the Hamburg site ([see the sustainability report at www.aurubis.com](http://www.aurubis.com)).

### Environmental Management Organization

As the operator of facilities requiring a permit in accordance with Section 52a Federal Immission Protection Law and Section 53 Recycling Management and Waste Law, the Aurubis AG Executive Board or an appointed member of the Executive Board is responsible for observing environmental protection and radiation protection regulations. A member of the Environmental Protection Department at the Hamburg site holds the position of Environmental Management Officer and reports to the Executive Board. As part of the environmental management system, the Hamburg Environmental Protection Department tracks changes in legal requirements, reviews their effects on the different areas of our company and ensures that our facilities are operated in conformity with the law. As a result of the greater complexity and increased requirements of regulatory compliance, it was decided to introduce an annotated catalog of statutory principles. The new system can be used to generate facility-specific action recommendations, designate responsibility to individuals and track implementation.

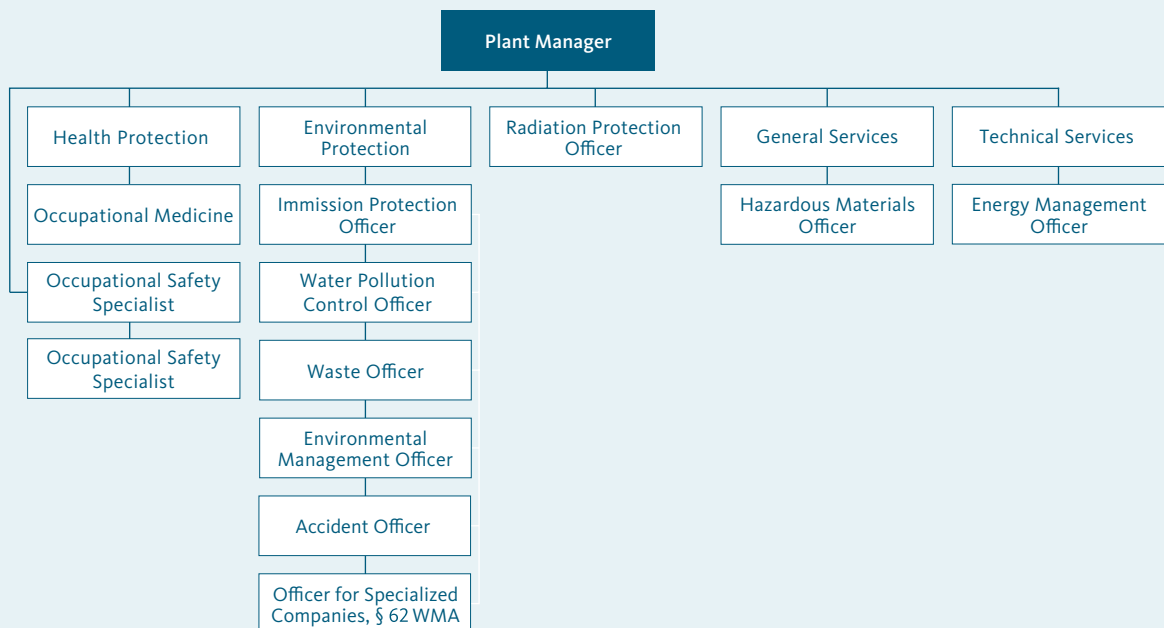


The Hamburg Environmental Protection Department provides employees with training and information related to environmental protection.

The company management has appointed officers or specified individuals responsible for the following issues in order to fulfill corporate duties (see Fig. 2.4):

- » Immission protection
- » Water pollution control
- » Waste management
- » Radiation protection
- » Hazardous materials
- » Environmental management
- » Officer for Specialized Companies pursuant to the German Water Management Act
- » Occupational Safety Specialists
- » Plant medical department
- » Energy management
- » Accidents

Fig. 2.4: Environmental protection organization at the Hamburg site



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

### Monitoring and Internal Auditing of Environmental Management

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

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

The plant manager of Aurubis AG, Hamburg Plant, 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.

Forming the basis of the management review are 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. The management review establishes the annual management goals.

### Indirect Environmental Effects

Indirect environmental effects are effects that are not directly caused by our production processes on site. Therefore, Aurubis cannot directly influence them. These include the upstream and downstream value-added stages. We cannot directly influence transports of hazardous materials that we have commissioned, either.

### Transporting Hazardous Materials

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

In the 2015/16 fiscal year, outgoing hazardous materials of 853,514 t were registered at the Hamburg site of Aurubis AG. Of the total amount of hazardous materials, approximately 60 % are shipped by inland vessel and 20 % each by truck and train (see Fig. 2.5).

No accidents with hazardous material leakage occurred during the reporting period. Isolated irregularities were corrected immediately before transport in compliance with the relevant regulations on hazardous materials. Internal consultations, monitoring and training were carried out repeatedly in order to maintain this high safety standard.

### Origin of Copper Concentrate Raw Material

Our raw material for primary copper production, copper concentrate, is mainly extracted on site at mines, where ores with about 0.5% to 4% copper content are concentrated to an average copper content of 25–30% to reduce transport volumes.

Our primary ore concentrate suppliers are the mining companies Vale, Teck, Glencore, Antofagasta and Newmont Mining. These global mining companies have committed themselves to a sustainable corporate policy and to releasing environmental reports, which can be found on the companies' websites.



Fig. 2.5: Quantity of hazardous materials transported at the Hamburg and Lünen sites

Category	Description	2011/12		2012/13		2013/14		2014/15		2015/16	
		incoming	outgoing	incoming	outgoing	incoming	outgoing	incoming	outgoing	incoming	outgoing
1	Explosive materials and objects	0	0	0	0	0	0	0	0	0	0
2	Gases (compressed, liquefied, or dissolved under pressure)	556	1	593	1	331	1	410	1	1,225	0
3	Flammable liquids	1,882	0	1,804	0	1,679	0	1,607	0	1,651	0
4.1	Flammable solid materials	90	29	108	32	78	31	73	29	69	0
4.2	Materials liable to spontaneous combustion	53	222	0	0	0	0	0	0	0	0
5.1	Oxidizing materials	1,849	1	2,810	0	768	6	685	6	3,940	0
6.1	Poisonous materials	3,239	6,102	12,069	5,766	11,201	8,215	13,771	7,924	7	0
7	Radioactive materials	1	1	0	0	0	0	0	0	0	6
8	Corrosive materials	13,226	1,084,357	18,073	973,203	28,671	980,395	30,536	1,067,003	35,189	839,412
9	Miscellaneous dangerous materials and objects	5,867	21,695	5,996	20,492	6,231	26,330	6,598	24,241	1,034	14,096
<b>Total quantities of all hazardous materials</b>		<b>26,763</b>	<b>1,112,409</b>	<b>41,453</b>	<b>999,494</b>	<b>48,959</b>	<b>1,014,978</b>	<b>53,680</b>	<b>1,099,204</b>	<b>43,115</b>	<b>853,514</b>

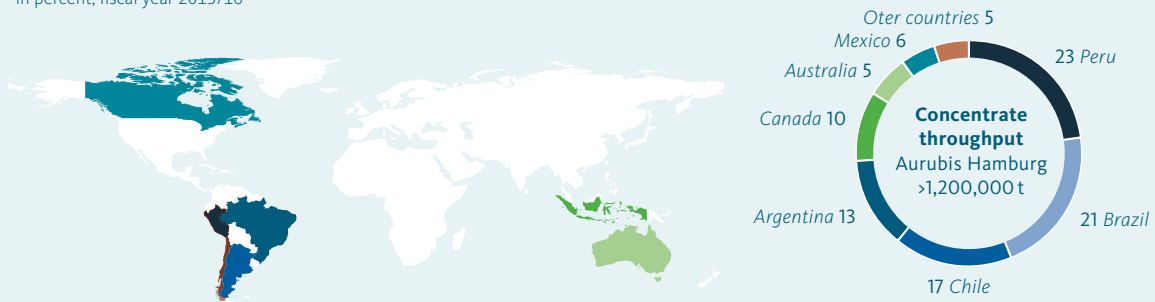
Responsibility in the supply chain is one of the relevant issues of the Aurubis sustainability strategy. In addition to the group-wide guideline to avoid raw materials for gold manufacturing from conflict zones (Gold Supply Policy), Aurubis introduced a uniform and IT-based screening system for business partners in the supply chain in 2013. The screening system is used to review the identity and integrity of Aurubis AG's business partners before entering into contracts. Business Partner Screening is based on a software and relies on multiple steps. The plan is to implement it across the Group. It is based on a questionnaire that analyzes possible financial, tax, criminal, sustainability and reputation risks, among other factors. If this systematic review indicates an increased risk, this can be confirmed or refuted in subsequent screening steps. In the case of increased risk, the Compliance and Sustainability Departments carry out an expanded review according to appropriate criteria. Based on their recommendation, management decides on possible contracts or restrictions. Contracts will not be entered into with new business partners before they are screened.

The screening program was initially applied within the framework of the Gold Supply Policy. This program is based on the OECD Due Diligence Guidance for conflict minerals as well as the provisions of the Global Compact of the UN, which Aurubis joined in 2014. In December 2016, Aurubis' gold production was certified as conflict-free for the fourth consecutive time according to the gold guidance standards of the London Bullion Market Association (LBMA). The Business Partner Screening is continuously developed and adjusted to changes in requirements.

We obtain most of the copper concentrate from South America (75%); 15% comes from North America, 5% from Australia and small quantities from other countries. The concentrate is transported almost exclusively by sea in bulk carriers via Brunsbüttel. Special ships suitable for inland waterways are used to deliver the concentrate mixtures. They drop off their cargo in the Müggenburg Canal with a crane. In the 2015/16 fiscal year, over 1.2 million t of copper concentrates were delivered to our plant in this way.

Fig. 2.6: Origin of copper concentrates for the Hamburg site

in percent, fiscal year 2015/16



### Certificate for Conflict-Free Gold

We've already gained initial experience with supplier screening in the area of precious metals in 2013. A review of the sources of precious-metal-bearing and particularly gold-bearing raw materials concluded that Aurubis does not extract any conflict-affected gold-bearing raw materials. The early application of the screening program resulted from the Gold Supply Policy, which was developed in the same year. This policy is oriented to the requirements of the Gold Guidance of the London Bullion Market Association (LBMA) and is based on the OECD Due Diligence Guidance for conflict minerals as well as the provisions of the UN Global Compact. Since 2013, Aurubis' gold production has been certified as conflict-free according to the standards of the LBMA.

The current audit was carried out in November 2016 by the independent assessor TÜV Nord. Aurubis has now received the audit certificate.

### Environmental Protection Data and Facts

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

Data is collected at the Hamburg plant on the basis of data in the SAP system, the PI system, internal recordings and the results of comprehensive measuring programs. Calculation methods and data collection are documented so that data is always traceable and verifiable.

Environmental aspects and data are reviewed, analyzed and evaluated as part of routine quality circles, management discussions and audits. Environmental protection focuses and environmental targets can be established this

way. The key indicators required by EMAS III are also redefined annually and checked for plausibility in this process. During the internal audits, the company's 2016 environmental targets were reviewed to see if they had been fulfilled. This was confirmed for all of the relevant environmental targets with a direct influence on environmental effects. Several additional targets were updated and new targets were defined and documented.

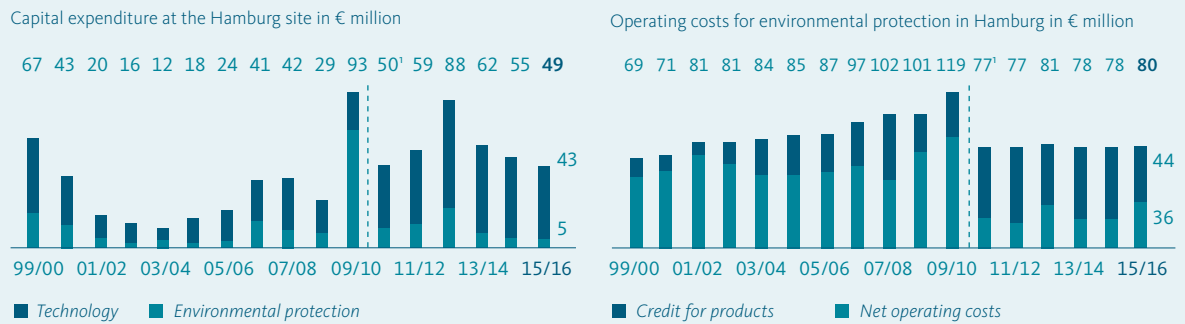
The focus of the new environmental program is on further improving fugitive emission reduction and climate protection and on promoting electric cars. Environmental quality circles and continued employee training that strengthen environmental awareness and implement the environmental protection targets are being continued. Beginning in 2017, the 5S methodology should be extended to the entire Hamburg plant. 5S serves as an instrument to keep workplaces and their environment safe, clean and well organized. Order and cleanliness are fundamental prerequisites to improve the work processes that are performed there.

The public contract Aurubis signed in 2011 with the city of Hamburg addresses the issue of air pollution control. It was possible to demonstrate a total reduction of 9 t in dust emissions per year based on the Emissions Declaration of 2008. A total of approximately € 20 million was invested to implement the agreed measures. The reduction will be verified with the declaration of the immission protection officer in 2017.

The main measures were as follows:

- » In secondary copper production, the new crusher will be connected to the recently constructed North Plant warehouse.

Fig. 2.7: High capital expenditure for environmental protection measures leads to higher operating costs



<sup>1</sup> Because of a change in the accounting procedure, the information starting in 2010/11 deviates significantly from the previous years.

» In primary copper production, a turbine was built to produce electricity from waste heat (CO<sub>2</sub> reduction of 5,000 t per year). It was commissioned in the fourth quarter of 2014.

» A feasibility study on sealing off the ridge turrets in the primary smelter has been drafted. The subject of the study is the avoidance of fugitive emissions via the ridge turrets in primary copper production.

» In final measures taken in response to a comprehensive measurement of emissions on the ridge turrets of the RWO converter hall in 2016, flow conditions in the hall are being optimized, and source extraction equipment is being installed for the skip loading of ladle linings.

A new public contract with the city of Hamburg should be concluded in 2017 that stipulates a further reduction particularly in dust emissions.

### Investments in Environmental Protection

At Aurubis, copper and by-products are produced as sustainably as possible with the use of state-of-the-art plant technologies with very high environmental protection standards in order to conserve natural resources and maintain a clean environment for future generations. We therefore continuously invest in modern plant and environmental protection technology. Our most important tasks include constantly improving air quality, energy efficiency and water pollution control, as well as conserving natural resources for future generations.

Following fundamental investments in filtering technologies in the 1980s and 1990s, an additional € 210 million has been invested in environmental protection since 2000. With a total investment of more than € 700 million, environmental measures account for 30% on average.

By implementing these measures and operating state-of-the-art, innovative plant technologies, Aurubis AG is a leader in climate and environmental protection in the primary and secondary copper production sectors and in the production of wire, continuous cast material and flat rolled products (preliminary stages of processing). Today, only comparatively smaller improvements can be achieved with continued high capital expenditure on environmental protection because a leading international environmental standard has been reached and emission reduction is subject to technological limitations (see Fig. 2.7).

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

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

Aurubis had already been observing for years the EU target values for arsenic (6 ng/m<sup>3</sup>) and cadmium (5 ng/m<sup>3</sup>) that went into effect in 2013.

The investigations carried out by the Aurubis environmental monitoring team on the plant premises confirmed the values from the official recordings (see Fig. 2.8 und 2.9).

Fig. 2.8: Location of the Aurubis AG factory premises

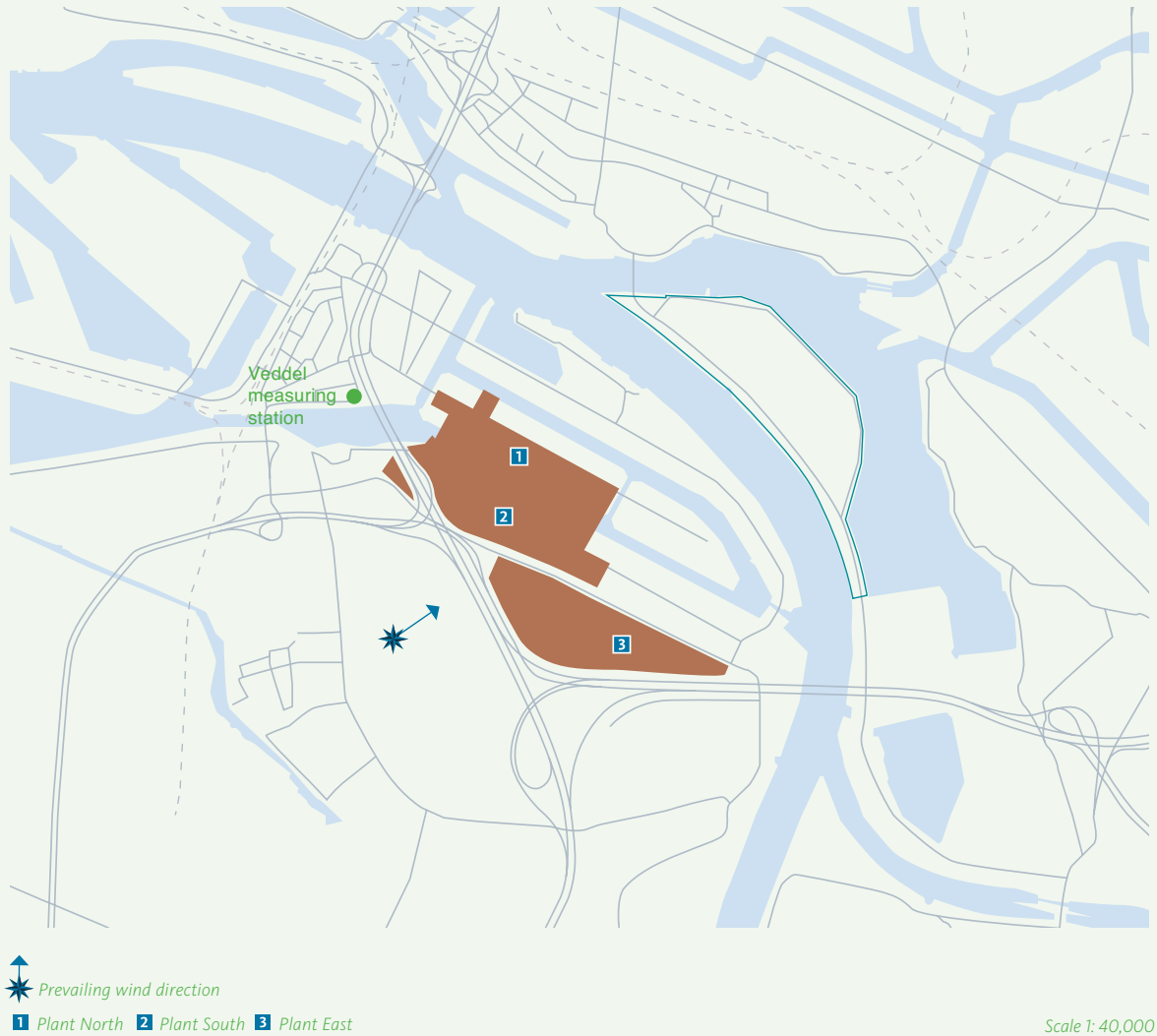
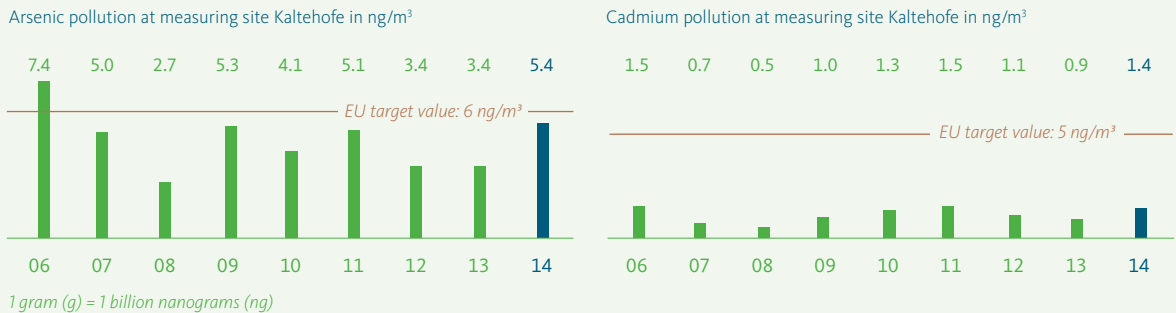


Fig. 2.9: Low immission values (suspended particulates) at the Veddel measuring station<sup>1</sup>

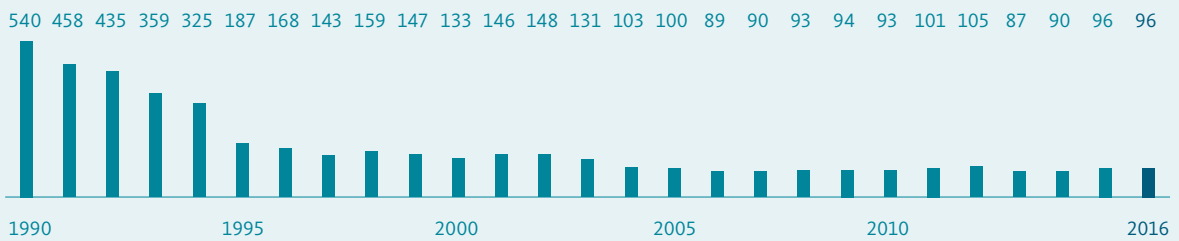
» Heavy metal immissions considerably below EU target value (valid from 2013)



<sup>1</sup>Data published by the State Ministry for Urban Development and Environment. Data for 2015 and 2016 is not yet available.

Fig. 2.10: Dust emissions at the Hamburg site

Dust in g/t of copper output



The best available plant technologies (BAT) are in operation at Aurubis AG, offering a very high standard of environmental protection. Through what is known as the Sevilla or BREF process, the BAT are being updated for the non-ferrous industry. Further emission reduction measures therefore require disproportionately high capital expenditure, but they are still planned and carried out to continuously improve environmental performance.

### Air

One of the most important environmental protection milestones in the 1990s was the use of state-of-the-art filtering technologies for all directed emission sources, or smokestacks.

All of the statements in this chapter are based on the current Emissions Report, which is issued annually by the Immission Protection Officer. The values outlined below are made up of a number of individual recordings. Directed emissions are recorded as classified values from continuous measurements made with a system provided by Durag data systems GmbH. Fugitive emissions from hall ventilation facilities, etc. are determined in recording campaigns carried out by both external recording institutes and the company's own environmental monitoring team and are projected to find the annual loads. Fugitive emissions due to transshipments in storage areas, etc. are calculated using the corresponding emission factors from the technical literature. The national calculation standards for data from continuous measurement institutes have changed since 2011. The so-called validation value is no longer considered, which leads to higher results. Actually, dust emissions were further reduced, but the values can't be directly compared to the data from the previous years.

The projects to reduce fugitive emissions in particular are milestones for environmental protection. It is therefore crucial for Aurubis to develop innovative technologies for environmental protection and to enter new technical territory in the process.

Specific emissions to the air have been reduced significantly since 1990. This is illustrated in the following figures. Almost 80% of the remaining metal emissions from the Hamburg production site come from fugitive sources, the majority of which stem from hall ventilation facilities.

Specific dust emissions have been reduced by 82 % since 1990. They remained constant relative to the previous year 2015 (see Fig. 2.10).

Copper is the main metallic substance in the dust at the Hamburg production site. Specific copper emissions have been reduced 78 % since 1990. This low level was maintained, as the changes compared to the previous year were in the expected range (see Fig. 2.11).

Specific lead emissions have been reduced considerably (by 91%) compared to 1990 and are therefore still at a low emission level. The fluctuations observed are due to the use of various concentrates (siehe Abb. 2.12).

Arsenic is a natural component of copper concentrates. Arsenic emissions have been reduced by about 90 % since 1990 in various steps of the copper refining process and have been at a low level in the last several years (siehe Abb. 2.13).

Fig. 2.11: Copper emissions at the Hamburg site

Copper in g/t of copper output

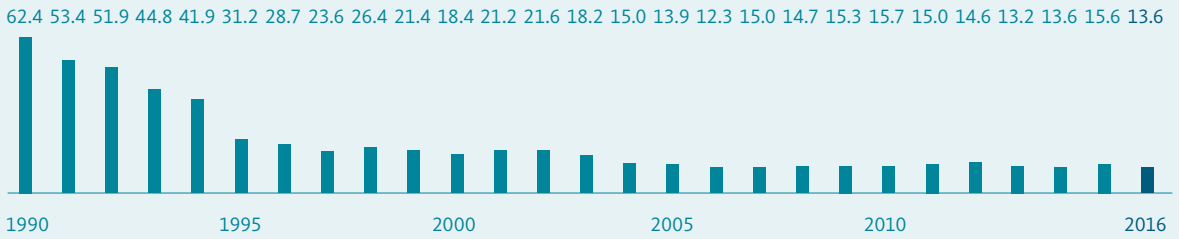


Fig. 2.12: Lead emissions at the Hamburg site

Lead in g/t of copper output

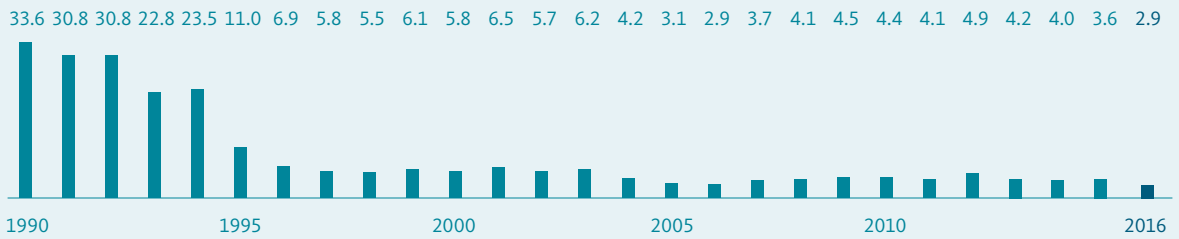


Fig. 2.13: Arsenic emissions at the Hamburg site

Arsenic in g/t of copper output

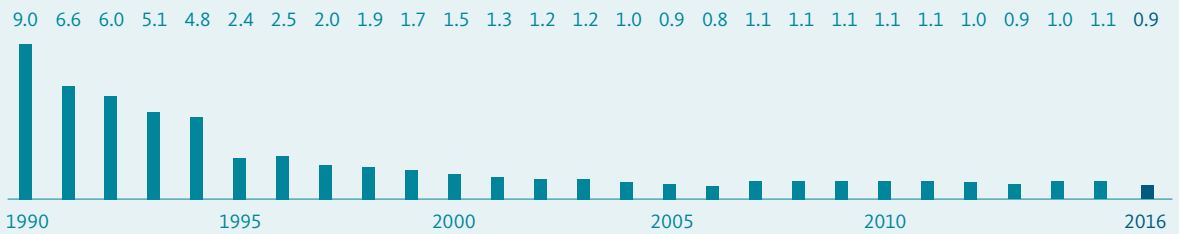


Fig. 2.14: SO<sub>2</sub> emissions at the Hamburg site

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

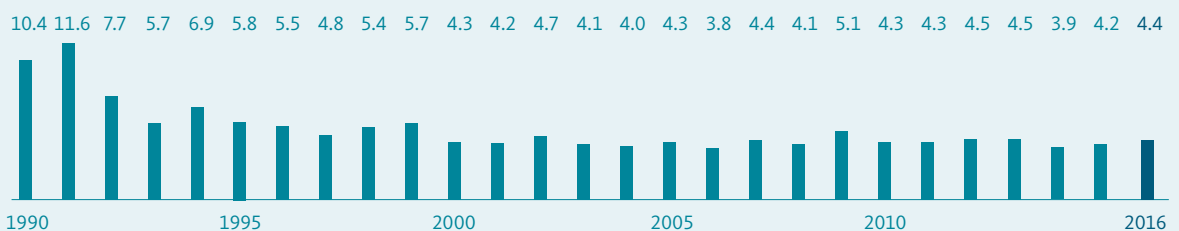
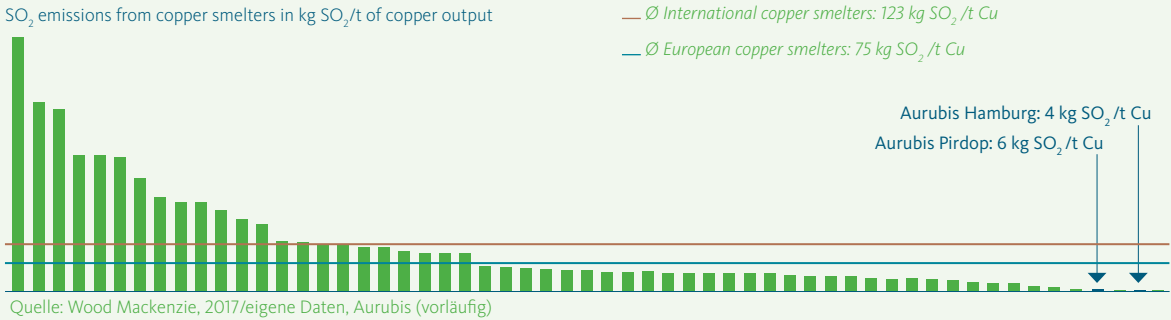




Fig. 2.15: Highest environmental standards worldwide

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



Apart from copper, sulfur is one of the main components of copper concentrates. The gaseous sulfur dioxide produced when ore is smelted is converted into sulfuric acid in the sulfuric acid plant using the modern double catalysis process. The sulfuric acid is mainly used in the chemical industry. Specific sulfur dioxide emissions have been reduced by 57% since 1990 and tend to vary at a low level (siehe Abb. 2.14).

When compared internationally, the Aurubis Hamburg site continues to be a forerunner in reducing specific sulfur dioxide emissions (see Fig. 2.15).

With an input of 1,426,628 t of material and an annual output of 450,400 t of copper, specific emissions for 2016 are as follows:

Type of emissions		Specific emission related to:	
		Input material	Copper output
SO <sub>2</sub>	kg/t	1.4	4.4
Dust	g/t	30.3	96.0
Copper	g/t	4.3	13.5
Lead	g/t	0.9	2.9
Arsenic	g/t	0.3	0.9

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

### Environmental Impact of Noise

There were no noise complaints from the area around the plant in 2016.

A noise register was created for the Hamburg site. Here the relevant noise sources of the site are recorded. In the area around the site, there are 20 immission locations for which the responsible authority (BUE) establishes noise immission limit values that are incorporated into the relevant permits. The impact on the noise situation in the neighborhood must be evaluated for all facility modifications.

Quieter cooling towers were installed in 2016 in the area of RWO to cool the pelletizing water.

### Water

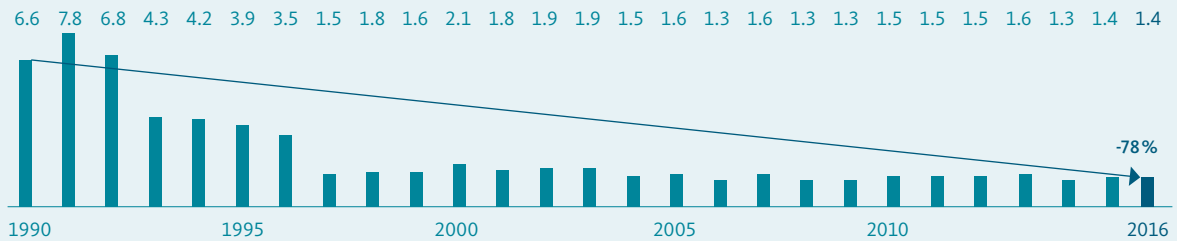
The wastewater from Aurubis AG's entire Hamburg plant is composed of precipitation, indirect and direct cooling water, condensate, process wastewater and desludging water. All of the plant's precipitation is collected and cleaned together with other wastewater (e.g. from the anode casting machine in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

Accumulated process water is cleaned in a separate state-of-the-art wastewater treatment facility. The Hamburg plant has water law permits and observes their requirements. The sanitary water (especially wastewater from kitchens, cafeterias, showers and social rooms) is discharged into the city sewer system to be treated by the city's wastewater treatment plant.

The proportion of heavy metals discharged by Aurubis in the Elbe's total load is less than 0.1%. Aurubis has reduced the heavy metal load that is discharged with the waste-

Fig. 2.16: Metal emissions in water at the Hamburg site

Metal emissions in g/t of copper output



water into the Elbe by 78% since 1990. Today's average emission value of 1.4 g/t of copper products is evidence of Aurubis' top position in environmental protection.

The minimum requirements for discharges into bodies of water are regulated in the German Wastewater Ordinance (AbwV) – Annex 39. Furthermore, the requirements and limit values in the water law permit apply, some of which considerably exceed the requirements of the AbwV. They are monitored by both internal recordings and unannounced recordings by the relevant authorities. The recorded values clearly fall below the regulated limit values. The following diagram shows the total metal emissions of all discharge points (see Fig. 2.16).

Aurubis operates an extensive monitoring network for cooling water discharge. In the process, the discharge temperature, temperature increase and cooling water quantity are measured and recorded at all discharge points. In order to monitor the impact of discharges on the water temperature in the northern Elbe River and the Muggenburg Canal, two measuring buoys were installed in 2016, each above and below the discharge points into the water.

Through the planned construction of waste heat recovery from the acid coolers of KAWO in order to supply Hafencity East, the average thermal output from discharges will be reduced by about 18 MW (160 GWh/year).

Moreover, the oxygen concentration in discharges that are relevant in terms of quantity were measured continuously. The quality of the discharged water increases as a result of enriching the cooling water with oxygen at the significant discharge points by operating turbulence points.

An evaluation system that statistically assesses and documents the parameters determined for the cooling water has been in operation since 2011. Monitoring heat emissions through the cooling water is another measure for improving water pollution control that is being continuously expanded.

The new water law permit for implementing the thermal load plan for Aurubis Hamburg, which was negotiated with the Hamburg Authority for the Environment and Energy, was issued in 2015. To put this plan into effect, new limit values for discharge temperatures, heat levels and oxygen concentrations were implemented in the control rooms and adhered to in a verifiable manner.

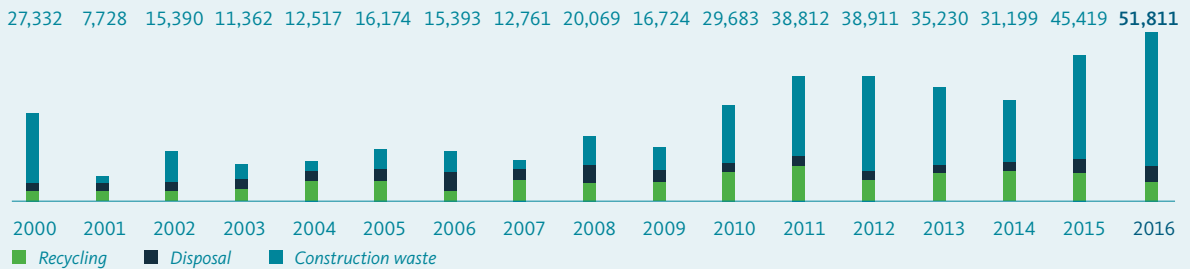
Water usage declined in 2016 by a total of about 5% from the previous year, while potable water usage from the Hamburg Water Works remained almost constant. The removal of cooling water declined correspondingly, primarily due to the shutdown for general repairs in the fall of 2016. In total, the treatment of Elbe River water to convert it into fully desalinated water saves the consumption of about 400,000 m<sup>3</sup> of potable water per year.

#### Facilities Handling Substances Hazardous to Water

Aurubis is considered a specialized company pursuant to the German Water Management Act (WHG). A specialist company under the WHG is distinguished by factors including specific devices and equipment; specific, trained personnel and their targeted employment; work in accordance with generally recognized technical rules at the minimum; a company organization that can react quickly and flexibly; and sufficient documentation of the work that is performed.

Fig. 2.17: Disposal methods for waste produced at Aurubis AG, Hamburg

in t p.a.



The mandatory specialized audits of the relevant facilities under the German Act on Plants Handling Materials Hazardous to Water (VAWS) were carried out by TÜV Nord pursuant to the established audit cycles. The specialized company inspections in accordance with the Water Management Act were also performed by TÜV Nord.

If they aren't double-walled and designed with leakage monitoring, these facilities under the VAWS have leak-proof, stable collection devices that, at a minimum, correspond to the possible volume of materials that could leak in the case of malfunctions.

New installations and renovations in the facilities were also constructed pursuant to the applicable state ordinances and accepted by TÜV specialists.

### Waste

In 2016, a total of 121,287 t of waste were accepted and recycled at the Hamburg site, of which 6,308 t were classified as hazardous waste. A total of 3,169 t of this came from other countries and was registered.

Overall, 11% of the waste accepted was used as a slag former (e.g. spent abrasives, sand and excavation residues), and 89% was used for metal recovery (dust, slimes, slags and precious metal-bearing sweeps). At about 108,000 t, the use of metal-bearing secondary raw materials remained constant.

In the 2016 calendar year, a total of 51,811 t of waste were generated and directed to waste management at the Hamburg site (see Fig. 2.17). Of this amount, 15,239 t were classified as hazardous waste. The proportion of construction waste in the total waste volume increased further in 2016 to 80%, caused by increased demolition activities of old facilities (2015: 70%). A total 10,609 t of waste arose

from production processes, of which 4,617 t were directed to waste disposal and 5,992 t to external recycling. This corresponds to a recycling rate of 56%.

Most of the waste that is disposed of is slimes from off-gas cleaning.

With an annual copper output of 450,400 t, the specific waste level (excluding construction waste) is 24 kg/t of product (2015: 30 kg/t).

43,268 t of olivine pyroxene rock from the secondary smelter (RWN) and 17,230 t of slag material from the primary smelter (RWO) were not marketed as substitute construction material but were recycled as construction material for landfills.

### Energy and Climate Protection

We act responsibly towards future generations by economically and efficiently using raw materials and energy. Our main energy sources are electricity and natural gas. Aurubis AG consumed a total of 1,160 GWh of energy at the Hamburg site in 2016. With an annual copper output of 450,400 t, this amounts to specific energy consumption of 2.6 MWh/t of copper output (2015: 2.7 MWh/t; 2014: 2.5 MWh/t).

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

The new anode slime processing building



Furthermore, a trend towards using lower-energy, i.e. less sulfurous, copper concentrates can be observed. This leads to higher gas consumption for producing heating steam.

Taking a longer-term view, specific energy consumption as a yardstick for energy-efficient production has been significantly reduced at the Hamburg production site in the last few decades, falling by 44% compared to 1990. It has even been possible to reduce fuel-related specific CO<sub>2</sub> output by 68% since 1990. The reason for this is the much reduced use of particularly CO<sub>2</sub>-intensive fuels, particularly coal.

With an output of 450,400 t of copper in the calendar year, specific CO<sub>2</sub> emissions from fuel amounted to 0.26 CO<sub>2</sub>/t of product (see Fig. 2.18a and 2.18b). This corresponds to 118,954 t CO<sub>2</sub>.

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

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

### Waste Heat Use

Aurubis strives to use process waste heat to the greatest possible extent. It is used to heat buildings, to facilitate the production processes and to generate electricity. In 2016, 74% of the steam needed was produced from waste heat and only 26% of the steam needed was produced from fossil fuels.

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

so-called contact acid plant.

The 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 volume is depressurized to 3 bar in the first stage of another steam turbine in the thermal power plant. This steam is then used as process and heating steam in the plant and administrative buildings. Any leftover steam (mainly in the summer months) is depressurized in the second stage of the steam turbine (condensation stage). This is how the existing pressure drops in the steam pressure levels are used to consistently produce electricity. However, if too little steam is available (mainly in the winter months), additional 20 bar heating steam is produced using auxiliary boilers. A total of 11 GWh of electricity was produced from waste heat in 2016, or 1.83% of total electricity consumption (2015: 2.22%). The reason for the slight decline in electricity produced from waste heat was the planned shutdown of the waste heat boiler in fall 2016 as well as the overhaul of one of the steam-driven turbines.

The heat content of the hot waste air from the contact acid plant's air coolers is also utilized year-round and produces 3 bar steam in a so-called waste heat boiler, which flows into the plant network. The waste heat boiler produces around 30,000 t of steam per year and thus reduces CO<sub>2</sub> by 2,000 t p.a.

Furthermore, landfill gas was used in the production

Fig. 2.18a: **Specific energy consumption at Aurubis Hamburg**

in MWh/t of copper output

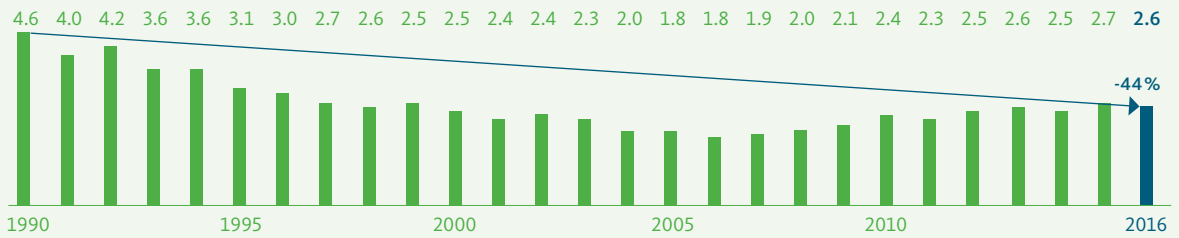
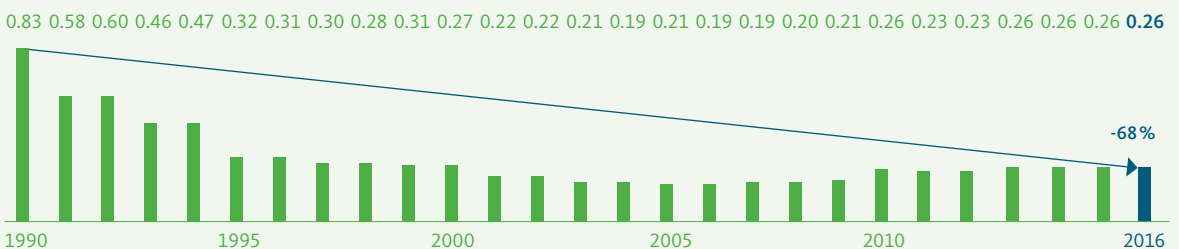


Fig. 2.18b: **Specific fuel-related CO<sub>2</sub> emissions at Aurubis Hamburg**

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



processes instead of natural gas (2016: 1.9 GWh). Aurubis thus uses 100 % of the landfill gas collected in the former Georgswerder landfill.

**Direct CO<sub>2</sub> Emissions – Emission Trading System (ETS)**

The third trading period of the EU emissions trading for greenhouse gases started in 2013. Energy-intensive companies in the production industry, such as Aurubis, will now be included in this trading period. These companies were excluded from emissions trading until 2012.

Direct CO<sub>2</sub> emissions are reported in the Emissions Trading System (ETS) to the German Emissions Trading Authority (DEHSt). Each participant in emissions trading is assigned a certain contingent of CO<sub>2</sub> allowances at the beginning of a trading period. Because of the multi-year trading period (2013–2020), it is possible for the higher emissions in one of the years to be balanced either by lower emissions in the other years or by the subsequent purchase of certificates from the trading authority. The price of an emission allowance for a ton of CO<sub>2</sub> was about € 5 in the spring of 2017.

emissions. One involves fuel-related quantities (mainly natural gas) and the other involves quantities that arise from the oxidation of carbon contained in input materials during the fabrication processes (e.g. with coal and recycling materials). According to the guidelines of CO<sub>2</sub> reporting, the CO<sub>2</sub> emissions of diesel vehicles are not taken into account.

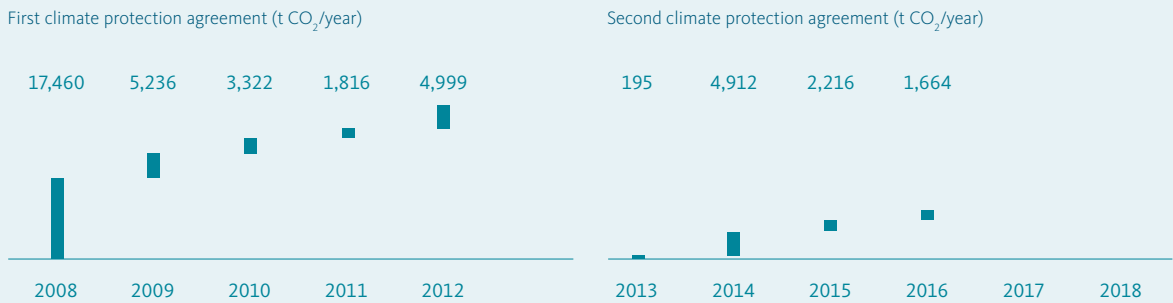
A monitoring plan stipulates the performance criteria and accuracy required for documenting CO<sub>2</sub> emissions. The DEHST must approve this plan. The most recent update was at the beginning of 2017.

CO<sub>2</sub> emissions have been documented pursuant to the approved monitoring plans since 2013.

TÜV Nord CERT verifies annually the CO<sub>2</sub> emissions

A distinction is made between two types of direct CO<sub>2</sub>

Fig. 2.19: Annual CO<sub>2</sub> reduction in the context of the Hamburg Climate Protection Concept



generated, which are reported to the DEHST every year on March 31. The CO<sub>2</sub> emissions reported in 2016 amounted to 166,472 t. This signifies that direct CO<sub>2</sub> emissions since the start of monitoring in 2005 have remained at a relatively constant level (average for 2005–2016: 170,000 t). More than 70% were caused by the fuels used, e.g. natural gas, while the remainder was caused by the coal contained in recycling materials and additives.

### Indirect CO<sub>2</sub> Emissions

Copper production is an energy-intensive process for which a reliable electricity supply is very important in particular. Aurubis therefore has a long-term cost-based electricity supply contract with the coal power plant Moorburg (a so-called virtual power plant slice). This is one of the most state-of-the-art and efficient power plants of its kind. Electricity production in this power plant nevertheless leads to CO<sub>2</sub> emissions, which are indirect CO<sub>2</sub> emissions for Aurubis, and therefore indirect environmental effects. In 2016, these indirect CO<sub>2</sub> emissions totaled 359,172 t. Overall, 288,154 t of the indirect CO<sub>2</sub> emissions resulted from electricity consumption in the production processes, while 71,017 t resulted from the additional electricity consumption for oxygen production.

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

### Climate Protection Agreement with the Hamburg

### Senate on CO<sub>2</sub> Reduction

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

Aurubis AG was one of the first companies to participate in this climate protection concept and implemented a number of projects between 2007 and 2012 that cut CO<sub>2</sub> by 32,000 t each year (see Fig. 2.19).

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

As of March 2017, Aurubis has already realized 9,000 t of CO<sub>2</sub> reductions through the implementation of almost 20 projects.

At least another 20,000 t of CO<sub>2</sub> reductions will be achieved as a result of the decision to use hot water extraction to supply heat to the new urban quarter under construction, HafenCity East. In order to accomplish this, technical changes must be made to one of the acid coolers of a lines in the contact acid plant in order to reach a higher usable temperature level. In addition to CO<sub>2</sub> reduction, heat extraction for district heating will also avoid having to remove up to 12 million m<sup>3</sup> of cooling water from the Elbe.

Our investments amount to about € 17 million. The German Federal Ministry of Economics and Technology will provide a subsidy of € 5.4 million. Furthermore, the district heating is one of ten case examples for the project

“Flagships of Energy-Efficient Waste Heat Use” started by the German Energy Agency (dena).

Additional extractable heat with potential savings of up to 120,000 t of CO<sub>2</sub> would be technically available in the remaining two lines of the contact acid plant. The capital expenditure needed for the heat extraction and its integration into the Hamburg district heating system are still so high even with the subsidy that additional discussions must be held with the potential partners in order to obtain clarity about the technical and economic implementation.

### **Commitment to the Environment**

At Aurubis, copper and by-products are produced sustainably using state-of-the-art, energy-efficient plant technologies with very high environmental standards in order to conserve natural resources and to maintain a clean environment for future generations. Raw materials and recycling products (such as copper scrap and computer scrap) are almost completely converted into marketable products.

Various projects illustrating Aurubis' commitment to the environment are explained in more detail below.

### **Partnership for Air Quality and Low-Emission Mobility**

In September 2012, Aurubis and eleven other companies of different sizes and from different industries signed the “Partnership for Air Quality and Low-Emission Mobility” initiated by the city of Hamburg. The objective of the partnership is to reduce pollution resulting from individual transport. A reduction in nitrogen dioxide emissions, which are caused by road traffic in particular, are a special focus.

In order to bundle the ideas and projects already avail-

able in the area of mobility, Aurubis Hamburg has participated in the Mobil.Pro.Fit model project since 2016. The goal is to establish systematic mobility management. Building on mobility analysis and the creation of a database for the subsequent evaluation of implemented projects, a catalog of measures should be adopted that will improve both low-emission employee mobility and the environmentally responsible management of business trips and the vehicle fleet.

Initial measures have already been implemented. The bus connections from the Veddel train station, which lies approximately two km from the plant, have been significantly expanded. This project initially ran on a trial basis for half a year. Both bus lines now operate longer in the evenings, and buses also service shift changes, including on the weekends.

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

### **Promoting Biodiversity**



Peregrine falcon nesting box



A falcon egg was discovered in early March 2017 during an inspection drive to the falcon nest installed in 2011 at a height of 50 m on chimney 4. Although falcons have lived in the plant for a long time, this is the first offspring. As hunters, the falcons are after the pigeons in the plant.

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

For this purpose, a plant inspection was conducted with NABU experts in June 2016 to identify suitable areas and measures. Although 88 % of the plant premises are developed or paved (766,000 m<sup>2</sup> of a total 871,000 m<sup>2</sup>), it was possible to identify areas that could be rededicated, for example, to butterfly or insect meadows through appropriate changes in use or through plants and maintenance. It was determined that areas exist on the edges of the plant that have been partially untouched for years and undisturbed by the fencing of the plant.

The implementation of the recommendations made by the NABU experts should begin in 2017. Trees and bushes have been planted in the green areas. The plant also has its own tree registry. For the future Aurubis campus, which has been under development since the beginning of 2017, and which is located in the northwestern corner of the plant, the topic of biodiversity will also come into play through the integration of green roofs.

### Polluted Areas

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

The baseline report for the soil pursuant to the Industrial Emissions Directive was submitted to the Hamburg Authority for Urban Development and Environmental Protection. The plan is for the report to be passed during the next permit process. The objective of the report is to evaluate the condition of the soil and the groundwater at the site with respect to hazardous substances. If the site returns to its original state, the baseline report serves as evidence and a standard of comparison and is obligatory for Aurubis in the case of significant facility. Assessment points for a subsequent monitoring program are being coordinated with the oversight authority responsible.

### Emergency Measures and Crisis Management

Because of the type and quantity of materials handled, the Hamburg production site is subject to the obligations of the German Accident Regulation.

Last year the Hamburg environmental authority subjected all facilities to an inspection. No deviations from its intended operational use were found.

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

In the fourth quarter of 2012, the informational brochure on incidents, Safety for Our Neighbors, was revised and updated in collaboration with 30 other companies in Hamburg to provide information to the public. The brochure, which was coordinated by the Hamburg Chamber of Commerce, was sent to all of the households concerned in February 2013. The brochure is also available as a download on the Chamber of Commerce website.

In preparation for the adoption of the Seveso III Directive into German law, a new version of the range of information for the public is currently being worked on in coordination with the Hamburg Chamber of Commerce.

The existing safety report in accordance with Section 9 Accident Regulation was updated for the entire Aurubis AG plant in Hamburg in 2010.

The inspections in the safety report are based in particular on the relevant technical facility data and the composition

of the materials handled. According to this safety report, serious danger within the meaning of the Accident Regulation can be ruled out for the facilities. Furthermore, the measures provided to protect the general public and the surrounding area from other dangers, substantial disadvantages and significant disturbances pursuant to Section 4b of the 12th German Federal Immission Protection Law (BImSchV) prevent or limit large-scale damages.

The safety report is current and is regularly reviewed and updated according to legal requirements.

Emergency plans are in place for emergency situations and accidents. They describe how to react to prevent or limit environmental effects. We routinely carry out emergency drills, and we document and evaluate the processes. Moreover, we have developed an alarm and danger prevention plan in coordination with the responsible authorities, which describes emergency measures for our plant premises. The individual plant divisions also have alarm and danger prevention plans. These documents are issued by the Plant Fire Department or the plant divisions in cooperation with the Environmental Protection Department and are accessible to all parties involved in the emergency.

Our Plant Fire Department works around the clock in Hamburg.

Employees are on call for each plant division and for all of the relevant departments. An engineer on duty who can also be reached at any time coordinates the required measures. The engineers rotate weekly.

In an emergency, the individuals listed in the emergency plan are responsible for passing on information to the public.

The alarm and danger prevention plan was updated in May 2015 and sent to the relevant authorities.

### Accident Prevention

In June 2016, the Hamburg Municipal Fire Department, Fire Prevention Department, conducted a fire prevention presentation for the entire plant. Various topics were considered, such as fire regulations, escape and rescue plans, assembly points, positioning and operating spaces, accessibility of water intakes, using the fire alarm system to alert the control center of the Plant Fire Department, and other measures that serve to prevent fires.

In September, the annual flood protection drill was held in the plant as part of the alarm and danger prevention plan.

In December 2016, the effectiveness of the alarm and danger prevention plan was tested. An accident scenario was simulated while filling the SO<sub>2</sub> tank, which would have led to a gas leak and casualties. The goals were the inspection of the alarm equipment, the functionality of the alarm message chain, the introduction of containment measures, hazardous substance controls by the fire department, the execution of a rescue mission, and a test of current employees' behavior. The drill was successful. Potential improvements regarding the marking of the danger zone and the rerouting of plant traffic were identified and incorporated into the plans' revision.

The Plant Fire Department conducted 29 drills in and at various facilities and buildings. In the process, accessibility and options for positioning emergency vehicles were investigated. Additional topics covered included practical tactical measures for the suppression of emissions and dealing with environmental damage from heavy rains and thunderstorms.

The Fire Prevention Department instructed 536 employees in preventive and defensive fire control, including the handling of various fire extinguishers.

As of January 1, 2017, the Plant Fire Department is reorganizing emergency and crisis management so it includes a dedicated crisis room at the Hamburg site. Fictional scenarios can be planned and executed here through staff exercises with the employees responsible.

The hazardous materials department of the Plant Fire Department, which was first created in 2016, has supervised more than 100 hazardous materials situations, such as the filling of tank wagons, the loading of general cargo in containers, as well as preparatory measures for the transportation of hazardous materials in the facilities of Aurubis AG at the Hamburg site. For this purpose, 4 employees received qualifications through training as hazardous materials officers.

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

## **Environmental Program**

The targets set in the context of the Environmental Statement 2016 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 2017. The results are presented in the following Environmental Program:

## Strengthening Environmental Awareness

Target	Planned measure	Degree of implementation/date
14-day information session of the works management team on environmental protection as part of regular communication	Routine discussions and review of measures with works management and the department or production managers	14 days or if necessary, ongoing
Training employees working in all plant areas relevant for environmental protection	Annual training sessions for employees in the primary smelter, secondary smelter, lead plant, precious metal recovery, casting lines, rod plant, ELWO, acid plants and logistics	Implemented in 2016; to be repeated annually
Information and training session for the department and plant managers on environmentally relevant topics	Conducting of environmental quality circles; information session on the legal situation and the correct implementation of regulations. Clarifying the consequences of non-compliance	Training sessions were successfully carried out again; they will continue in 2017 as part of general continuing education on an ongoing basis
Plant tours by employees in the Environmental Protection Department	Monitoring operations with regard to environmental effects and compliance of Environmental Protection Department with regulations	Information is provided to the works and plant management in short reports including implementation controlling
Strengthening environmental awareness	All employees should be reached by distributing the Environmental Report and providing the environmental handbook with the relevant instructions on the intranet	Completion of the Environmental Report including Environmental Statement ready for printing by August 2017

## Reducing Dust Emissions by 9 t Each Year

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

Target	Planned measure	Degree of implementation/date
Reducing dust emissions by 9 t each year	Diverse measures – see the chapter Environmental Protection Data and Facts	Verification will follow with the 2016 Emissions Declaration
Remaining tasks:	Improvement of the flow situation in the RWN converter hall	Start of implementation 2017
	Source extraction equipment skip loading ladle linings	Start of implementation 2017

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

Target	Planned measure	Degree of implementation/date
Additional improvements to reduce fugitive emissions	Suctioning of the ridge turrets in the RWO Program for the cleaning of surfaces and roofs Improvement of filter facilities Introduction of 5S beyond individual plants/ departments	Specific goals should be set in a new public-law contract in 2017

### Air Pollution Control and Permits

Target	Planned measure	Degree of implementation/date
Participation in the Hamburg Senate's Climate Protection Concept	Implementing projects to cut 12,000 t of CO <sub>2</sub>	Implemented so far: Interplant turbine as well as conversion of the cracking plant from HD to MD oxygen (degree of implementation 2016: 9,400 t CO <sub>2</sub> ); additional projects in the planning stage, particularly waste heat use, acid cooling, MSO
Voluntary pledge among Hamburg industrial companies		

### Energy Optimization

Target	Planned measure	Degree of implementation/date
Heat extraction for internal use and the supplying of district heating to HafenCity East – Reducing heat discharge in the Elbe River	Conversion of Line 1 for the extraction of 90 °C hot water; construction of the heat line up to the transfer point on the plant boundary Review of additional potential for the extraction and supply of heat from Lines 2 & 3 to the district heating grid of the city of Hamburg	Heat supply contract between Aurubis AG and enercity Contracting Nord (eCGN) signed on February 17, 2017 Conversion during the partial shut-down of the facility in April 2018 Discussions with the city of Hamburg on further arrangements for waste heat recovery and heat extraction for district heating

## Water Pollution Control

Target	Planned measure	Degree of implementation/date
Reducing the authorized heat input via the cooling water	Measurements of heat-relevant parameters, including a data analysis unit (classification unit) to record and assess the heat-relevant data (discharge quantity, temperature increase, discharge temperature, volume measurement, heat input and oxygen content or oxygen saturation for the discharge point	Measurement program has been in place since March 2011; continuation in 2014 Requirements of the thermal load plan have been implemented since 2013. Water law permit was issued in 2015
- Max. heating of water by 3 K	Norderelbe and two points in the Müggelberg Canal) as an hourly average or 6-hour moving average	Installation of measuring buoys in the Elbe and Müggelberg Canal in 2016
- Max. discharge temperature 33 °C		Monitoring of criteria: compliance with new limit values
- Min. concentration of 6 mg/l O <sub>2</sub> in the discharged cooling water		
Reduction of heat input via the cooling water by 18 MW	Construction of waste heat recovery from the acid coolers of KAWO	Start of construction 2017 Commissioning April 2018

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

Target	Planned measure	Degree of implementation/date
Sustainable, efficient and climate-friendly mobility	Program Mobil.Pro.Fit: Development of mobility management (Focuses: Business trips, vehicle fleet, and the improvement of employee mobility, in particular	Participation in the second round of Mobil.Pro.Fit in 2016
Coordination of the Mobil.Pro.Fit measurement plan with works management – certification Q2 2017.	Developing a concept for e-bike/personalized bike leasing	Continued in 2017
	Reviewing the feasibility of a better public transportation connection (additional Hamburg bus routes or shuttle service to Veddel train station)	Start of an evaluation phase in December 2016 with an improved public transportation connection during all shift changes and on the weekend
	Construction of a bike compartment at the Veddel train station	Continued in 2017
Promotion of e-mobility	Installation of charging points (car & e-bike) at the employee parking lots in the North Plant and the West Plant	Start of implementation in 2017
	Test of e-mobility for internal traffic	Acquisition of first cars and transporters in 2016 – extension & continuation of the pilot phase in 2017



### Promoting Biodiversity

Target	Planned measure	Degree of implementation/date
Promotion of biodiversity at the Hamburg plant	Sowing of butterfly meadows, planting of native bushes, installation of insect hotels	Plant inspection with NABU in 2016; implementation of recommendations in 2017

### Safety Aspects/Plant Safety

Target	Planned measure	Degree of implementation/date
Support in the case of transport and warehouse accidents with chemicals in public spaces	Participation of the Plant Fire Department in the TUIS system	Initial deployments have been taking place since 2015
Ensuring security	Drills for the alarm and danger prevention plan	Conducted annually, most recently in Nov. 2016

### Continuous Improvement of Environmental Management System

Target	Planned measure	Degree of implementation/date
Introduction of an integrated management system (IMS) for Aurubis AG, for the environment, quality and energy areas	Introduction – IMS handbook Introduction of IMS handbook Hamburg Introductory phase – taking advantage of synergies Revision of documents	IMS handbook & Hamburg handbook adopted (2016)  Reorganization, consolidation and revision of traffic instructions for the environment, quality and energy areas  Certification of IMS by TÜV Nord May 2017
Ensuring compliance	Further development of the annotated catalog of statutory principles, incl. derivation of actions and follow-up on implementation	Continuously

### Business Partner Screening

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

**Key figures for Aurubis AG, Hamburg site,  
in the 2016 calendar year**

<b>Input</b>	<b>2016</b>	<b>2015</b>
<b>Raw materials</b>		
Copper concentrate (dry)	1,042,703 t	1,218,492 t
Copper scrap/refining material	47,928 t	46,218 t
Other Cu-bearing raw materials	137,773 t	126,759 t
PM-bearing raw materials incl. scrap	22,398 t	22,885 t
Lead scrap and waste	24,439 t	23,490 t
Other metal-bearing waste for recycling	579 t	385 t
<b>Total TC/RC-earning raw materials</b>	<b>1,275,821 t</b>	<b>1,438,229 t</b>
<b>Auxiliaries</b>		
Sand and additives incl. cyclone sand	135,531 t	138,473 t
Iron as an additive	15,276 t	16,856 t
<b>Total input materials</b>	<b>1,426,628 t</b>	<b>1,593,557 t</b>
<b>Input material/t copper</b>	<b>3.2 t/t Cu</b>	<b>3.6 t/t Cu</b>
<b>Energy</b>		
Electricity consumption	511,764 MWh	539,442 MWh
Additional electricity consumed to produce oxygen	118,362 MWh	118,794 MWh
Natural gas	481,446 MWh	468,933 MWh
Coke	52,254 MWh	56,077 MWh
Other energy sources	17,034 MWh	19,053 MWh
<b>Total energy consumption</b>	<b>1,180,860 MWh</b>	<b>1,202,300 MWh</b>
<b>Energy consumption/t copper</b>	<b>2.6 MWh/t Cu</b>	<b>2.7 MWh/t Cu</b>
<b>Water withdrawal/uptake</b>		
River water	63,676,000 m <sup>3</sup>	67,406,000 m <sup>3</sup>
Potable water	339,000 m <sup>3</sup>	343,000 m <sup>3</sup>
Precipitation	397,000 m <sup>3</sup>	428,000 m <sup>3</sup>
<b>Total water uptake</b>	<b>64,412,000 m<sup>3</sup></b>	<b>68,177,000 m<sup>3</sup></b>
<b>Water discharge/t copper</b>	<b>143 m<sup>3</sup>/t Cu</b>	<b>154 m<sup>3</sup>/t Cu</b>
<b>Area used at the Hamburg site</b>		
Total plant area	871,000 m <sup>2</sup>	871,000 m <sup>2</sup>
Buildings and paved area	766,000 m <sup>2</sup>	766,000 m <sup>2</sup>
	(equivalent to 88 %)	(equivalent to 88 %)

Output	2016	2015
<b>Products</b>		
Copper	450,400 t	443,185 t
Sulfuric acid products as H <sub>2</sub> SO <sub>4</sub> (from exhaust gas cleaning)	946,224 t	1,005,178 t
Iron silicate stone (incl. granules)	743,204 t	777,165 t
Silver and gold, selenium	1,804 t	1,430 t
Metal compounds (Ni, As)	2,317 t	2,635 t
Lead	13,123 t	13,876 t
<b>Total products</b>	<b>2,157,071 t</b>	<b>2,243,469 t</b>
<b>Waste</b>		
Recycling	5,992 t	8,773 t
Disposal	4,617 t	4,630 t
<b>Total recycling &amp; disposal</b>	<b>10,609 t</b>	<b>13,403 t</b>
of which hazardous waste	7,812 t	10,493 t
<b>Waste/t copper production</b>	<b>24 kg/t Cu</b>	<b>30 kg/t Cu</b>
<b>Waste/t input material</b>	<b>7 kg/t</b>	<b>8 kg/t Cu</b>
Construction waste (informative)	41,202 t	32,016 t
<b>Total waste</b>	<b>51,811 t</b>	<b>45,419 t</b>
<b>Conversion into products</b>	<b>99.3 %</b>	<b>99.2 %</b>
<b>Emissions</b>		
Dust	43 t	42 t
Dust/t copper	96 g/t Cu	96 g/t Cu
SO <sub>2</sub>	2,004 t	1,868 t
NO <sub>x</sub> /t copper	482 g/t Cu	478 g/t Cu
Direct CO <sub>2</sub> emissions (diesel for vehicles)	166,472 t	171,410 t
of which CO <sub>2</sub> from fuels	118,954 t	117,230 t
CO <sub>2</sub> from fuels/t copper	0.26 t/t Cu	0.26 t/t Cu
Direct CO <sub>2</sub> emissions (diesel for vehicles)	3,498 t	3,807 t
Indirect CO <sub>2</sub> emissions		
from electricity consumed (ETS)	288,154 t	314,520 t
from the additional electrical consumption	71,017 t	71,276 t
for oxygen production (ETS)		
Metal discharge in water	647 kg	606 kg
Metal discharge in water/t copper	1.4 g/t Cu	1.4 g/t Cu
<b>Water discharge</b>		
Direct discharge	61,305,259 m <sup>3</sup>	66,048,533 m <sup>3</sup>
Indirect discharge	44,220 m <sup>3</sup>	54,147 m <sup>3</sup>
<b>Total water discharge</b>	<b>61,349,479 m<sup>3</sup></b>	<b>66,102,680 m<sup>3</sup></b>
<b>Water discharge/t copper</b>	<b>136 m<sup>3</sup>/t Cu</b>	<b>149 m<sup>3</sup>/t Cu</b>



# Consolidated Aurubis AG Environmental Statement 2017

Lünen site



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

The plant was built and commissioned on undeveloped land between the Cologne-Minden railway and the Datteln-Hamm Canal in 1916 as a branch plant of Hüttenwerke Kayser in Berlin. After the loss of the Berlin plants and reconstruction after the end of World War II, the production facilities were continuously expanded and steadily modernized. After the then Norddeutsche Affinerie AG acquired the majority of Hüttenwerke Kayser shares in 2000, the plant was initially integrated into the company structure and expanded to become the Group's recycling center. Today Aurubis AG's Lünen site is the largest secondary copper smelter in the world with a production capacity of 210,000 t of copper cathodes annually.

Recycling raw materials are almost exclusively used in the smelting units in Lünen, including traditional recycling raw materials such as copper scrap and other scrap, slimes and residues, as well as increasingly complex materials, in particular electrical and electronic scrap. The feed materials, which are largely delivered by truck, are first sampled, in some cases crushed and separated in a material preparation plant, and then processed in a multi-step metallurgical process. The copper anodes produced in this way are then refined electrolytically into cathodes, which are the final product at the Lünen site. Additional anode quantities from other Aurubis sites are also processed in the copper tankhouse (see Fig. 3.1).

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

There are about 600 employees at the Lünen site, around 43 of whom are apprentices.

### Environmental Management System

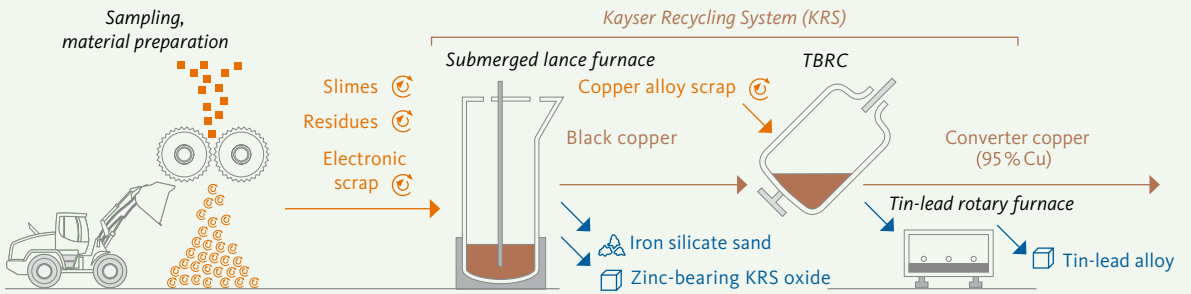
An environmental management system exists at the Lünen site as well. It has been certified in accordance with ISO 14001 and EMAS and incorporated in a TQM (total quality management) system in connection with quality management pursuant to ISO 9001 since 1997. Since 2013 the TQM has also included a certified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

Therefore, the management system and handbook and its process and work instructions, etc. are related not only to the environmentally relevant issues, including accident prevention and health protection, but also to quality assurance and energy management measures.

The TQM system continues to fulfill the requirements of the waste disposal regulation (EfbV) and the law on circu-



Fig. 3.1: Multi-metal recycling at the Lünen site



lation, withdrawal and environmentally sound disposal of electrical and electronic devices (ElektroG) for the material preparation plant. Since August 2016, the plant is a certified primary treatment facility, according to the ElektroG. The effectiveness of the environmental and energy management systems is reviewed with internal audits pursuant to EMAS regulations and ISO 14001/ISO 50001.

The approach for the internal audits is defined in specific process instructions. Internal and external audits take place annually in compliance with the EMAS and ISO 14001/ISO 50001 requirements.

The external audit involves verifying the description of operating processes and reviewing the environmental data provided. The results of the company environmental audits and internal audits are compiled in a report and presented to the plant management as the representative of the Executive Board for assessment (Management Review).

It evaluates how suitable, appropriate and effective the management system is and whether the principles for environmental protection, health protection, occupational safety and energy management are being successfully implemented.

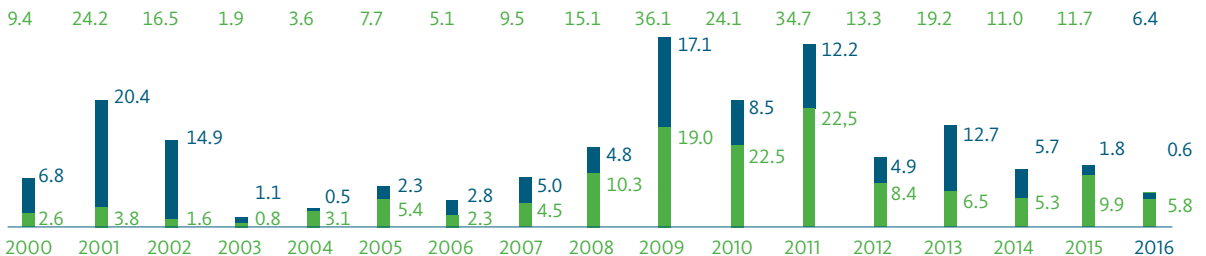
### Targets and Tasks of the Environmental Management System

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

The environmental protection management system ensures that the applicable legal requirements are fulfilled with respect to environmental protection. Furthermore, it

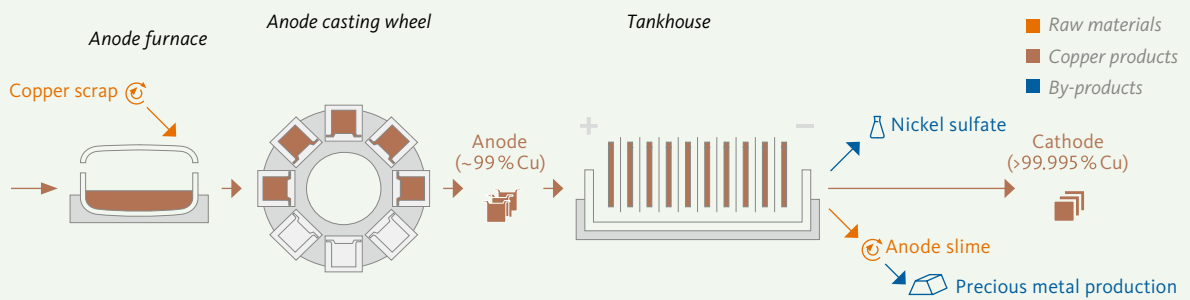
Fig. 3.2: Capital expenditure of Aurubis AG at the Lünen site

in € million/fiscal year



» A total of € 243 million has been invested in technology and environmental protection since 2000, of which € 121 million went to environmental protection alone.

■ Technology  
■ Environmental protection



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

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

In order to achieve these targets, the IMS is regularly reviewed using numerous key figures, which are usually determined and discussed on a group-wide basis and therefore provide a good estimate of the site's performance. These key figures include, for example, emissions to air or water. In addition, registers for operating events or neighborhood complaints are maintained in Lünen. The registers make performance easier to track, for example, by recording the response to each incident and documenting the solution that was found. The goal is to make as direct contact as possible with the complainants.

### Environmental Management Organization

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

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

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

are carried out by the employees mentioned above. The same applies to the Occupational Safety Specialist, while the health protection measures that extend beyond this are the responsibility of Aurubis AG's company Medical Department. The officer function for REACH and CLP (Classification, Labeling and Packaging) is carried out centrally for all of Aurubis AG from Hamburg.

### Investments in Environmental Protection

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

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

Fig. 3.3: Annual averages for dust 2012 – 2016

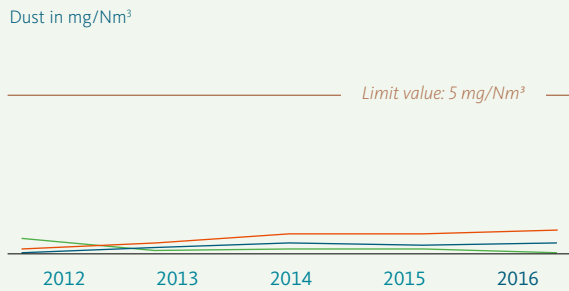


Fig. 3.4: Annual averages for NO<sub>x</sub> 2012 – 2016

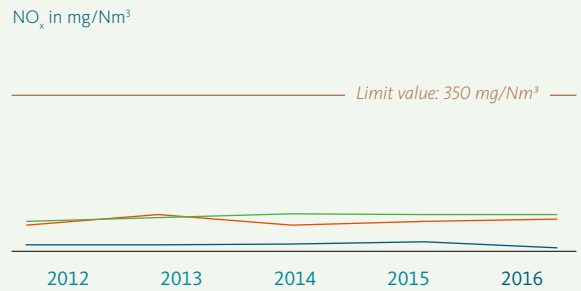


Fig. 3.5: Annual averages for SO<sub>2</sub> 2012 – 2016

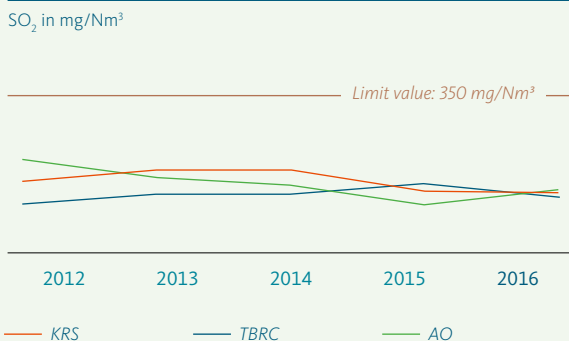
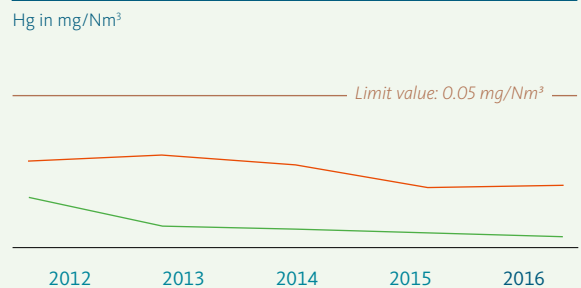


Fig. 3.6: Annual averages for Hg 2012 – 2016



investment costs of the KRS-Plus project, which has been implemented in the meantime.

Overall, around € 121 million has been invested in environmental protection from 2000 to 2016 (see Fig. 3.2).

### New Material Catalog for Waste Acceptance

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

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

## Environmental Effects

### Air

#### Emissions

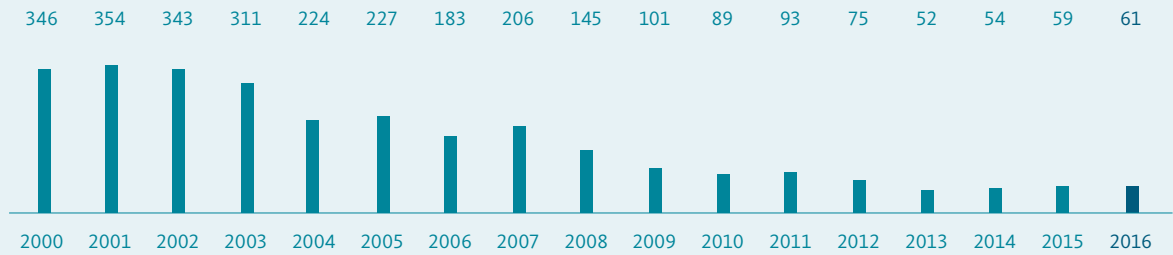
The emissions from directed sources (chimneys) are monitored by continuous measuring devices in connection with emission data transfer. Dust, sulfur dioxide, nitrogen oxides, hydrogen chloride, hydrogen fluoride and mercury in the KRS are measured continuously depending on relevance. Other off-gas and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

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

Consequently, the measurements comply with the limit values overall or fall significantly below them in some

Fig. 3.7: Dust emissions at the Lünen site

Dust in g/t of copper output



cases. The same applies to additional substances listed in the permits, e.g. NO<sub>x</sub>, HCl, HF, etc.

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

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

The dust emissions in 2016 were again at about the same low level of the previous year.

Mercury emissions were also completely unproblematic in 2016. In this regard, measures in recent years (additive dosing, early warning devices at the incoming control) have led to a sustained reduction.

The new added filter in the primary smelter (source 2041) stabilized the source's dust emissions at a low level (289 kg instead of 3,317 kg prior to installation).

In absolute terms, all values are at the low level of the previous years; the specific emissions are also nearly constant. However, shifts are expected for specific emissions in the coming years. This has already been the case for a long time for emissions per ton because the Lünen plant works with increasingly complex input materials and the miniaturization of technical devices also has also resulted in an increase in the number of processing steps. This

leads to less copper in exchange for more by-products per ton of material input.

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

With an annual output of 179,023 t of copper cathodes and a material input of 395,100 t, the following specific quantities result for 2016:

Emission		Specific emission related to input	Specific emission related to product
SO <sub>2</sub>	kg/t	2.5	4.9
Dust	g/t	68.0	131.0
Copper	g/t	4.0	7.8
Lead	g/t	3.0	5.7
Arsenic	g/t	0.1	0.2

Fig. 3.8: Copper emissions at the Lünen site

Copper in g/t of copper output

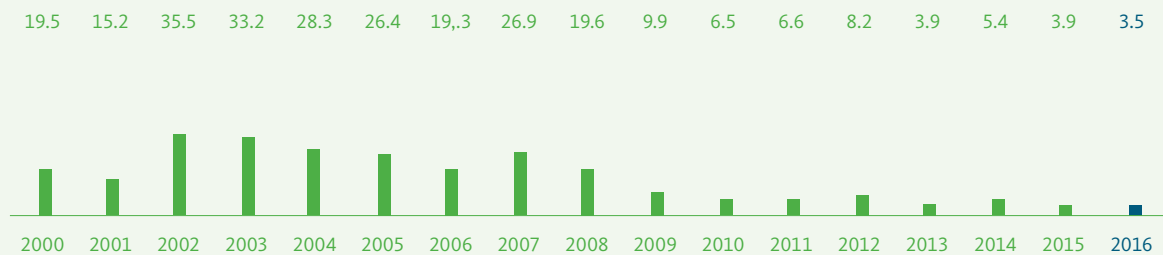


Fig. 3.9: Lead emissions at the Lünen site

Lead in g/t of copper output

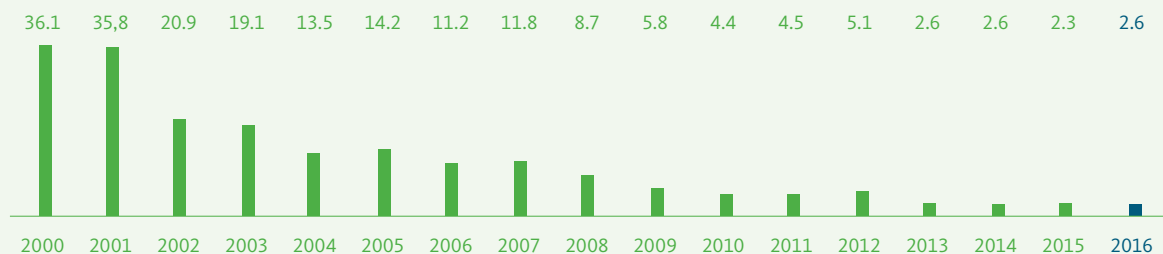


Fig. 3.10: Arsenic emissions at the Lünen site

Arsenic in g/t of copper output



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

## Immissions

To measure the immissions of dust precipitation including metallic components, the LANUV (NRW State Agency for Nature, the Environment and Consumer Protection) operates a network that currently consists of twelve "Bergerhoff" measurement points in the area surrounding the Lünen plant (see Fig. 3.11).

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

In addition, a LANUV measurement station for fine dust ( $PM_{10}$ ) is located on Viktoriastrasse (northeast of the plant). The position corresponds to that of the plant's calculated immission maximum (see Fig. 3.12).

The measurements of air quality for suspended particulates and content indicate that the levels are significantly and consistently below both the limit values for  $PM_{10}$  and lead as well as below the EU target values for arsenic, cadmium and nickel (see Fig. 3.13 – 3.16). The LANUV measurement station at Niederaden is listed for comparison; it serves LANUV as a neutral point measurement station without industrial impact.

## Noise

Noise protection measures take high priority in the conception of new facilities in particular. The additional noise pollution in the area in terms of TA Lärm should be mar-

ginal, i.e. the levels should be at least 10 db(A) lower than the TA Lärm immission reference values. This requirement was fulfilled in the last few years in all projects, and noise reduction measures were carried out at existing facilities as well.

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

There have been scarcely any noise complaints by residents. Factors for noise reduction at the plant are the repeated sensitizing of employees to loading and transport processes (low dumping height, etc.) as well as the noise protection wall.

In the coming year, planned construction and the training center on the edge of the plant as well as the heightening of the plant fence on the east side will further reduce noise immissions in the plant environment.

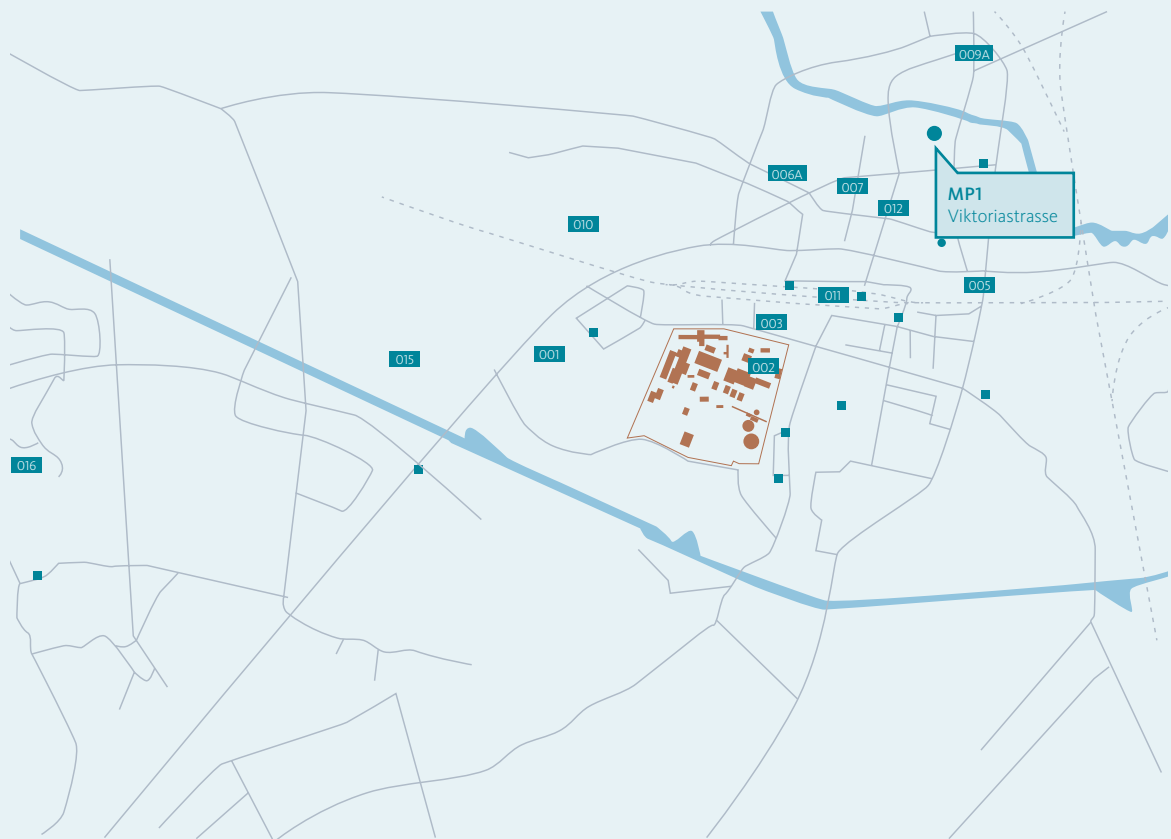
## Water

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

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



Fig. 3.11: Locations of immission measurement points near the Aurubis plant in Lünen



*"Bergerhoff" measurement points in Lünen*

001 Buchenberg

002 Kleine Bergstrasse

003 Bergstrasse 48

005 Bebelstrasse/Süggelbach

006A Rail line/mosque

007 Lünen South freight yard

009A B 236/Lippebrücke

010 Im Wiesengrund

011 Builders' association/building yard

012 Rail line/Kantstrasse

015 Im Engelbrauck/north side

016 Im Siepen

■ Aurubis plant building

Source: LANUV

Fig. 3.12: Fine dust emissions (PM<sub>10</sub>) compared to the plant's calculated emission maximum

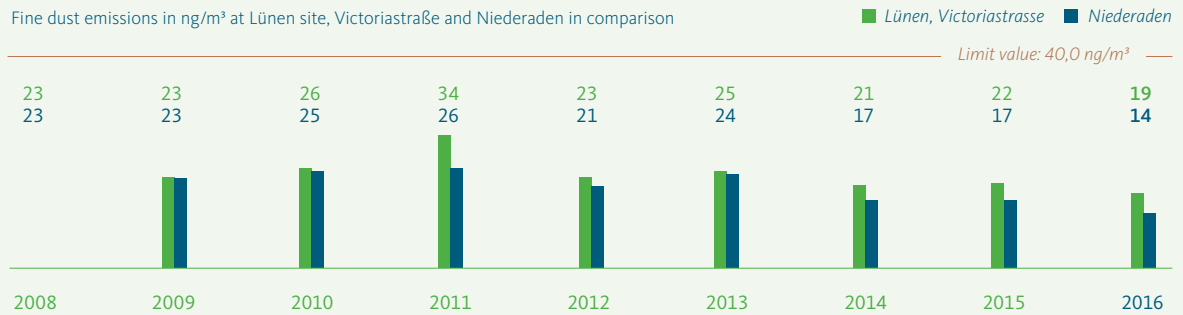


Fig. 3.13: Lead

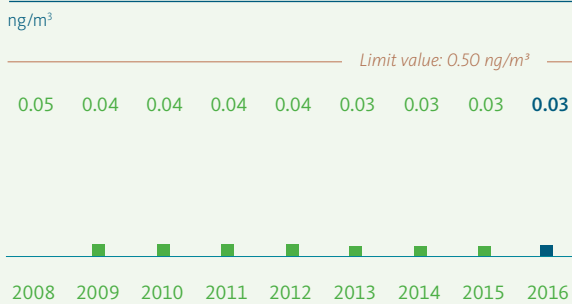


Fig. 3.14: Cadmium

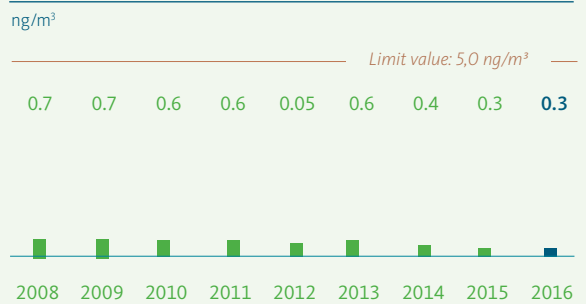


Fig. 3.15: Arsenic

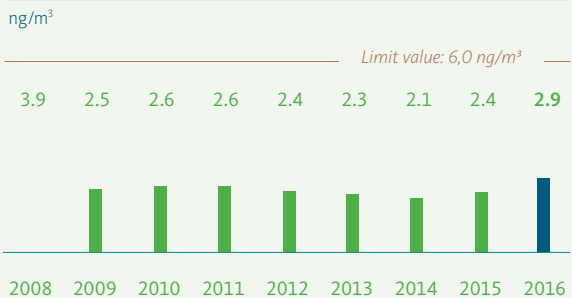
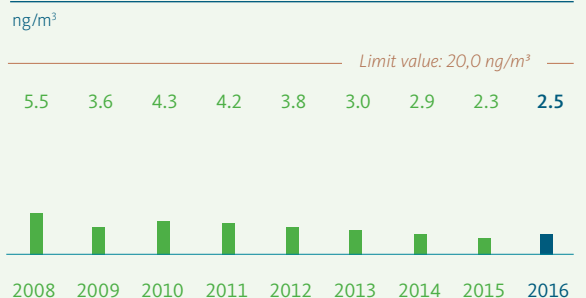
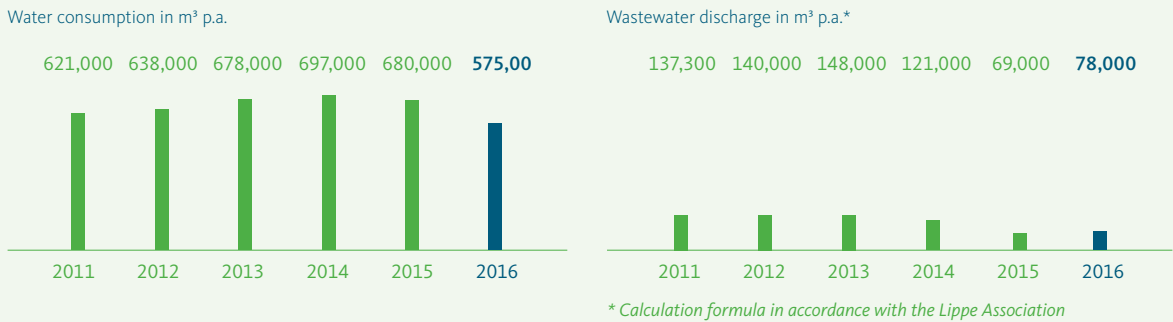


Fig. 3.16: Nickel



The measurements of air quality for suspended particulates and content indicate that the levels are significantly and consistently below both the limit values for PM<sub>10</sub> and lead as well as below the EU target values for arsenic, cadmium and nickel. The LANUV measurement station at Niederraden is listed for comparison; it serves LANUV as a neutral point measurement station without industrial impact.

Fig. 3.17a: **Water consumption and wastewater discharge at the Lünen site**



covered by the collected rainwater, so discharge volumes and water consumption will decline.

In 2016, more than 100,000 m<sup>3</sup> of surface water were used for the first time for internal purposes. As a result, the external water consumption has declined further. Overall, the rainwater-use project has significantly surpassed the quantities estimated in the permit in just its second year. However, contrary to forecasts, the wastewater discharge has not declined but has significantly increased. The reasons for this included excessive blowdown in a few boilers. Since then, the calibrations have been adjusted so that the wastewater quantities should continue to decline significantly next year (see Fig. 3.17a).

**Waste**

The waste from the Lünen plant mainly results from packaging from delivered materials, from construction measures and from spent potlining from the KRS, anode

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

The accumulated waste continued to be reduced in 2016. Significantly more hazardous waste has accumulated, but this is primarily attributable to construction work for ground mounting since the soil is supposed to be disposed of as hazardous waste in accordance with official requirements. The amount of hazardous waste from processing remains below the average in recent years (see Fig. 3.18).

Fig. 2.17b: **Layout of the two rainwater retention basins, central pump station, treatment plant and service water storage tank 1**

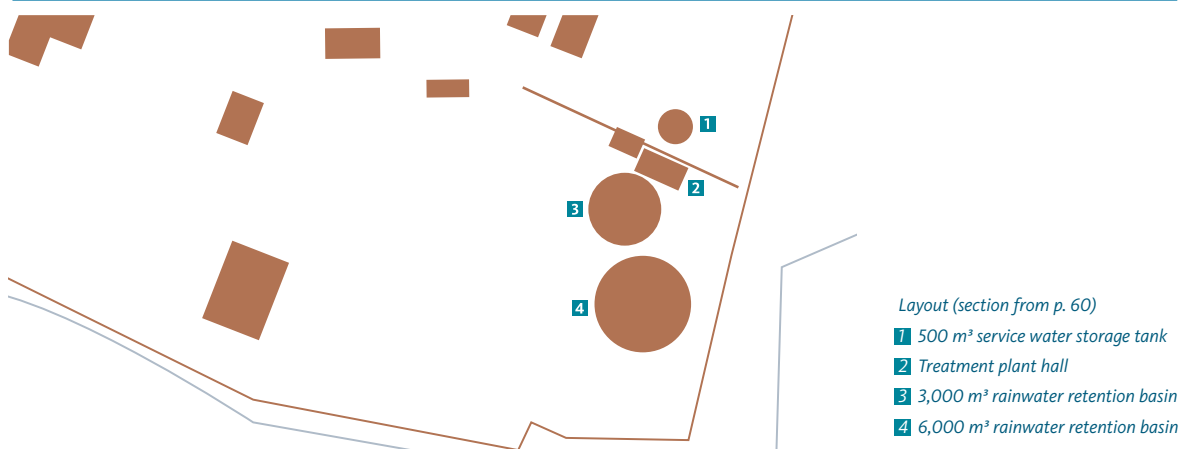


Fig. 3.18: **Generated waste at the Lünen site**

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

### Soil conservation – restoration measures

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

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

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

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

Furthermore, a groundwater flow model was developed for the site, which was welcomed as helpful by all participants. In 2016 it was refined a few more times, incorporating additional wishes of the Unna District into the monitoring concept. Permit applications are currently being prepared based on the new result and should be submitted by late summer 2017.

### Soil Conservation – Preventative Measures

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

Also in 2016, more than 15,000 m<sup>2</sup> of plant surface area that has heavy plant traffic was repaved according to WHG quality standards, further improving soil and groundwater protection by enabling a more effective cleaning of surfaces and less dust accumulation.

### Indirect Environmental Impacts

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

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

## Energy & Climate Protection

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

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

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

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

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

On the left-hand curve (see Fig. 3.21), the graphic shows that the site's absolute energy demand has been relatively constant for ten years. The specific energy KPI in relation to the input of recycling raw materials very concretely illustrates the multi-metal recycling strategy selected for the Lünen site. With the same or a declining cathode copper output in the last three years, metal is produced from a high and continuously increasing input of recycling materials. The average copper content in the raw materials is decreasing, while the proportion of tramp metals such as zinc, tin, nickel, gold and silver is increasing distinctly. The shift in the trend shows that the increasingly complex composition of raw materials is becoming more energy intensive when it comes to processing.

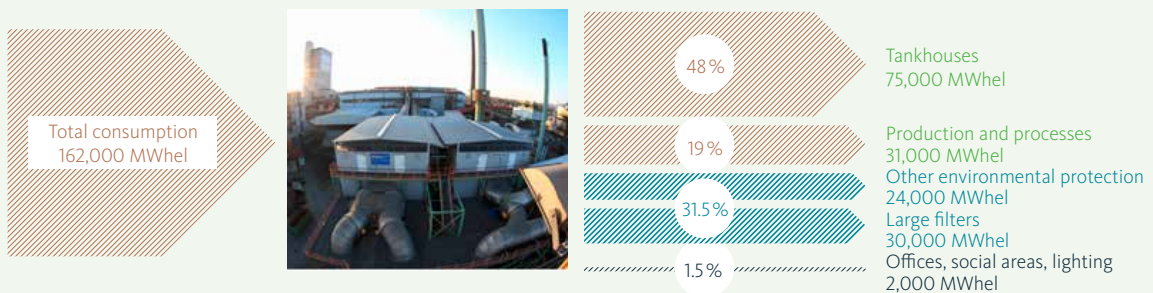
Fig. 3.19: Energy consumption<sup>1</sup> at the Lünen site

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

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

<sup>2</sup> Includes Internal electricity production from the steam turbine (2016: 14.9 GWh)

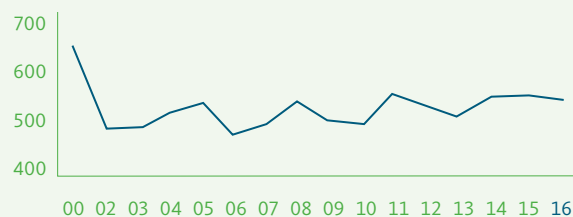
Fig. 3.20: Environmental protection facilities – including those at the Lünen site – are very energy-intensive



About 30% of electricity at Aurubis is used for environmental protection measures.

Fig. 3.21: Specific energy consumption in relation to recycling raw material input

Primary energy input at Aurubis Lünen (in GWh)



Spezifischer Energiebedarf am Standort Lünen in kWh/t Sekundärrohstoffeintrag

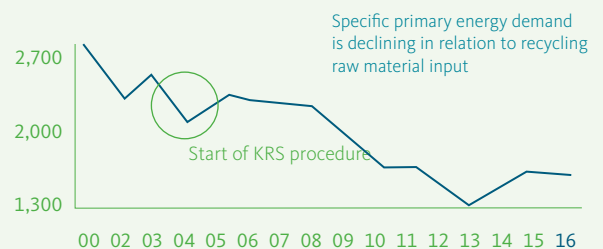


Fig. 3.22: CO<sub>2</sub> emissions at the Lünen site

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

<sup>1</sup> 2020 Data Collection Regulation for the third emissions trading allocation period

Fig. 3.23: Specific energy consumption at the Lünen site

in MWh/t of copper output

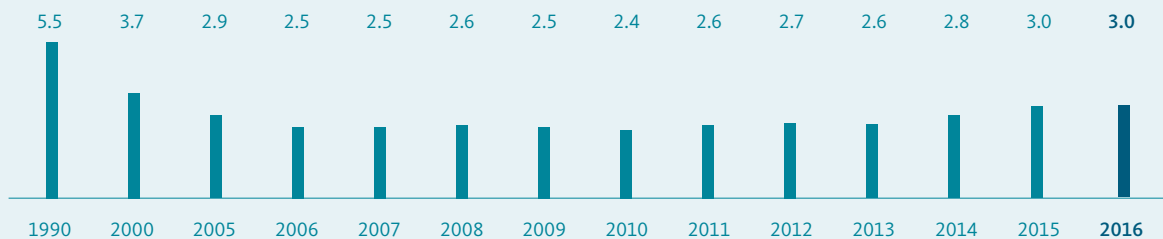
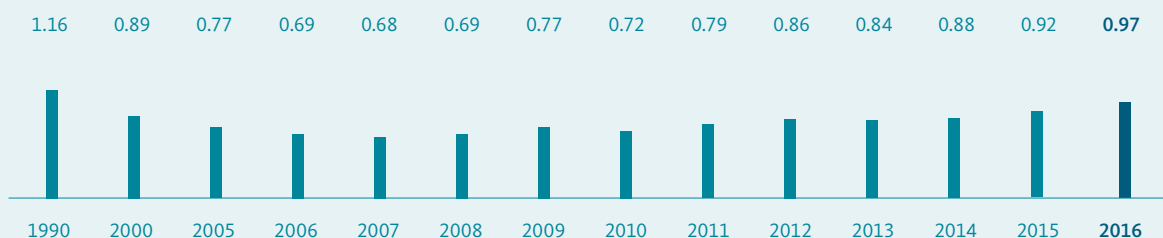


Fig. 3.24: Specific CO<sub>2</sub> emissions at the Lünen site

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



The CO<sub>2</sub> emissions were determined in accordance with DEHSt (German Emissions Trading Authority) standards. The increase in the absolute figures is mainly a result of a higher quantity of complex input materials with low copper contents. This trend, which has been observed for some time now, led to an increase of more than 10,000 t in 2011 due to the implementation of the KRS project. The total CO<sub>2</sub> emissions include biogenic emissions and emissions from mobile production equipment, i.e. the diesel

consumption of plant vehicles, which are not considered in emissions trading.

According to the reporting methods of the DEHSt, the raw materials contribute more to the site's CO<sub>2</sub> emissions than the main energy source, SE oil (40% compared to 37%).



### Communication with the General Public/Special Occurrences

There were no incidents or malfunctions with significant environmental effects within the meaning of the Hazardous Incidents Ordinance at the Lünen plant during the reporting period.

On the occasion of the 100-year site anniversary, calendars and information letters about the Hazardous Incidents Ordinance were distributed to all neighbors (private individuals and companies), and they were combined with an invitation to a plant tour. This invitation was well received by many neighbors, so that several plant tours were conducted in 2016.

On April 20, 2016, the current LANUV results on the contamination of leafy vegetables in small gardens in the Kupferstrasse industrial area were presented to citizens at a public meeting of the city of Lünen.

The contamination continues to abate, although the recommendation to restrict consumption in recent years remains in effect.

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

In addition to LANUV, others present at the public meeting included representatives of the district government, local companies like Aurubis and the environmental consultant Aneco, which used the opportunity to present the planned immission protection report for the Kupferstrasse industrial area.

### Audits and Inspections by the Authorities

The following environmental inspections were carried out by the relevant authorities in 2016:

- » -IED inspection to review the HOS landfill, BR Arnsberg, September 15, 2016
- » -IED inspection, acceptance of changes to the anode furnace and anode furnace filter 2, BR Arnsberg, December, 13, 2016

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

## **Environmental Program**

The targets set in the context of the Environmental Statement 2016 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 2017. The results are presented in the following Environmental Program:

### Air pollution control

Target	Planned measure	Degree of implementation/date
Completely closing the storage area on the west side of the plant	Connection and storage hall 2A to close the gap between halls 2 and 3	The project was postponed indefinitely due to new prioritization
Closing the KRS roof ventilation	Analysis of the emission effects after closing the smelting operations hall and possibly closing the KRS roof ventilation	A filter facility for roof ventilation is scheduled and budgeted for FY 2017/18 Planning for the project is underway. A filter will probably be installed in the roof ventilation in 2018/19. Therefore, a complete closure does not appear to be necessary

### Water Pollution Control

Target	Planned measure	Degree of implementation/date
Optimizing wastewater flows	Separate treatment of sanitation water	Details are currently being coordinated for environmental remediation with the responsible authorities. The concept is still being adjusted as part of this coordination process

## Energy Optimization

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

## Plant Safety

Target	Planned measure	Degree of implementation/date
Adaptation of the requirements to Seveso-III	Public disclosure	Development of a new information concept with flyers, visitor orientations and possibly a website
	Preparation of a new hazardous substances register	Revision of the quantities, incl. new thresholds, acceptance of waste and reporting to the authorities

## Environmental Management System

Target	Planned measure	Degree of implementation/date
Improved organization	Computerized integrated management system First Step: Data and document management	Document management has been developed for Aurubis AG and is currently being implemented at the Lünen site. The data is already being entered into the system in a pilot phase, and employees are being trained comprehensively (about 80–100 users at the site)
	Second Step: Organization and authorization, assumption of business and operator obligations	Currently an extensive training program, which offers an overview of all important legal areas for the operation of facilities and the management of employees, is underway for all employees in positions of responsibility

Key figures for Aurubis AG, Lünen site,  
in the 2016 calendar year

Input	2016	2015
<b>Input or raw materials</b>		
Recycling raw materials	376,891 t	348,403 t
Blister etc.	15,979 t	33,217 t
Copper anodes of other Aurubis sites	6,306 t	6,813 t
<b>Total raw materials</b>	<b>395,100 t</b>	<b>388,433 t</b>
<b>Input material/t Cu cathodes</b>	<b>2.21 t/t Cu</b>	<b>2.09 t/t Cu</b>
<b>Auxiliaries</b>		
Oxygen	40 Mio. m <sup>3</sup>	43 Mio. m <sup>3</sup>
Rhine sand	12,982 t	11,823 t
Limestone	4,579 t	2,949 t
<b>Energy</b>		
External power sources	140,200 MWh	143,789 MWh
Internal power sources	14,855 MWh	17,379 MWh
Natural gas, oil, coal	390,734 MWh	404,317 MWh
<b>Total energy consumption</b>	<b>545,789 MWh</b>	<b>565,485 MWh</b>
<b>Energy consumption/t Cu cathodes</b>	<b>3.05 MWh</b>	<b>3.04 MWh</b>
<b>Water withdrawal/uptake</b>		
Potable water	575,151 m <sup>3</sup>	680,000 m <sup>3</sup>
Precipitation	139,164 m <sup>3</sup>	21,000 m <sup>3</sup>
<b>Total water uptake</b>	<b>756,461 m<sup>3</sup></b>	<b>701,000 m<sup>3</sup></b>
<b>Water consumption/t Cu cathodes</b>	<b>4.22 m<sup>3</sup>/t Cu</b>	<b>3.60 m<sup>3</sup>/t Cu</b>
<b>Area used</b>		
Total plant area		
(incl. south plant entrance)	316,000 m <sup>2</sup>	316,000 m <sup>2</sup>
Buildings and paved areas	247,000 m <sup>2</sup>	247,000 m <sup>2</sup>
	(equivalent to 78%)	(equivalent to 78%)

Output	2016	2015
<b>Products</b>		
Copper cathodes	179,023 t	186,022 t
KRS oxide	21,118 t	21,846 t
Iron silicate sand	136,599 t	157,904 t
Other (tin composite, nickel sulfate, etc.)	25,001 t	13,271 t
<b>Total products</b>	<b>361,741 t</b>	<b>379,043 t</b>
<b>Waste</b>		
Recycling	7,036 t	4,707 t
Disposal	0 t	2 t
Waste/t copper production	39.31 kg/t Cu	25.31 kg/t Cu
Waste/t input material	28.73 kg/t	35.09 kg/t
Construction waste	4,313 t	8,923 t
<b>Total waste</b>	<b>11,350 t</b>	<b>13,632 t</b>
<b>Emissions</b>		
CO <sub>2</sub>	0.97 t/t Cu-Kathoden	0.92 t/t Cu-Kathoden
Dust	131 g/t Cu-Kathoden	124 g/t Cu-Kathoden
SO <sub>2</sub>	4.89 kg/t Cu-Kathoden	4.90 kg/t Cu-Kathoden
NO <sub>x</sub>	1.93 kg/t Cu-Kathoden	1.86 kg/t Cu-Kathoden
<b>Water discharge</b>		
Wastewater (indirect discharge)	78,000 m <sup>3</sup>	69,000 m <sup>3</sup>
Water discharge/t Cu cathodes	0.43 m <sup>3</sup>	0.37 m <sup>3</sup>

## GÜLTIGKEITSERKLÄRUNG

gemäß den Vorgaben der

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

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



Der unterzeichnende Umweltgutachter, Ralph Meß, zugelassen für den Bereich "NACE-Code 24.44" bestätigt, begutachtet zu haben, dass der Standort, wie in der konsolidierten Umwelterklärung der Organisation

**Aurubis AG**  
**Hovestrasse 50**  
**20539 Hamburg**  
**Deutschland**

mit der Registrierungsnummer DE-131-00035 angegeben, alle Anforderungen der Verordnung (EG) Nr. 1221/2009 des Europäischen Parlaments und des Rates vom 25. November 2009 über die freiwillige Teilnahme von Organisationen an einem Gemeinschaftssystem für Umweltmanagement und Umweltbetriebsprüfung (EMAS) erfüllen.

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

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

Hannover, 2017-05-19



Ralph Meß  
Umweltgutachter  
DE-V-0300



# CERTIFICATE



Aurubis AG

Hovestrasse 50  
D-20539 Hamburg

Kupferstrasse 23  
D-44532 Lünen

Registration-No.: DE-131-00035

Date of first registration  
1<sup>st</sup> November 2005

This certificate is valid until  
19<sup>th</sup> May 2020.

This organisation has established an environmental management system according to EU-Regulation Nr. 1221/2009 and EN ISO 14001:2004 section 4, to promote the continual improvement of environmental performance, publishes an environmental statement, has the environmental management system verified and the environmental statement validated by a verifier, is registered under EMAS and is therefore entitled to use the EMAS-Logo.

Hamburg, 1<sup>st</sup> August 2017

HAMBURG CHAMBER OF COMMERCE



  
Tobias Bergmann  
Präses

  
Ulrich Brehmer  
Stv. Hauptgeschäftsführer

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www.aurubis.com

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Jörg Grega  
Andreas Nolte  
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istockphoto.com  
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### Editorial deadline

This report describes calendar year 2015. Current events were included up to the editorial deadline of May 2017.

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

## Your contacts

### Dr. Karin Hinrichs-Petersen

Head of Corporate Environmental Protection  
Phone +49 40 7883-3609  
k.hinrichs-petersen@aurubis.com

### Arne Schilling

Head of Environmental Protection Hamburg  
Phone +49 40 7883-3788  
a.schilling@aurubis.com

### Dr. Hendrik Roth

Head of Environmental Protection Lünen  
Phone +49 2306 108-606  
h.roth@aurubis.com

### Michaela Hessling

Head of Corporate Communication  
Phone +49 40 7883-3053  
m.hessling@aurubis.com

### Kirsten Kück

Head of Sustainability  
Phone +49 40 7883-3270  
k.kueck@aurubis.com



[aurubis.com](http://aurubis.com)

DE\_17/06

## Metals for Progress

Aurubis AG  
Hovestraße 50  
D-20539 Hamburg  
Telefon +49 40 7883-0  
Telefax +49 40 7883-2255  
[info@aurubis.com](mailto:info@aurubis.com)