Cu 150.0

Tradition · Expertise · Innovation

1866–2016 · The History of the Copper Group

150 Aurubis

Years of the Future.

Imprint

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To facilitiate readability of this book, we have dispensed with gender-specific differentiation. Any relevant terms apply to both genders and imply equal treatment.

EN 16/03

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Dear readers,

A Hamburg company celebrates its 150th anniversary. One hundred and fifty years of copper, red gold from Hamburg for Germany, Europe and the world. What began in 1866 as Norddeutsche Affinerie und Aktiengesellschaft is now Aurubis AG and is known all over the world as a leading integrated copper group. It is not without good reason that copper is called “aurum rubrum”, Latin for “red gold”. There is hardly another material that is equally versatile in its applications; it is almost eternal.

Aurubis AG is Europe’s largest copper group and the world’s largest copper recycler. Industries such as the electrical, electronics and chemical industries, suppliers to the renewable energies sector, and the construction and automotive industries all need copper and therefore they need Aurubis, a showcase for our city’s industry.

Whether sustainable pollution control or promotion of culture, whether technological innovation or support for children and young people, Aurubis has been a versatile partner for both Hamburg and the surrounding region on multiple occasions. Today, the Group’s commitment in all matters far exceeds the city’s boundaries and stretches across the world. Its roots, however, will remain here with us, in Hamburg.

The company will continue its impressive success story. Both our city and Aurubis will stay side by side. We extend our congratulations to both Hamburg and the company on our joint anniversaries and wish you, dear readers, a pleasurable journey through 150 eventful years of copper history.

Mayor of the Free and Hanseatic
City of Hamburg

Olaf Scholz

150 years of the future – and often one step ahead!

150 years of Aurubis AG. Who would have dared to hope that a small Hamburg silversmith business would grow to become an international player in the copper industry – acting globally, with about 6,300 employees all over the world? Today, it is not possible to imagine Hamburg, Europe or the wide world of copper without Aurubis. And, least of all, our living environment because copper accompanies us all, every day and everywhere. In our homes, our PCs and tablets, our cars, our workplaces or in elegant design – copper is around us almost everywhere and plays a fundamental role, sometimes invisible yet always connecting.

To mark 150 years of Aurubis AG on April 28, 2016, this exciting history has been written down from its beginnings to this day and looking ahead. Our employees, investors, customers, cooperation partners and anyone else interested can follow our successes and challenges here and can retrace our efforts and solutions. They can do so even beyond the 150 years because our beginnings date back further than our official incorporation in April 1866, even to times before the French Revolution of 1789.

Both the Group and its history will be given a face for you, the readers. Take a look at history and stories, at the company reflected in society, but also behind the scenes. This anniversary publication is not only a journey with us through more than 150 years, it also provides an insight into skilled crafts and workshops, the necessity of continuous innovation, into adjustments and changes of strategies and directions – sometimes determined by Aurubis but occasionally initiated from outside.

The book you are holding in your hands offers two parts with great visual power: a chronological one and a thematic one. We have provided seven chapters with attributes which have accompanied the Group during the course of its historic developments and which characterize it to this day.

"We are experienced and aware of the past. We are international, loyal and innovative. We are sustainable and future-oriented." That is Aurubis.

You can read the first three chapters first to follow the course of time over 150 years. **We are experienced** is the statement at the beginning.

Rightly so, since copper is one of the oldest metals in the world used by man and is synonymous with the company. A history which has been rich in ups and downs, in stunning progress but also in setbacks and even phases of standstill. We have grown from this and have learned from the past to shape the future. **We are aware of the past.** The company faces up to its history, including those times during which Germany committed crimes and Aurubis was part of the country's industrial organization. **We are international** tells of the postwar period and the outstanding development during the subsequent decades leading up to the successful stock market launch and the consequent internationalization. Without these two aspects – that much can honestly be said – the Group would probably no longer exist. Not only were sails set during that time but a new course, too – one which the company follows to this day: reliability in national, regional and global decisions concerning corporate strategy. A corporate management which takes the workforce on board and creates value for both stakeholders and customers of Aurubis AG, which is the basis for the ability to shape the future.

The statement we make in the second part of the book in chapters four to six is: **We are loyal, innovative and sustainable.** Our focus is on people; they are what enable progress. They are the valuable core of Aurubis – the people who work with us and for us. Training, continuing education, health and safety at work are of paramount importance to Aurubis. However, we are characterized not only by technological leadership and the courage to continuously think ahead and implement technological innovation but also by our processes and products, which are often cutting-edge and have in many cases been introduced in pioneering work. Both these aspects, the people and their productive activities,

are consistent with our responsibility toward the enviroment and the climate as well as our commitment to sustainable economic activity in the best ecological, humanitarian and economic sense. These activities result in the company's public perception. It is in these three sections in particular that the book doesn't simply tell the inside story but includes the environment of our corporate activities. That is where obligations arise which Aurubis takes on, such as in our sponsoring projects which foster good relationships with our neighbors; when we enter into a dialogue with the political level or with Europe; when we make commitments to protect the environment; or when we introduce instruments for assessing the integrity of business partners.

At the end there is an outlook: **We are future-oriented.** 150 years of history have now been read, and the last chapter is characterized by our claim that we will continue to shape the future. Copper and its unique properties, a clear understanding of global megatrends which impact our industry as well as the Group's focused strategic alignment all help us demonstrate that Aurubis will often be one step ahead in the future, too.

Dear readers, it is, of course, not possible to present the complete eventful corporate history exhaustively in book form. Yet it helps to enhance the profile of Aurubis AG and to make its traits recognizable, both for the people behind the company and for its many external target groups. A large part of our history has been focused on Hamburg. That is the way our history has happened. Today, Aurubis is several thousand employees richer than a few decades ago and bigger than ever before with sites all over the world. This chronicle will serve to unite them all under one roof and to strenghten our common bond.

Numerous helpers and supporters both from the present and the past of Aurubis have contributed to the success of this book. Valuable archive documents, anecdotes and memorabilia have been gathered and used: photographs dating from the 19th century, original sound recordings from the 1940s, workplace safety posters from the 1960s and advertising material from the 1990s – far more than we were able to to include in this book. The vast amount of material collected shows the extent to which so many people feel special ties to Aurubis, sometimes over several generations and beyond their active working lives, and that they have been happy to contribute to this great anniversary – 150 years of Aurubis.

Our biggest thanks, however, go to our active as well as our former employees. They have made 150 years of Aurubis possible. They are Aurubis.

In this spirit, we look forward to 150 years of the future and hope that all our readers will find this book interesting to read and an enjoyable journey of discovery with copper and Aurubis!

Sincerely,

Aurubis AG

150 Aurubis
Years of the Future.

The history of copper processing

Copper is one of the world's oldest metals. It was already popular when we were still hunters and gatherers: archaeological excavations in western Asia have shown that the metal was used for making coins and ornaments more than 10,000 years ago. There is almost no other material that is so versatile, so topical and offers such a wide range of possible applications.

But where does the copper that we see today come from? Many copper products have already been used in other products before being recycled. The raw material itself can be found in the natural environment in its metallic state, either as small grains, in loose/porous or sheet-type materials, or in compact form. The largest deposits of this kind are found in North America. In Europe, Asia and Africa, however, metallic copper is rarely found in large quantities. The "red gold" is also found in the form of ores, which are still vital for copper extraction today. These occur as crystalline minerals which are found in rocks as veins of ore and have to be extracted at considerable cost. However, they can be found worldwide, for example in Eastern and Central Europe but also in Asia, the Caucasus and, in particular, in South Africa.[1]

The era between 5,000 and 3,000 B.C. is referred to as the Copper Age. During this period, ancient cultures learned how to extract copper and to use it for making various objects. These skills were honed during the succeeding Bronze Age, and from about 2,500 B.C. onward, copper was converted to a bronze alloy using other minerals. What made this new material unique was its greatly increased durability.

Copper was not only practical, valuable and beautiful but also vital to human health: The Egyptians, for example, used bronze for fighting infections as well as for killing germs in water. This knowledge is still used today. The major consumer of copper, however, was the Roman Empire, which usually defeated its enemies with its sturdy bronze weapons. Equipped with bronze swords and shields, the Roman army succeeded in bringing half of Europe under its control. The copper used by the Romans came from Cyprus and was also much sought-after by the Greeks and Phoenicians. This Roman connection gave the metal its Latin name cuprum, derived from aes cyprium, which means "ore from the island of Cyprus". Yet copper was not only processed in Europe. The Mayans, Aztecs and Inca in South America used the precious material, for example in a gold and copper alloy for making ritual knives.

The use of copper in Europe declined somewhat during the Middle Ages, while it flourished in China, India and Japan. During this period and extending into the modern age, copper ores were arduously extracted underground. It was not until the second half of the 19th century that surface mining on copper ore deposits developed. In solid ground, miners were equipped with hammers and picks. These tools were used to break the copper out of the rock, a strenuous task, which led to the creation of entire galleries and pits. An alternative mining method which was not without danger was called fire driving. The copper-bearing rock was heated by fire and then cooled down, causing fissures and cracks within the rock from which the pieces of copper either dropped out by themselves or were hewn out with appropriate tools. This only changed with the emergence of one of the most significant advances in copper extraction: the invention of blasting. This has been complemented in recent years by the use of jackhammers and rock drills, which has led to further increases in efficiency.

However, the more demanding step in terms of technology was the subsequent production of copper by smelting, which required multiple complex processes. The initially extracted copper matte was processed in several stages using the roasting and reduction method. This entailed either roasting sulfurous copper ores (with the oxide thus obtained being reduced to metal) or only part of the copper sulfide being converted to oxide and then reacting with the remaining copper sulfide in a second processing stage, precipitating copper metal.[2] Any remaining impurities were then removed in kilns and reverberatory furnaces. At first, this was a cumbersome process and its result was not really pure. But

because the furnaces in particular were subject to continuous technical improvement, it became possible to produce purer copper using only a few steps. Besides these “dry” treatments, some “wet” methods were introduced, mainly based on sulfuric acid. During the last quarter of the 19th century, electrolysis added a previously unknown level of purity to copper production.

However, the practical application of this method was only enabled by the invention of an efficient power generator and by brilliant German chemist Dr. Emil Wohlwill, who worked for Norddeutsche Affinerie. During the ensuing period, the copper electrolysis method he developed conquered copper smelting plants across the world.[3]

Discoveries relating to electricity and magnetism brought about new applications and a rising consumption of copper and bronze in Europe. With the Industrial Revolution, the importance of copper increased enormously.

Today, copper is one of the major industrial metals and it is impossible to imagine everyday life without it. Its composition means it is tough yet easy to shape. It is an excellent conductor of both heat and electricity and belongs to the group of mintage metals.

Although man has known about copper and used its different alloys for several thousand years, there are still innovative ways of using it waiting to be discovered. Copper has been accompanying mankind for a long time and will continue to do so in the future.

We are experienced

From the small Beit'sche Gold- und Silberscheideanstalt (Beit's Gold and Silver Separating Works) to Norddeutsche Affinerie to the present group of companies: Today the Hamburg plant on Peute Island is the largest production site and the corporate headquarters of Aurubis AG.

From the Beit silver smelting plant to Norddeutsche Affinerie

Aurubis. Today, we are one of the world's largest producers of copper cathodes and semifinished copper products and the largest copper recycler in the world. With more than 6,300 people on its payroll and multibillion revenues, Aurubis is an industrial giant. Yet it wasn't that long ago that employees, the industry and, last but not least, Hamburg's citizens knew "their" global market leader under the name of *Norddeutsche Affinerie AG* (NA).[1]

This is the name the company traded under for 143 years – until 2009. Even when it was established in 1866, the company was able to look back on an impressive tradition. Its immediate predecessor in the middle of the 19th century had been *Elbhütten-Affinir- und Handelsgesellschaft,* a merger of two existing companies in 1856: *Elbkupferwerk* (Elbe Copper Plant), founded in 1846, and the far older silver smelting plant and gold and silver refinery owned by the Beit family of entrepreneurs. It is worth taking a closer look at the history of the Beit gold and silver refinery because the first documents that mention enterprises in Hamburg which are considered to be predecessors of Aurubis can be found as early as the second half of the 18th century.

Silver – The Beit family business at the company's nucleus

The first record mentioning the name of Beit within the context of metal smelting dates from 1770. On September 26 of that year, the Senate of Hamburg granted permission to 35-year-old Marcus Salomon Beit to operate a "silver separating and smelting furnace."[2] This was the prerequisite for establishing a parting workshop for precious metals, namely silver and gold. Initially, its principal client was the Hamburger Bank.[3] At that time, there were too many different types of coins with varying exchange rates in circulation within the Hanseatic City, which was an impediment to trade. In 1770, the Hamburger Bank introduced a silver-based currency as a test and in the same year Marcus Salomon Beit was tasked with carrying out any incidental smelting and separating work.[4]

So, against the backdrop of this currency reform, he began to smelt silver-bearing metals – initially old coins – to obtain purer silver in bullion form during the subsequent separating process, which he then handed over to the bank. Some gold was accumulated in addition.

After the Senate had finally enforced the use of silver as sole currency in Hamburg 20 years later, in 1790, the Hanseatic City became the center of the European silver trade.[5] Besides the new silver currency, one significant factor that contributed to Hamburg's rise was the fact

Coins within the financial system

Right into the 19th century, numerous towns and cities in Germany as well as the individual kingdoms, duchies and principalities minted their own coins. In a center of trade such as Hamburg, a wide variety of coins accumulated, which was a time-consuming nuisance for merchants. This was why the Hamburger Bank introduced the banco-mark as the standard unit of account as early as the 17th century. This was, however, purely check money which was only used for non-cash transactions. Despite this, it was defined in so-called "species-reichsthaler". Since this thaler lost more and more of its pure silver content over time, the banco-mark also suffered an increasing loss in value. In 1770, therefore, the *Norddeutsche Bank* broke away from the nominal value of the coins when evaluating the banco-mark and henceforth defined it in accordance with the weight of unminted pure silver.[1]

that Amsterdam – hitherto an important center for the precious metal trade – was occupied by French troops in 1795 during the French Revolution. Within a few years, the Beit family was to profit from this, most notably the gold and silver separators Marcus Salomon and his younger brother Raphael Salomon, who had joined this business division around 1790, as well as Leffmann Salomon, another brother who took care of the trade in precious metals on his own.[6]

Marcus Salomon Beit was born in 1734, the son of wealthy Jewish draper Salomon Isaac Beit.[7] His family was of Portuguese-Dutch descent and had probably arrived in Hamburg via Dutch seaports after the expulsion of the Jews from the Iberian Peninsula at the end of the 15th century. Neither Marcus Salomon nor his two brothers joined the drapery business of their father, who died in 1772. It was presumably taken over by their eldest brother Isaac, which meant that the only thing left to do for Marcus Salomon, Raphael Salomon and Leffmann Salomon was to reorient their careers. It was smart of them to look for something new for themselves in the "financial business" at a time when Hamburg had converted to the new silver-based currency.

September 26, 1770

Marcus Salomon Beit is granted permission to operate a "silver separating and smelting furnace" at 1 Elbstrasse, thus establishing the first precursor of NA.

1770

Hamburger Bank introduces a trial silver currency and becomes Beit's principal customer.

1787

Marcus Salomon now runs the business with his brother Raphael Salomon Beit under the name of "Gold and Silver Separators".

1789

Beginning of the French Revolution. From 1806 onward, French troops occupy Hamburg, which leads to a temporary blocking of Beit's smelter.

1790

Hamburg ultimately introduces the silver currency and the city becomes the center of the European silver trade, which greatly benefits the Beit family business.

1824

Raphael Salomon Beit introduces gold and silver separation by "wet process" with the help of sulfuric acid. The new process is called "refining".

1826

The sons of Raphael Salomon Beit, John Raphael and Lipmann Raphael, have been running the business for two years. They rename it *Beit, J. R. u. L. R., Gold- und Silberaffinierer.*

1842

Hamburg experiences a great fire. Large parts of the town center are destroyed. This results in new rules laying down that non-combustible materials must be used for roofing, including copper.

In addition, Marcus Salomon Beit was in charge of poor relief and tax estimates and was thus a respected member of the Jewish community in Hamburg. And, like his younger brother Raphael Salomon, who was born in 1742 and later joined the company, he was a member of the "Hamburg Patriotic Society of 1765". This allows an insight into both Marcus Salomon's attitude and the way he saw himself, as the "Society" felt an unselfish commitment to the common good and was considered to be particularly enlightened.[8]

Marcus Salomon Beit's smelter was situated at 1 Elbstrasse (now called Neanderstrasse), within the catchment area of St. Michaelis Church, roughly halfway between the Millerntor and the "Michel", as the citizens of Hamburg call their principal parish church. Today, it is intersected by the multi-lane Ludwig-Erhard-Strasse.[9] In those days, private lodgings and craftsmen's businesses in this district were next door to one another – with all the problems arising from such close proximity, such as cramped conditions and dirt.

Competitors also established themselves in the immediate vicinity, at Neuer Steinweg where the business of *Heymann, Abr. Jonas, Gold Refiners* was based from 1792 onward.[10] In 1834, the company changed its name to *Jonas H. A., Söhne & Co, Gold- und Silberaffinerie*.[11] It was acquired by its much larger competitor NA in 1873, at a time when that company had not been established very long.

The Patriotische Gesellschaft (Patriotic Society)

On April 11, 1765, the Patriotische Gesellschaft in Hamburg was founded under the title "Hamburgische Gesellschaft zur Beförderung der Künste und nützlichen Gewerbe" (Hamburg Society for the Advancement of the Arts and Useful Trades). The term "patriotic" had a different meaning then and described the idea behind the Patriotische Gesellschaft quite aptly: to serve their home country. The society took on a leading role in some unusual urban development projects, such as the introduction of potato growing and lightning rods. More significant, however, is the fact that it was instrumental in founding the first European savings bank in Hamburg in 1778 as well as poor relief agencies, a labor exchange for longshoremen, numerous museums, schools and colleges.[2] The Patriotische Gesellschaft celebrated its 250-year anniversary in 2015.

Hustle and bustle on Elbstrasse in the 19th century when manufacturing and living quarters were close together. The background shows the tower of St. Michaelis Church with its copper roof.

For quite a long time, the Beit family operated their smelter at rented premises at no. 43, 1 Elbstrasse. In those days, it was very difficult for Jews to acquire property within the town and this was usually only possible with the Senate's permission.[12] After renting for 25 years, the Beits endeavored to formally buy the property and succeeded in July 1795.[13] Marcus Salomon also moved his private residence to the Elbstrasse premises sometime between 1784 and 1790 and his brother Raphael lived there at least from 1787 onward.[14] Although street numbers changed, this address was to be the family's private residence as well as the company head office for many years to come.

Few records relating to the early years after the Senate's first permission to operate a smelter in 1770 have survived. It seems to be certain, however, that Marcus Salomon operated his smelting furnace on a permanent basis before July 14, 1783, because a fire broke out at his smelter shortly before this date. On July 14, 1783, the damage was inspected by two "parish masters" who were carrying out building inspections in their respective church parishes at the time.[15] Marcus Salomon had

The courtyard of the plant at Elbstrasse with the gateway from Elbstrasse. On the left, the shaft furnace building with slag ladles and workers in the front.

Wet chemical workshops at the vitriol smelter at Elbstrasse. This was the location where copper vitriol was produced. The foreground of the photo shows crystallization tanks hung with lead bars. Evaporating pans are standing on the platform in the background.

been storing peat on a loft above the furnace and the peat had caught fire. There was obviously a kind of night shift already operating at the smelter, as the men talked Beit out of this after the incident. The episode shows that the business was already working to capacity at the time.

Refining – The Beit business after the introduction of wet refining of precious metals

Following Marcus Salomon Beit's death in 1810, his brother Raphael Salomon, who had been a partner since at least 1790, continued the business on his own.[16] He died on December 18, 1824 and his sons John Raphael and Lipmann Raphael took over the management.[17] Shortly before that, Raphael had fundamentally altered the process used in separating silver at his company, switching from a dry process "to separating in a wet manner with the help of sulfuric acid".[18]

There were several methods used in the dry separation of precious metals.[19] Sulfur was added to the raw material inside the furnace in order to set the separating process in motion. Chlorine was used, too. There was the casting method and the flux method and cementation. In addition, a wet separation method based on nitric acid was already being used. All of these variants were effective methods of gaining relatively pure silver, however, they were not suitable for producing gold of sufficient purity, let alone pure gold. It is not known today how accurately silver was separated at the Beit plant prior to 1824. It is, however, very likely that the concentrations of gold accumulated as a by-product did not amount to any significant business.

Workshop with coke-fired crucible furnace for melting precious metals at the Elbstrasse plant.

The new wet method – called "refining" – was a great step forward for the company. The molten precious metal alloys were boiled with concentrated sulfuric acid, a process which was not only simpler but also cheaper and, above all, more effective. Fine silver became even purer and it was now possible to obtain sufficiently pure gold from almost any silver coins minted up to about 1830.[20] Wet refining was not invented by Raphael Salomon Beit. French silver separator Jean Pierre Joseph D'Arcet had already used sulfuric acid for boiling as early as 1802. The German term "affinieren" may be derived from the French "affiner", i.e. to spruce up. Hence, "a refinery is, generally speaking, a smelter for sprucing up metals".[21]

Although the wet refining method was further optimized by Raphael's sons in the decades that followed,[22] the technical "leap" made in 1824 remained the guidepost for the company's economic importance. For the first time, it was now possible to recover even the smallest amounts of gold from silver-bearing intermediate products, which increased the reputation of the Beit separating workshop in the Hanseatic City considerably.[23] Beit was now able to supply purer silver and pure gold. The new refining method was so successful that the new generation of Beits renamed their business in 1825/26 after the new technology (roughly a year after its introduction). They now called themselves *Gold- und Silberaffinierer* (Gold and Silver Refiners).[24]

The Beit product range expanded noticeably during the subsequent years. Besides gold-bearing and silver-bearing alloys, they also processed other alloys containing copper and lead.[25] The quantities and types of metal processed at the plant increased continuously. The versatile new separating process resulted in an increase in the by-products accumulated: copper vitriol (chalcanthite), iron vitriol (melanterite) and so-called "Salzburg vitriol", a mixture of the first two. All of these substances quickly attracted interest. Hamburg, as the center of European silver trading in the first half of the 19th century, benefited from the good reputation of Beit's products. More and more of the continent's silver orders were executed in the Hanseatic City – or, more precisely, via the Hamburger Bank as trader – and they expressly stipulated fine silver produced by Beit. The beginnings of the company's independent trade relations with remote nations such as Russia also originated in this period. The company took another logical step by supplementing its supply of raw materials with silver ore. It arranged for the ore to be smelted at a branch at Bernhardstrasse (today called Bernhard-Nocht-Strasse) above St. Pauli Harbor.

The parent plant had originally been situated on the outskirts of the city, but Hamburg experienced an undreamed-of expansion during the 19th century and was soon spreading beyond the old city walls. The share of residential housing within the area of the parting workshop which had formerly been a mixed use area had increased, leading to problems which from today's viewpoint could be described as early environmental problems. Complaints about nuisances caused by the plant were rising and were to be an almost constant

companion from this time on. After the great fire in 1842, the local authorities stipulated some protective building constraints such as the erection of a formidable smokestack of 30 m height which towered over the quarter. The potential of the plant was further expanded by modifications and reconstruction measures which included the furnaces in 1847. The production facility had long developed into a "combined copper-lead-precious metals smelting plant" and became more and more varied in its activities.[26] Thus, the foundation for the liberation from its dependence on the Hamburger Bank was laid. This bank – more or less Beit's only customer – had been the only buyer of its silver for decades. This period also saw the last renaming of the old Beit company before it merged into NA: *L. R. Beit* (later L. R. Beit & Co.), Gold- und Silberaffinerie.[27]

Copper – A new plant at Steinwerder

"Metals deserve every attention (...) we will do brilliant business with them", wrote Hamburg shipowner Johann Cesar Godeffroy IV in a letter to Chile in 1845.[28] He was expressly referring to copper. The importance of the red metal did in fact increase enormously with the progress of industrialization during the 19th century.

There were hardly any other people in Hamburg more capable of recognizing the triumphant success copper

Copper as the motor of industrialization in the 19th century

Industrialization in England began with the steam engine. Coal was produced in large quantities, which facilitated early industrial mass production. By the middle of the 19th century, the changes in Hamburg were also unmistakable. Technical facilities were becoming increasingly larger and they required components made of copper. Piping, for example, but also boilers and parts of machine tools were made of the red metal. Ever larger quantities of copper were now being used for producing sheet metal and no longer mainly as a component of bronze for bells, guns and coins.[3]

1843

The company name is changed again to "L. R. Beit, Gold- und Silberaffinerie". Due to the new metal refining process, the plant turned into a "combined copper-lead-precious metals smelting plant".

1846

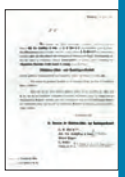
Lipmann Raphael Beit and Hamburg shipowner Johann Cesar Godeffroy, together with merchant Siegmund Robinow, establish *Elbkupferwerk* on the island of Steinwerder in the Elbe River to process copper ores from overseas.

1846

Lipmann Raphael Beit makes his nephew Dr. Ferdinand Beit and Ferdinand's brother Siegfried partners in L. R. Beit & Co.

1850

Between 1850 and 1939, approximately 5 million people emigrate via Hamburg to the New World. In 1901, Hamburg shipowner Albert Ballin builds mass accommodation for people waiting to emigrate on the island of Veddel, which can be viewed today as part of the BallinStadt adventure museum.



1857

Founding of Elbhütten-Affinir- und Handelsgesellschaft as a successor of Elbkupferwerk.

1859

As a result of an economic crisis starting in 1857 and declining ore supplies, the Steinwerder plant is forced to close down.

April 28, 1866

Founding of Norddeutsche Affinerie AG with Dr. Ferdinand Beit as chairman.

1870–71

Franco-German War.

would be than the Beits. They had, after all, accumulated more than seven decades of experience in processing metals, including their first copper products. They were sure to have anticipated the excellent business opportunities offered by the rising demand for copper.

Since 1843, Lipmann Raphael Beit had initially been the sole owner of the refinery at Elbstrasse, before taking in Dr. Ferdinand Beit, his nephew, as partner. In 1846, the two of them together with Godeffroy and the trading firm *M. Robinow & Söhne* established the Elbkupferwerk on the island of Steinwerder in the Elbe River. Its purpose was to process copper ore mainly from South America, later also from Australia, Sweden and Central America.[29] Some ore (albeit in relatively modest quantities) was obtained from the German regions of Hesse and Nassau, where the Beit Company owned some smaller mines at the time. Sourcing the ore solely from German or European ore mines would hardly have been possible at that time. The output was already allotted to other companies and there was no way of increasing it in any substantial way. The English mines, for example, were already exhausted before the middle of the 19th century. One strategic idea, however, brought the solution to the problem of supplying the large smelting works with sufficient amounts of copper ore. The overseas contacts of Mr. Godeffroy, the shipowner, were utilized for this purpose.

He and his company were the link between the establishment of the Elbkupferwerk copper mill and the advancement of shipping in Hamburg.[30] *Joh. Cesar Godeffroy & Sohn* – the company had been founded by his grandfather in 1766 – traded in overseas settlements for emigrants, initially mainly at the South American west coast, and offered boat tickets to people wishing to emigrate overseas. On their return voyages, the load capacities of these ships were hardly used, so it seemed obvious to use them for shipping ore to Europe. During the 1840s, the only noteworthy overseas extraction of copper ore was in Chile. Between 1847 and 1854, around 10,000 t of ore and unwrought copper were shipped to Hamburg by Godeffroy & Sohn from the Chilean port of Valparaiso.[31] Shipments from Australia were added beginning in 1851. It probably occurred to Johann Cesar Godeffroy from his business dealings with the Beits that metals – and particularly copper – would be a worthwhile investment because the Beits had acquired shares in his shipyard and engineering works, *Reiherstieg Schiffswerft und Maschinenfabrik*, only a few years before the founding of the Elbkupferwerk copper mill.

The mother of Siegmund Robinow, one of the founders of the Elbkupferwerk, hailed from the Beit family.[32] Through her son, the family line of founder Marcus Salomon Beit returned to the company again. Robinow traveled extensively on behalf of the company during its initial phase. He not only inspected the ore mines acquired both in Hesse and at Dillenburg, Nassau but also went to Swansea in Britain in 1849 to visit some large and already established copper smelters.[33] Therefore, it seems that when the Hamburg copper mill was set up, it was based on models from elsewhere.

In August 1854, Siegmund Robinow left the company as partner. He was replaced a short while later by Robert Kayser. However, Robinow was to return to the Elbkupferwerk indirectly from 1856 to 1857 when he became the authorized representative of Johann Cesar Godeffroy (who had fallen ill) at Godeffroy & Sohn.[34]

In 1846, Elbkupferwerk, which processed ores from overseas, was established on Steinwerder Island in the Elbe River. (Illustration by Chr. Timmermann, 1856)

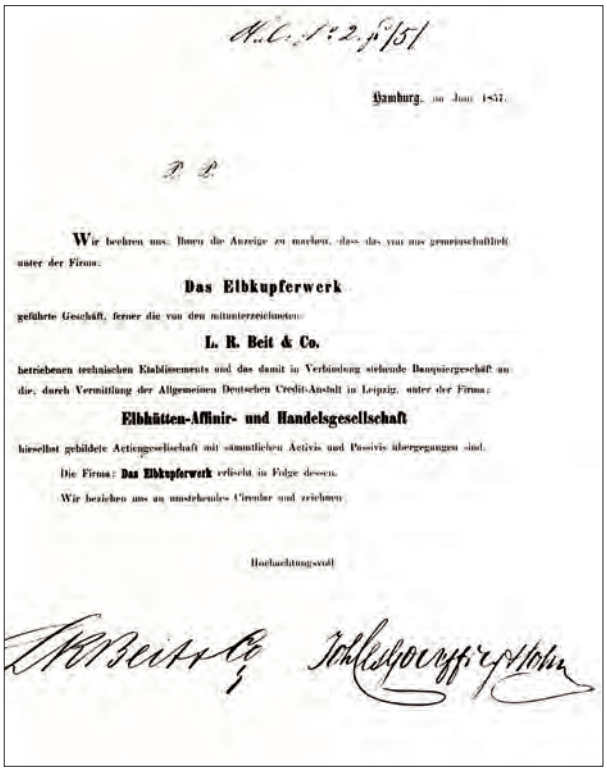
The island of Steinwerder in the Elbe River, which today is diked and connected to the mainland, was originally called Nordersand. It was only after the great fire in Hamburg in 1842 that it became commonly known as Steinwerder because large quantities of stone rubble from the town were deposited there, which formed the foundation of the Elbkupferwerk. The island situated south of the Elbe River was only sparsely populated. The Hamburg Senate had already envisaged it as a future industrial location and incorporated it as part of the city in 1894. There is nothing left to see of the old Elbkupferwerk today. Two striking new musical theaters have been built directly east of its former site, opposite the St. Pauli landing stages. It is likely that choosing Nordersand/Steinwerder as the location of their new plant was a joint decision by the Beits and shipowner Godeffroy at the time. After all, the island which consisted mainly of wasteland was located opposite their shipyard at Reiherstieg, the canal separating Steinwerder from the Kleiner Grasbrook. It was the perfect choice from a logistical standpoint.[35]

In 1846, L. R. Beit & Co. leased three lots of land of about 5,000 m² each on the northern shore of the island; another lot of the same size followed a year later.[36] The lease contracts were for an initial period of 25 years. Right from the start, the factory inspectorate laid down precise constraints for the new plant.[37] It stipulated that only arsenic-free ore was to be smelted and that complaints about major nuisances coming from neighbors must be taken seriously. Failure to comply with these rules could result in license withdrawal. This means that environmental problems were already debated in the middle of the 19th century, without a doubt also motivated by the experiences with the Beit plant at Elbstrasse. Approval was granted for buildings and facilities for technical operations such as a smelter, an ore stockpile, a forge, an administrative office, a steam engine, landing stages on the water and buildings for workers' accom-

Detail from a site plan from 1855: The Elbkupferwerk plant is located opposite the present landing stages on the southern bank of the Elbe River. Today, the musical theaters in the harbor are situated approximately at this spot. Some parts of the buildings of the first plant at Elbstrasse are recognizable at the upper edge of the plan, near St. Michaelis Church and bordering on Mühlenstrasse.

modation. The buildings were erected in half-timber construction wherever possible and work was carried out speedily.

Even after the commissioning of the Elbkupferwerk copper mill, work at the Beit parent company continued at two locations: the separating workshop at Elbstrasse and the plant at Bernhardstrasse in the St. Pauli district, where small quantities of silver ore were smelted.[38] Sadly, very few details are known today about this plant near the port. All that is known is that a pilot furnace was installed there which was used to gain some experience in smelting copper ore before the Elbkupferwerk was established and that the plant closed down in 1859 when the new Steinwerder plant with its facilities for silver ore smelting was able to take over its production as well.[39] The proprietors of L. R. Beit divided their tasks between them: Lipmann Raphael Beit took care of the traditional workshops, while his nephew, Dr. Ferdinand Beit, took over the technical administration of the Elbkupferwerk copper mill from its beginnings in 1846.



Hamburg, im Juni 1857.

Wir beehren uns, Ihnen die Anzeige zu machen, dass das von uns gemeinschaftlich unter der Firma:

Das Elbkupferwerk

geführte Geschäft, ferner die von den mitunterzeichneten:

L. R. Beit & Co.

betriebenen technischen Etablissements und das damit in Verbindung stehende Banquiergeschäft an die, durch Vermittlung der Allgemeinen Deutschen Credit-Anstalt in Leipzig, unter der Firma:

Elbhütten-Affinir- und Handelsgesellschaft

hieselbst gebildete Actiengesellschaft mit sämmtlichen Activis und Passivis übergegangen sind.

Die Firma: **Das Elbkupferwerk** erlischt in Folge dessen.

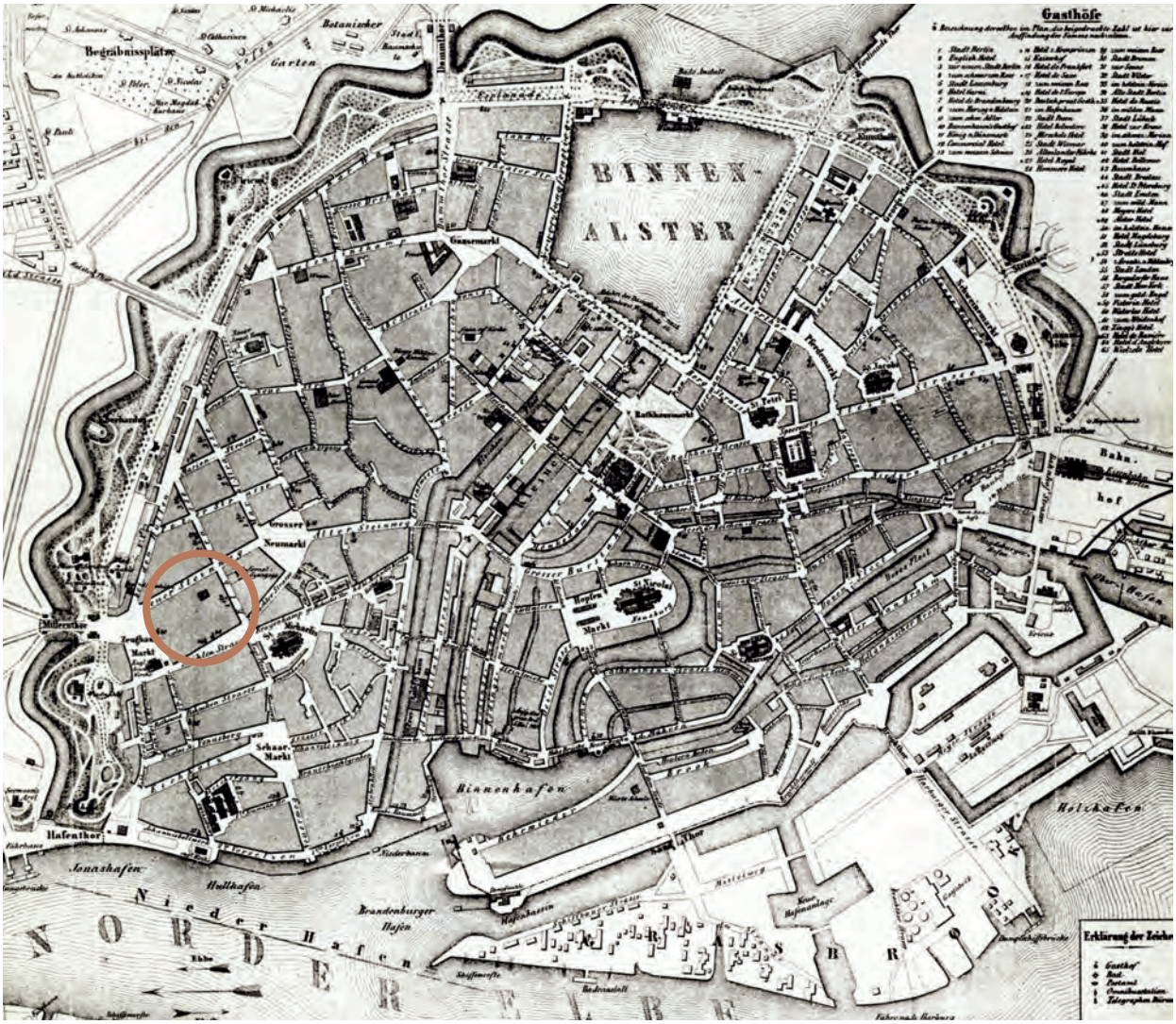
Wir beziehen uns an umstehendes Circular und zeichnen

Hochachtungsvoll

Announcement of merger. In June 1857, the Elbkupferwerk plant on Steinwerder and L. R. Beit & Co. at Elbstrasse merged to form Elbhütten-Affinir- und Handelsgesellschaft.

Even during its first few years of operation, the quality of the overseas copper produced under the brand name of "E. K. W." (Elbkupferwerk) enjoyed an excellent reputation.[40] However, the economic success of this relatively large plant was linked to the long-term supply of ore, copper-bearing intermediate products and unwrought copper delivered by sea. Doubts regarding this were raised as early as the beginning of the 1850s, causing the operators of the plant to supplement its supply with copper-bearing silver ore. Up to that time, large-scale smelting of this ore had not been possible in Hamburg. However, the Steinwerder plant now offered ideal conditions for this, although considerable amounts of money needed to be invested.

Admittedly, one characteristic of silver ore is its heavy accumulation of arsenic, and the terms of the license granted in early 1847 did not permit the processing of that type of material. A new license was required, but the authorities protracted their approval from the end of 1853 to the end of 1856: Numerous expert opinions were invited and all kinds of structural alterations for the protection of health and the environment in the neighborhood had to be agreed on.[41] This had become necessary because in the meantime – and contrary to the original intentions of the city's administration – Steinwerder was on its way to becoming a mixed development area, a quarter with residential buildings including businesses and a school. The major constraints imposed in 1856 required that no ore containing more than 5 % arsenic was to be processed; that the silver smelter at Bernhardstrasse had to be closed down; and that a smokestack 85 m high would have to be built, which would tower over the port area. This tower, which was the highest of its kind in Germany, turned into something of an attraction. It could be viewed and climbed and even had a gallery below its top for this purpose. Since the original lease agreement for Steinwerder would have expired in 1871, the proprietors insisted on an extension to a term of 99 years.[42] However, the investment costs of 200,000 banco-marks



Town map of Hamburg around the middle of the 19th century. The Beit parent company, L. R. Beit & Co., was situated between Zeughausmarkt, Elbstrasse and Neuer Steinweg (see mark).

were too high to be paid out of the capital held by Elbkupferwerk.[43] The solution was its conversion into an incorporated company: In 1856/57, Elbkupferwerk merged into a new company called Elbhütten-Affinir- und Handelsgesellschaft.[44] The two companies L. R. Beit and Joh. Ces. Godeffroy & Sohn contributed a quarter each to the capitalization amounting to a tidy three million banco-marks, with the remaining half borne by the *Allgemeine Deutsche Credit-Anstalt* in Leipzig, which provided the financing.[45]

Around 1860, Ferdinand Beit was technical director at the Steinwerder plant, which was equipped with state-of-the-art facilities: 15 reverberatory furnaces with 5 t capacity each, 3 shaft furnaces, 5 double roasting furnaces, each with 5 t capacity, a refining furnace, a rolling mill, mills and steam engines. Their annual output was around 3,000 t of copper products, which were then put into different forms for further processing. This may not sound like much from today's viewpoint, but at that time the entire remaining output in Germany was only approximately 2,500 t.

Copper tankhouse cells at Elbstrasse.

Was this project too ambitious and were the hopes resting on Hamburg as an important transshipment center for ore exaggerated? The development of Elbhütten-Gesellschaft suggests that opportunities were overestimated. The initially enthusiastic expectations regarding the supply of raw materials from overseas and the irresistible upward spiral of the sales markets were gradually disappointed.[46] The number of people emigrating – and with it the lucrative business with return freights of ore – declined in the middle of the 1850s. The end of the Crimean War (1853–1856) also ended the bulk of speculation in the metal market. The great crisis came about during the founding year of Elbhütten-Gesellschaft in 1857 – and it also hit Godeffroy & Sohn hard. After losing parts of their fleet, they only narrowly escaped bankruptcy. The key stockholder of Elbhütten-Gesellschaft was forced to radically rebuild its trade relations, which greatly limited the dealings with Chile and Australia. Supplies of ore for Hamburg were becoming scarce. During the fiscal year 1864/65, it was no longer sustainable for the company as a whole (which also included the Beit precious metal refinery at Elbstrasse) to operate the large, modern facilities at low capacity, and production at Steinwerder had to close down. Although Elbhütten-Affinir- und Handelsgesellschaft was not formally liquidated until 1884, its tall smokestack, the new landmark at Hamburg's port, only emitted smoke for a very short period.

1866 – The founding of Norddeutsche Affinerie

On April 28, 1866, Dr. Ferdinand Beit, together with two other gentlemen, Louis Maas and Ferdinand Jacobson, appeared before the Hamburg Commercial Court. They declared before the judge that they had founded an incorporated company under the name of Norddeutsche Affinerie.[47]

At a prior meeting, a founding committee had appointed an initial board of administration from its ranks for a period of five years. The members of this board were Dr. Ferdinand Beit, the head of L. R. Beit; Louis Maas, director of Norddeutsche Bank; the merchants Ferdinand Jacobson and George F. Gorrissen; and K. Friedrich L. Westenholz, then consul general of the Austro-Hungarian Monarchy in Hamburg. The modern equivalent of this body would be the Executive Board. The company's day-to-day business was conducted by the directors. Ferdinand Beit became the first chairman of the board of administration. After his death, he was replaced by K. Friedrich L. Westenholz, who held the post until 1898. The first thing the founders (who were simultaneously the stockholders) effected was the acquisition of Gold- und Silberaffinerie L. R. Beit at Elbstrasse.[48]

Together with Norddeutsche Bank Hamburg, they had been preparing the founding of NA throughout the spring of 1866. This had become necessary as a result of the Steinwerder copper mill closing down. The prospects of the Beit parent company at Elbstrasse with its special wet refining method were just too good for it to con-

tinue to be part of the stricken Elbhütten-Affinir- und Handelsgesellschaft. Although conditions there were cramped, the facilities "quite worn out" and the "buildings all in all old and dilapidated",[49] its independence or integration into a new company seemed worthwhile.

The company's seed capital of 550,000 banco-marks was exactly the same as the purchase price paid for the Beit refinery, with Norddeutsche Bank contributing three quarters. The bank's commitment can be explained by the close ties its management had with Elbhütten-Affinir- und Handelsgesellschaft. The same men who ran the business there assembled here: Gustav Godeffroy as the bank's chairman of the board and Johann Cesar Godeffroy and Robert Kayser as the bank's co-founders, together with Ferdinand Beit, were members of the board of administration. All this meant that they knew the Beit plant and its long tradition very well. On March 10, the bank's management ordered some final expert opinions on the actual value of L. R. Beit. When these turned out to be positive, the founding of NA was decided on April 4, 1866.

New coins, electricity and Peute – Milestones of Norddeutsche Affinerie up to the 20th century

During its first five years, things at NA went smoothly, despite the fact that the co-founder Ferdinand Beit died on April 1, 1870. His passing marked the departure of the last member of the family dynasty which had been the company's nucleus and which had adapted the business to new conditions and progress over many decades. The political changes during these years, however, created the foundations which were to lead to a rapid upturn of the young company.

After the German Empire was established in 1871, the new Berlin government set to work to create a new currency unit. A variety of currencies and coin shapes still existed side by side within the patchwork of individual German states. The mark finally became the new nationwide currency unit in 1873. During this year, NA

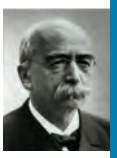
Aurubis and world events

1871

Founding of the German Reich.

1873

The mark becomes the standard currency of the German Empire. NA is commissioned to melt and refine almost all of the thaler coins that had been issued up to 1856.



1876

Dr. Emil Wohlwill, the company's chief chemical engineer, invents the first fully continuous copper electrolysis system.

1892

Cholera epidemic in Hamburg lasting over 10 weeks. During the late summer nearly 9,000 people die as a result of contaminated drinking water and unhygienic, cramped living conditions in neighborhoods such as Gängeviertel.

1901

The smokestack of the former Elbhüttenwerk just before being blasted on December 29, 1901. The smokestack had been built at the instigation of the municipal authorities after the great fire in 1842. Its purpose was not only fire prevention but also the protection of the environment and public health.

1908

Start of NA relocation to Peute Island in the Elbe River. The new tankhouse starts operating here as early as 1910.

1909

Due to lack of space at Elbstrasse, NA moves to Peute in the Elbe River, complete with all its existing plants.

1913

The relocation of all plants to Peute Island has been completed. The old parent plant of the Beits at Elbstrasse is subsequently torn down.

The workforce of NA in the yard of the Elbstrasse plant in 1887. In this year, approximately 200 employees produced almost 2,000 t of electrolytic copper.

managed to secure an agreement with the Chancellor's Office about the smelting and refining of almost all thaler coins that had been issued up to 1856.[50]

This was a volume hitherto unparalleled in this line of business. Net profits earned by NA quintupled between 1871 and 1874,[51] much to the delight of stockholders, whose dividends more than quadrupled. On the other hand, production was bursting at the seams and it became essential to expand the site and modernize facilities at the Elbstrasse plant. To this end, the joint stock had to be doubled in volume in 1878 to amount to 1,650,000 marks.[52] The large-scale smelting of coins also meant that new buyers for the resulting silver products needed to be found. The search succeeded not only in Germany but also abroad, particularly in St. Petersburg. In the course of its search, the Affinerie also came into contact with transregional competition: not least with *Deutsche Gold- und Silberscheideanstalt vormals Rössler* in Frankfurt. Decades later, this contact was to prove decisive for the company's history.

However, the greatest change in the technical development of NA to this day was the pioneering work done by Dr. Emil Wohlwill: the introduction of electrolytic copper production in 1876. NA was the first company to market chemically pure electrolytic copper on a large scale. Apart from a brief interruption around 1900, it was a world

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Norddeutsche Affinerie

Goldene Medaille. Paris 1881.

in Hamburg.

Goldene Medaille. Hamburg 1889.

Gold- und **Silber-Scheidung**

Silbererz-Schmelze.

Einkauf und Verarbeitung

von gold- und silberhaltigen Produkten und Gekrätzen

sowie von

gold- und silberhaltigen Kupfer-Barren, Regulus etc.

Fabrikmässige Herstellung

von

elektrolytischem Kupfer, Silber und Gold, Kupfer- und anderen Vitriolen, Hartblei, Bleiglätte, Platinpräparaten, Wismuth u. s. w.

Verkauf

von

feinem Scheidegold und Scheidesilber

sowie

Silber-Legirungen.

Advertisement in the magazine "Hamburg's Handel" (Hamburg's Trade) promoting current products from NA. The medals shown above indicate that NA was awarded gold medals for its products at the Paris International Exposition of Electricity in 1881, as well as in Hamburg in 1889.

leader in output and made the name of NA internationally known: Its products were awarded a gold medal at the Paris International Exposition of Electricity in 1881. Both Dr. Wohlwill and the company were granted numerous patents relating to the electrolysis method – not only for copper but also for gold and silver. An additional source of profits for NA was the sale of licenses for this method.

The newly introduced process was of enormous significance for general technical development, beyond just the plant. Never before had such high electrical conductivity existed and this opened up completely new opportunities. It paved the way for the triumphant advance of the electrochemical industry as a whole – and subsequently that of electrical engineering, culminating in the introduction of electricity into all areas of industry and of life in general. The new improved copper became the base material of modern life.

Step by step, attempts were made at finding a remedy for the shortage of space at the Elbstrasse plant from which all branches of production were suffering. In 1885, NA rented parts of the old Elbkupferwerk copper mill at Steinwerder for the operation of a new copper smelting plant. The remaining site and the silver smelter followed three years later. The new facilities at Steinwerder were transferred to an independent company, *Elbhüttenwerke GmbH*, for a short time between 1898 and 1900. However, two bad deals resulted in its ruin after only two years. The production of electrolytic copper declined rapidly for several years, not least due to extremely strong competition from the United States and a scarcity of ore on the world market. The turnaround came only with an improved electrolytic method developed by Dr. Heinrich Wohlwill, Emil Wohlwill's son.

All emergency solutions executed during the previous 20 years, however, looked like patchwork compared to the decision made in 1907: Beginning in 1909, a brand-new plant was to be built on the island of Peute upstream in the Elbe River.[53] All existing plants were to be consolidated here on an area of 64,000 m² with sufficient space for future expansion. *Metallurgische Gesellschaft* in Frankfurt, which had by then acquired half the stock of NA, was significantly involved in this decision. After the Hamburg City Assembly approved the plan in 1908, construction progressed rapidly. The first phase of the copper electrolysis facility, or tankhouse, was commissioned in 1910, and by 1913 all areas of the new plant were running at full capacity. This marked the end of the first 140 years of the history of Aurubis, then NA: The Beit parent plant at Elbstrasse was torn down.

We are aware of the past

The German population's metal donations, which also included the melting down of church bells, were significant in both World Wars as well as for the company. The photo shows a so-called "bell graveyard" shortly after World War II.

Norddeutsche Affinerie during World War I

During the first decade of the 20th century, Norddeutsche Affinerie (NA) had returned to its original business, the separation of precious metals. Around the end of the previous century, producing electrolytic copper had become less and less profitable. The Hamburg company had been outstripped by US competitors. The cost of conventional copper production had decreased and copper ore had become scarce. With the new plant on the island of Peute, the installation of the tankhouse in 1910 and its subsequent rapid expansion, copper once again became the company's core product.

The ownership structure at NA changed as well: New principal stockholders came on board in 1910, such as *Frankfurter Metallbank und Metallurgische Gesellschaft*, a subsidiary of *Metallgesellschaft,* and Deutsche Gold- und Silber-Scheideanstalt vormals Roessler AG (Degussa). This move was accompanied by a doubling of the company's capital, and Norddeutsche Bank, which had been the majority stockholder at NA since 1866, now only owned 50 % of stock.[1]

It was only in 1912, two years before the start of World War I, that the new copper smelter and the lead plant on Peute Island had been commissioned. When war broke out in 1914, NA, like the entire German raw materials industry, was unprepared for wartime economy. Only a few months into the war, stocks of ammunition at the front were running low. Copper, lead and tin were needed above all.

The supply of raw materials for these metals in Germany had been difficult even before the outbreak of World War I, since 46.5 % of all German imports of raw materials were coming from overseas sources.[2] When Great Britain entered the war on August 4, 1914, the Royal Navy blocked the North Sea outside the German Bight so effectively that this route was barred for the supply of raw materials.[3] Primary materials for the smelting works in Hamburg were in short supply. To keep up production at all, it became necessary to resort to the use of secondary raw materials from residues and waste from other production processes, in particular all kinds of collected scrap metals.

The shortage led to a considerable fall in prices. To counteract this, the Department of War established the *Kriegsmetall Aktiengesellschaft* "for the procurement, distribution and utilization of non-ferrous metals and metal products for army requirements"[4] as early as September 2, 1914. This institution took care of recording any scrap metal items and called on the population to donate metal. Posters were printed to increase people's willingness to give.

Besides household items, many other objects were donated such as copper tanks from breweries, copper inner fireboxes of train engines, lightning rods, etc.

These items were supplied to NA as well as to other metal recyclers.

The company smelted these metals and initially used them to produce mainly copper as well as tin as a by-metal. This work – and the company as a whole – came to be classified as "strategic to the war effort". NA was a sub-contractor for Kriegsmetall AG and was no longer free in its entrepreneurial activities. The company's work was dictated by Kriegsmetall AG, which demanded an increase in production but, on the other hand, also contributed to the necessary investments.

Accordingly, an agreement was reached in January 1915 to expand the capacity of the copper tankhouse from an output of 10,000 t per year to 25,000 t.[5] A volume of 20,000 t of output was to be achieved by mid-July of that year. However, the plant's electricity supply was not laid out for such high-capacity production. Thus, for the first time, NA concluded a supply agreement with the Hamburg power station in 1915.[6]

Although scrap metal was registered by the state and the population donated large quantities of metal – until 1918 donated household objects resulted in a copper volume

Starting in 1908, a completely new plant site was developed on the island of Peute in the Elbe River which consolidated all previous facilities on an area of 64,000 m². The first phase of the new copper tankhouse shown here went into operation in 1910.

Aurubis and world events

1910

Metallbank in Frankfurt, Metallurgische Gesellschaft and Deutsche Gold- und Silber-Scheideanstalt vormals Roessler AG (Degussa) become major stockholders.

1913

All operations at the new plant on Peute are running at full capacity.

July 28, 1914

Start of World War I. NA is commissioned by Kriegsmetall AG to melt down metals in order to obtain raw materials for army requirements.

1915

NA has a headcount of approximately 660 employees and celebrates its 50th anniversary in 1916. Prisoners of war, mainly from Russia and Belgium, are employed as forced laborers.

November 11, 1918

Signing of armistice agreement.

1919–1933

The Weimar Republic: Germany's first democratic constitution, the Roaring Twenties, inflation and the Great Depression.

1920

After a thorough assessment by Dr. Felix Warlimont, NA decides to expand and modernize the plant considerably so as to make the company more flexible and internationally competitive.

1923

Beginning of wirebar production.

1928

***Chemische Fabrik J. E. Devrient AG* is taken over and moves to Peute a year later.**

of 91,000 t all in all – the resulting volume of material was not sufficient to keep up production. To guard against a shortage of raw materials, a decree issued on March 1, 1917 demanded that church parishes should now also hand over their church bells and organ pipes.[7] Their collection was again organized by Kriegsmetall AG.

Any church bells turned in were first transported to the *Bleihütte Call* lead works for blowing. The tin obtained from this process was then shipped to *Metallhütte Duisburg,* which in turn shipped the produced bronze anodes to Hamburg for reworking.[8] NA especially built a tin electrolysis facility for this method and applied for a building license in March 1917.[9]

Apart from raw materials, there was also an increasing shortage of energy for production during the course of the war, as coal supplies were running short. Furthermore, the mass drafting of men had led to a shortage of labor, which was a great problem for the company.[10] It therefore deployed prisoners of war, the majority of them Belgians and Russians, between 1915 and the end of the war.[11] All in all, 50 Russians were employed by NA in 1915, while in 1916 a total of 170 prisoners of war of different nationalities were working. They were accommodated and cared for at the plant.[12] Their number rose to between 200 and 300 toward the end of the war. NA had a total of about 660 employees at that time, which means that around a third of the workforce consisted of prisoners of war.

In 1916, the company also celebrated its 50th anniversary. The Beit silver smelting plant had turned into a thriving business. Because of the war, which was in its second year, however, there were no official celebrations. Instead, NA donated 10,000 marks each to the Red Cross and the Hamburg War Aid Fund. [13]

The time of the Weimar Republic

A ceasefire agreement between the German Reich and the Allied Forces was signed on November 11, 1918, four years after the outbreak of the war. World War I was over. With the signing of the Treaty of Versailles on June 28, 1919, peace was officially declared. NA went through difficult times in this period. Production had to be converted from a wartime to peacetime economy. At the same time, there was still a shortage of labor leading to restrictions of work and to the temporary closure of individual factories. Inflation was on the rise. It had already done so during the war, but after its end the pace accelerated. Both wages and costs of materials increased by a total of 73 % in 1918.[14] In 1919, the crisis was reinforced when major stockholder Degussa ordered the closing down of silver electrolysis and 100 workers had to be laid off.[15] Moreover, the working hours of those still employed were reduced to 20 h/week.

Geschichte des Aktienkapitals der Norddeutschen Affinerie

	Aktien-kapital	Anteile der einzelnen Aktionäre: Allgemeine Deutsche Credit-anstalt	Nord-deutsche Bank	Versch. Aktionäre	British Metal Corporation Ltd.	Degussa	Metallbank u. Metallurg. Gesellschaft A.G., ab 1928 Metallgesellschaft A.G.
1866	BM 555000	110000	420000	20000			
1873	M 825000	165000	630000	30000			
Februar 1878?	„	—	622500	202500			
7.3./12.4. 1878	1650000	—	1650000				
1900–1909	„	—	1296000	354000			
ab 1. 1. 1910	3300000	—	1281000	369000		825000	825000
ab Januar 1912	5500000	—	2269000	481000		1375000	1375000
ab 1916	„	—	—	—		2750000	2750000
ab 7. 7. 1921	16000000	—	—	—		8000000	8000000
ab 9. 9. 1921	32000000	—	—	—		16000000	16000000
ab Goldmark-Eröffnungs-bilanz	RM						
1. 10. 1923	6400000	—	—	—		3200000	3200000
1. 1. 1926	9000000	—	—	—		4500000	4500000
23. 7. 1926	„	—	—	—	2340000	3330000	3330000
9. 8. 1928	12000000	—	—	—	3120000	4440000	4440000
6. 1. 1936	15000000	—	—	—	3900000	5550000	5550000
24. 9. 1940	18000000	—	—	—	3900000	7050000	7050000
1941	„	—	—	600000	3900000	6750000	6750000
30. 9. 1941	22500000	—	—	750000	4875000	8437500	8437500
12. 10. 1950	„	—	—	—	5850000	8325000	8325000
1951: DM-Eröffnungs-bilanz	DM						
per 21. 6. 1948	30000000	—	—	—	7800000	11100000	11100000
27. 5. 1955	42000000	—	—	—	10920000	15540000	15540000
11. 12. 1958	„	—	—	—	9660000	16170000	16170000
15. 4. 1959	„	—	—	—	8400000	16800000	16800000
7. 4. 1961	70000000	—	—	—	14000000	28000000	28000000
April 1966	84000000	—	—	—	16800000	33600000	33600000

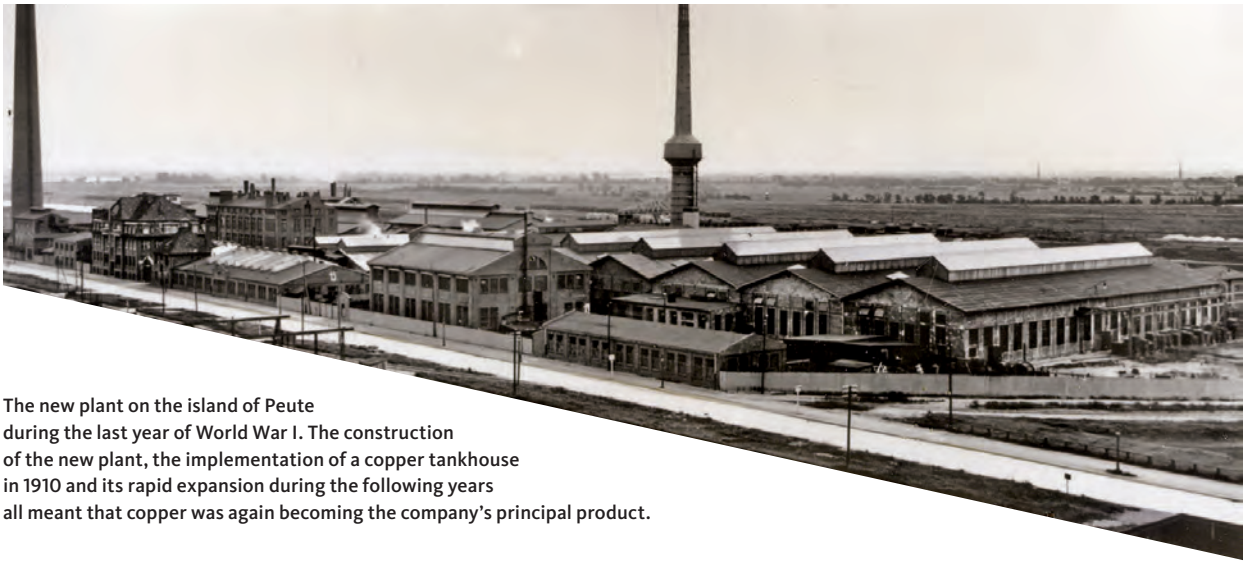
Die letzten Erhöhungen des Aktienkapitals — von 1941 einschließlich an — erfolgten aus Gesellschaftsmitteln.

Before and during World War I, the stockholder structure of NA changed fundamentally: In 1910, Degussa and Metallbank became new principal stockholders and from 1916 onward, they were sole owners. In addition, the first foreign stockholder, British Metal Corporation, acquired stock in the mid-1920s.

During World War I, posters called on the population to hand over objects containing the sought-after types of metal from their households. This poster shows the "German Michel" collecting metal: He is a traditional embodiment of the German, recognizable from his main attribute, the tasseled cap. To finance the war, voluntary donations of jewelry and coins were initially requested from 1916 onward to obtain foreign currency, under the motto "I gave gold for iron". Later, the population was compelled by law to hand over metal objects.

The situation of NA after the end of World War I was therefore extremely critical. Modernization and reconstruction were required to ensure the company's economic survival and to keep it competitive. In addition, its stockholders were very interested in expanding to form a copper mill of European importance. Metallgesellschaft, another major stockholder of NA, had also suffered a severe slump because of the war. Before the war, the worldwide price of copper had been fixed at their head office every day, but now they were cut off from international trade.

The expansion of the Hamburg plant on the island of Peute was to compensate for this. Dr. Felix Warlimont, who had been working for Metallgesellschaft in Frankfurt since 1915, surveyed the plant in 1920.[16] He came to the conclusion that it would need not only modernization but also considerable expansions to implement the project as intended by Metallgesellschaft. During that same year, the necessary steps were initiated to allow NA to compete against international smelters again. A major part of this was the flexible layout of technical facilities so they would not be tied to a specific form of raw materials. After all, NA during the war had proved its expertise in the recovery of special metals from alloys and scrap material.



The new plant on the island of Peute during the last year of World War I. The construction of the new plant, the implementation of a copper tankhouse in 1910 and its rapid expansion during the following years all meant that copper was again becoming the company's principal product.

To cover the costs of modernization and expansion on Peute, in 1921, the capital stock was initially increased almost sixfold to 32 million reichsmarks. The site was considerably enlarged by the additional acquisition of 178,000 m² of land, which enabled an expansion toward the southern side of the Müggenburg Canal. A new smelter was built, together with a converter facility and a refining mill.

NA finally began producing copper wirebars in 1923, followed by the installation of a Harris process facility for refining lead, a new copper vitriol unit and a sulfuric acid production unit. The smelting of overseas ores and silver electrolysis were taken up again during that same year. By the mid-1920s, the copper tankhouse had doubled its annual output to 50,000 t.[17]

In 1926, the ownership structure at NA changed yet again with *British Metal Corporation* (BMC) acquiring 26 %. A stake in NA was intended to help BMC secure their own access to metals. The acquisition of a 51 % stake in Chemische Fabrik J. E. Devrient AG in 1928 proved to be a forward-looking move. The plant moved to Peute in Hamburg the following year.

In the fall of 1929, the stock markets crashed worldwide and the economic crisis broke out across the world. Shortages of raw materials and semifinished products and falling prices of metals were a great strain on NA.[18] However, despite these difficulties, they were able to expand the facilities gradually by adding new products: cadmium electrolysis, nickel sulfate refining and the production of copper powder, selenium and cobalt oxide.

Norddeutsche Affinerie during the Nazi Era

The economy had not only been hit very hard by the provisions in the Treaty of Versailles but was also troubled by inflation and the Great Depression. Mass impoverishment, which accompanied these influences during the Weimar Republic, was an enormous challenge not only in Hamburg. Even in this former "stronghold of the left" which had been a place where liberal ideas and commodities were exchanged, the community's stability could no longer be maintained.[19] After Hitler's "Machtergreifung" (seizure of power) in 1933, the Nazis also conquered Hamburg within only a few weeks. The Hamburg Senate was reorganized to follow the example of the German Reich's cabinet and a new mayor with close ties to the NSDAP, the Nazi Party, was installed – Carl Vincent Krogmann.

Management and staff members outside the entrance to the office building in 1917 (left to right).
Top row: Messrs. Meyer, Hirsch (sales manager), Dr. Giulini (copper tankhouse manager) and Herrgen.
The central row shows Messrs. Lehmann, Dr. Tafel (technical director, 1914–1920), Dr. Wohlwill (Executive Board member, 1913–1933), Frank (authorized ore purchasing officer) and Baum (head of laboratory). Lined up in the front row are: Messrs. Lenk (successor of Baum), Dr. Stahl (chemical engineer), Nathansen (accounting), Schlesinger (Executive Board member, 1903–1924) and Hädrich (site manager).

In a brief inaugural speech, Krogmann cited the "reconstruction of Hamburg's trade and shipping" and the "fight against (...) unemployment" as future focal points of his work.[20] In June 1933, the Social Democratic Party SPD was outlawed and the so-called "Gleichschaltung" was driven forward: the forcible coordination and political and ideological alignment of all existing organizations with the aims of the Nazis in the city.[21]

Independent of the Nazi takeover of power, in 1932 a process of economic recovery had set in. The economic situation on the domestic metal market started to improve in 1933, so NA experienced a new upturn. Three factors were mainly responsible: the foreign exchange controls, domestic German pricing and the economic recovery which had been accelerated by certain measures taken by the Nazi government.[22]

It cannot be deduced from the sources available whether the NA management associated the upturn with Nazism or – as many other German entrepreneurs did initially – placed far-reaching economic hopes on the new rulers.[23] Nor is it possible to deduce a particularly strong permeation of the NA Executive Board with Nazi ideas.

The Nazi ideology was present within the workforce due to mandatory membership in the Deutsche Arbeitsfront (DAF – German Labor Front), quite independent of any individual attitudes. In parallel with the establishment of the DAF "Betriebsgemeinschaft" (works community), from 1933 onward, regular labor union work was prohibited.[24]

The NA workforce had more than doubled since 1918 and production had multiplied several times over.[25] In

Metal donations, monuments and bells

"In times of war, copper and tin are more useful in the worker's hand than in apartments and on church roofs."[1] Beginning in the spring of 1940, this was the motto used by Hermann Göring to call upon all sectors of German society to hand over metals of any type for purposes strategic to the war effort.[2] Household goods were collected as well as more bizarre objects such as copper brewing kettles, the tops of flagpoles or chemists' mortars. Added to this were industrial scrap metals and residues.

NA was among the companies that processed the "German people's metal **donation**". This initially meant additional costs due to the deployment of labor and the required technical equipment.[3] About a quarter of the entire material ended up on Peute Island. NA had to pay the "Reichsstelle für Eisen und Metalle" (Reich Office of Iron and Metals) for these new raw materials. However, prices were reasonable.

Monuments and sculptures were also delivered to Hamburg as part of this campaign, later followed by loot from the occupied European areas. NA used experts to examine items considered to be of artistic value and stored some at the Altona Museum.[4] However, they were forced to go back on this following pressure from the Nazi authorities.

Not all objects had been melted down by NA at the end of the war. Some were "simply piled up and left to lie".[5] The Allied forces began to arrange for works of art to be returned to their owners in the winter of 1947/48. There are two examples, however, which illustrate NA's own initiative. In the autumn of 1949, two bronze lion statues were returned to the Kaiserpfalz at Goslar (the medieval imperial palace).[6] In the middle of 1982, twelve bronze figures which had once been part of a wheel-shaped chandelier in the Berlin Reichstag were returned to the German Bundestag.[7]

Beginning in the winter of 1941/42, church **bells** were delivered to the smelters, too. Today, this is remembered as the tragedy of European church bells. It was not only the bells' copper that was considered to be strategic to the war effort but also their tin content. The bells were marked and categorized according to their artistic value, ranging from grade A (not valuable) to D.[8] The bells melted down at NA were almost solely damaged ones and category A items. They were the major part of the at least 18,000 t of bell material processed at the plant until 1945.[9] At the end there were about 4,700 t of bells left in Hamburg.

After the war, the term "bell graveyard" came up. It was used for various bell storage places in the Hamburg area such as Peute Island, Wilhelmsburg, the freeport area and the Speicherstadt. The bells were piled up in rows and waited for their return. Even decades after the end of the war there were still bells being returned to church parishes within Europe.

One episode shows that NA was aware of the danger posed to bells by bomb attacks. At the end of February 1945, a rescue campaign was initiated by NA to take the most valuable of the church bells still stored at the plant out of Hamburg.[10] They were loaded onto the vessel "Karl Heinrich" to be taken to the Elbe-Trave Canal at Lauenburg.[11] However, on February 24, the vessel which was still moored at the Reiherstieg was hit during a bomb attack and sank. The so-called "bell ship" was recovered in the summer of 1945. Unfortunately, some of its cargo had been destroyed.

At the front, the "Gloriosa", the largest bell from the Kaiserdom St. Bartholomäus in Frankfurt/Main, which survived the war at the Hamburg "bell graveyard". The photo shows the "ring test" carried out by acoustics engineer Dr. Thienhaus in front of the southern wall of the reverberatory furnace building on the works premises.

The metal objects donated by the population needed to be sorted. Scrap metal was piled several meters high on the NA works premises. Not only here but also at other smelting plants it was melted and supplied to the armaments industry.

A photo from 1949. The Allies decided on the preservation of monuments of historical figures which had survived the war. Those with a military background, such as Otto von Bismarck (left) or Wilhelm II. (second from left) had to be melted down.

1939, the company covered half the German demand for copper.[26]

On the eve of World War II, NA had a headcount of about 1,450 employees.[27] Nearly 120 employees were called up for military service on September 30, 1939.[28]

The situation was comparable to that of World War I. Again, NA acted as a supplier to the ammunitions industry and was considered to be "strategic to the war effort". The reason given was that "no other smelting plant in Germany was as versatile in its processing options and in the production of metals as NA".[29] And yet again NA, like the entire metal industry, came under the control of state institutions, in this case of Hauptring Metalle (Principal Metals Syndicate).[30]

Surprisingly, production output decreased in most areas during the first year of war (1939/40) – for copper by over a quarter to 68,000 t. New methods were developed and patented such as, in 1941, one "which would be of great importance for the processing of sulfuric acid waste in the explosives industry (...)".[31]

NA was affected by rationing measures beginning in the winter of 1941/42 at the latest. Following an order from Hitler, the arms industry had to find ways for plants with identical productions to either cooperate or pool their resources. The objectives of this order were a better distribution of raw materials, energy savings and, above all, to free workers for service in the military.[32] As a consequence, complete production lines at NA such as lead production were shut down.[33]

Unlike World War I, this war very soon made itself felt in Germany. As early as September 1939, there were first air raids on cities in the Reich by the British Royal Air Force. A short time after that, Hamburg became the target of air raids. NA itself was not affected, but company employees either died outside the plant, were wounded or had to stay with their families. Many of them could no longer reach Peute by public transport.

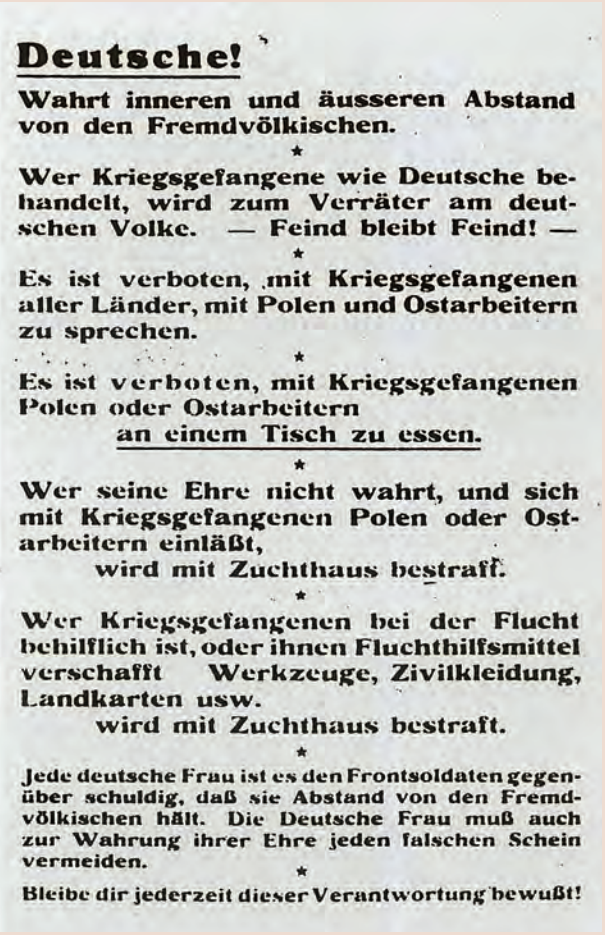
The first time the plant was hit directly was during the night of May 9, 1941. Dr. Warlimont referred to more than 120 incendiary and concussion bombs, which, however, only caused limited damage.[34] Much more devastating were the results of the "firestorm" in 1943, which ravaged large parts of Hamburg. Around 600 bombs destroyed parts of the plant during the second night of bombing on July 27. To this day, fragments of metal can be identified in some pillars of the

Background: Forced labor in the Third Reich

Forced laborers were either **prisoners of war**, so-called **"civilian laborers"** or **inmates of concentration camps**. Their labor was used by nearly all companies and public service employers in the German Reich during World War II.[12]

The first prisoners of war captured by the Wehrmacht were brought to the Reich to work soon after the war had started. As the war progressed, civilian laborers were recruited from the occupied territories. At first they came voluntarily – lured by false promises – but later they were forcibly recruited and abducted into the Reich.

There were considerable differences in the living and working conditions of forced laborers depending on their nationalities. Inmates of concentration camps were at the bottom of the ladder and received the worst treatment, followed by Eastern European laborers coming from the occupied territories of the Soviet Union and by Soviet prisoners of war. They had to do the hardest work and were frequently only given scraps to eat. So-called "Westarbeiter" (i.e. laborers from Western Europe) from France and the Netherlands were treated similarly to German workers.[13]



Deutsche!

Wahrt inneren und äusseren Abstand von den Fremdvölkischen.

*

Wer Kriegsgefangene wie Deutsche behandelt, wird zum Verräter am deutschen Volke. — Feind bleibt Feind! —

*

Es ist verboten, mit Kriegsgefangenen aller Länder, mit Polen und Ostarbeitern zu sprechen.

*

Es ist verboten, mit Kriegsgefangenen Polen oder Ostarbeitern an einem Tisch zu essen.

*

Wer seine Ehre nicht wahrt, und sich mit Kriegsgefangenen Polen oder Ostarbeitern einläßt, wird mit Zuchthaus bestraft.

*

Wer Kriegsgefangenen bei der Flucht behilflich ist, oder ihnen Fluchthilfsmittel verschafft Werkzeuge, Zivilkleidung, Landkarten usw. wird mit Zuchthaus bestraft.

*

Jede deutsche Frau ist es den Frontsoldaten gegenüber schuldig, daß sie Abstand von den Fremdvölkischen hält. Die Deutsche Frau muß auch zur Wahrung ihrer Ehre jeden falschen Schein vermeiden.

*

Bleibe dir jederzeit dieser Verantwortung bewußt!

The population had to keep to strict rules of conduct in their contact with the "foreign nationals".

Alte Schlosserei (Old Metalworking Shop), which now serves as an event hall. Some areas were immediately affected, such as the electricity supply, the shaft furnaces and converters, and the supply of cooling water and boiler steam to the ore reverberatory furnace. There were fires in the western part of the plant and on the southern shore, while the shaft furnace building was greatly endangered. The workers succeeded in putting out the fires and carrying out essential maintenance work. Following the air raids, they did everything they could to prevent long-term damage by shutting down steam boilers and furnaces and emptying converters. They could never be sure whether the next work shift would turn up as planned and whether the energy supply could be assured. NA was hit by at least six waves of air raids; the last one, on April 13/14, 1945, completely destroyed the company's downtown headquarters at Alsterterrasse.[35]

Large parts of the German economy worked in accord with the regime, in particular during wartime. In this sense, NA too was part of systems on which Nazi warfare relied. Although the company was neither a core element of the dictatorship nor was it directly involved in the dictatorship's central crimes, it still had a place within an economic network underpinning the state. During this period, 75 % of NA was owned by two companies both based in Frankfurt/Main and much more closely involved in the Nazi economy and its

crimes: Degussa and Metallgesellschaft. Although NA was technically independent in its decisions, Degussa and Metallgesellschaft naturally exerted a strong influence. The Supervisory Board of NA always included representatives from Frankfurt. Due to the war with Great Britain and the absence of the third majority stockholder British Metal Corporation, they were able to exert a strong influence on management decisions.[36]

After 1939, Wilhelm Avieny of Metallgesellschaft became chairman of the Supervisory Board at NA. His deputy was Hermann Schlosser, CEO of Degussa. The management in Hamburg was thus controlled by two men who were closely linked to Nazi politics because of the activities of their respective companies. Wilhelm Avieny, a qualified banker, was not only managing director and chairman of the supervisory board at Metallgesellschaft but was also integrated into the Frankfurt section of the Nazi party and an SS Obersturmbannführer (lieutenant colonel).[37] At Metallgesellschaft, Avieny was involved in the "aryanization" campaign, i. e. the enforced takeover of Jewish companies at prices far below their market value. After the war, Avieny was interned and categorized as "compromised" in "denazification" proceedings. In his activities at Degussa, Hermann Schlosser had also been responsible for "aryanization" processes, among other things.[38] The influence these men from Frankfurt exerted on business decisions made by NA in Hamburg is bound to have been noticeable.

Three men with a Jewish background held high-level positions at NA until early 1933: Dr. Richard Merton, Julius Levisohn and Dr. Heinrich Wohlwill. They all had to leave their positions on the board of management after Hitler's seizure of power. It should be noted, however, that both Levisohn and Wohlwill continued to receive payments from NA until the end of the 1930s and maintained ties to the company through consultancy agreements.[39]

In its concrete day-to-day business, NA was part of the Nazi industrial organization. NA took part in processing so-called "Jews' gold". Beginning in 1939, this had been extorted from its Jewish owners in the context of the "pawnshop campaign". The people in charge at NA were

Aurubis and world events

1929

Beginning of the Great Depression.

January 30, 1933

Takeover of political power by the Nazis.

September 15, 1935

The "Nuremberg Laws" provide a legal basis for anti-Semitism in Germany.

January 26, 1937

"The Greater Hamburg Act" is passed under Nazi rule, which suspends the Hamburg constitution. The new single municipality Hansestadt Hamburg is enlarged by 30 new boroughs and now has 1.68 million inhabitants, almost half a million more than before.

1938/39

Expansion of the plant after economic recovery. A total of 1,450 people now work for NA on the island of Peute.

September 1, 1939

The attack on Poland leads to World War II.

March 27, 1940

Field Marshal Hermann Göring issues an appeal for "a donation by the German people to mark the Führer's birthday", in which the Germans are called on to hand over metal objects, in particular those made of brass, copper, bronze, iron and tin, for the production of raw materials vital to the war effort. The term "donation", however, which suggests a voluntary action, is deceptive, as non-participation in the campaign could have resulted in a death penalty. Parts of this metal donation were melted down by NA.

May 9, 1941

First bomb hits the Hamburg plant: two casualties and a destroyed crane at the wirebar warehouse.

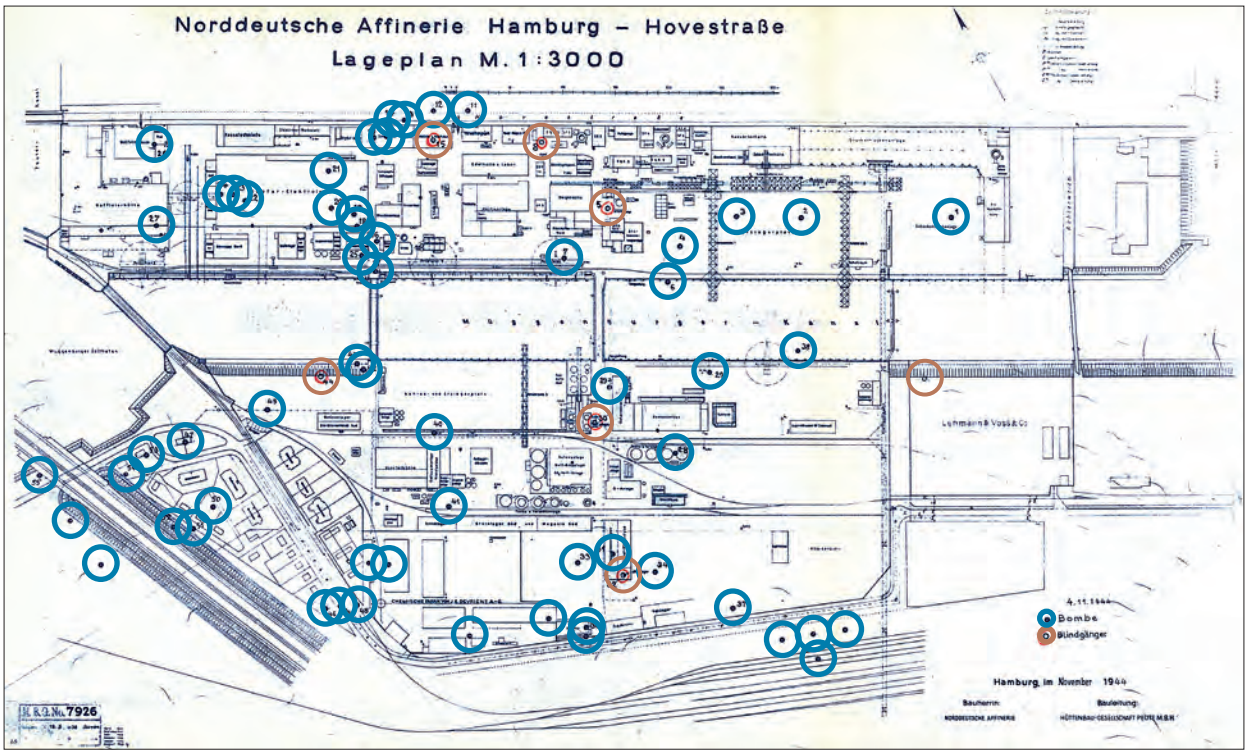
The ceremonial hall which was decorated in the spirit of the time for the company's 75th anniversary on April 28, 1941 was set up in the building of the planned cracking unit, which is now the workshop building on the south bank (top).
Shown here, the celebration of the event with Hitler Youth lined up in front of the orchestra (bottom). This event was celebrated with a grand gala in 1941. The original recordings with the commemorative speeches by Dr. Felix Warlimont have been preserved in the company archives of Aurubis AG.

aware of the origin of the material and wanted a share in the business. When the matter of the distribution of the "pawnshop gold" came up in early 1940, NA stressed that they "definitely were interested in (...) obtaining a share in the Jews' gold business".[40] The gold could be obtained extremely cheaply because it had been taken from its previous owners at prices far below its value: "As is well known, the profit in this business lies (...) in the buying price of the old gold and in the trade price of the fine gold."[41] This concerned "material at original terms and in original condition".[42] Frequently, the items were family heirlooms of sentimental value.

Dr. Warlimont stated "that N.A. would have to demand the entire volume of 'pawnshop gold' accumulated in Hamburg, (because) only obtaining a part would be of no use to the company. We (NA) would rather do without in that case."[43] In February 1940, NA tried to profit from the coercive actions against Jews.[44] Despite their appeal to the Reich's Ministry of Economic Affairs, they failed to get the contract for the "Jews' silver" from Degussa.[45] Instead, Degussa delivered a total of 556 kg of gold to NA for reworking, which had come directly from pawnshops.[46]

During the entire period of World War II, millions of foreign nationals were forced to work for Germans, mainly in the territory of the German Reich. Among these were numerous prisoners of war but even more civilians. NA also employed forced laborers who were at that time called "Fremdarbeiter" (foreign workers). These comprised different groups, the largest of which were the so-called Ostarbeiter, who came from Central and Eastern European countries.

There were also some transports comprising complete families amongst the forced laborers arriving in Hamburg.[47] The women were usually deployed for lighter work such as cleaning or kitchen work. Children under 14 years of age remained at the place of accommodation and were taken care of by older women. Youths over 14 years of age were officially treated as adults and had to work at the plant. In 1942, NA stressed that the young people were deployed "in suitable positions".



This site plan from November 1944 shows markings of where the bombs, including unexploded ones, struck the plant in several waves of air attacks.

Single women were housed separately at the company welfare building at Hovestrasse 44. Men, their spouses and children lived at the "Ostarbeiterlager" (camp for Eastern European workers) at Hovestrasse 77, a hutment built in 1941/42. Another three camps existed besides this.[48] The "Ostarbeiter camps" were regularly visited by the plant social worker.

Beginning at the end of 1943, NA also deployed prisoners of war, almost all of them Soviet soldiers. In October, a camp with five huts was built at the top end of Hovestrasse "to duly accommodate these people".[49] It is known that NA did offer prisoners of war some small benefits like a regular supply of water, tea and coffee. The huts were cleaned and straw was provided for the beds because "wood shavings were too hard", along with better quality "Dutch blankets", cutlery, wooden clogs, underwear, wrapping paper and toilet paper.[50]

In July 1944, the headcount at NA was at its highest wartime level with 806 forced laborers out of a total of 1,900 employees.[51] During that summer NA rented "a hut with fixtures, the so-called Polish hut", at Hovestrasse from the "Verein der am Kohlenplatzhandel Beteiligten" (Association of Coal Yard Traders).[52] Another new massive hut with four rooms for 20 people each was built later. On October 1, 1944, a total of 222 men were living in all the scattered accommodation facilities.

Beginning in 1943, the management of NA grew increasingly dissatisfied with the deployment of civilian forced labor from the western occupied territories, mainly the Dutch and French.[53] They stated that they had had "the most positive experience" with "Eastern European labor", whereas the performance of prisoners of war had been "satisfactory".[54] These prisoners were often enfeebled from malnutrition and wounding. They were therefore given "better food" to help them regain their strength.

One of the factory buildings after being hit by bombs. The plant had sustained light damage during the first direct air attack in the early hours of May 9, 1941. In the summer of 1943, however, parts of the plant were destroyed by several hundred bombs.

Although both the accommodation and treatment appear to have been relatively kind under the circumstances, their coercive nature should never be forgotten. The management of NA regarded the foreign laborers primarily as business resources, especially where productivity was concerned or "the difficulty of supervising and instructing foreign laborers adequately".[55] This is the background against which one should view the clearly noticeable efforts by NA to keep the living conditions of their forced laborers relatively bearable. Both aspects may have played a role: the maintenance of the laborers' capacity to work and humanitarian motives. Nevertheless, there were attempts by forced laborers to remedy their situation: Western European civilians often did not return after home leave, while both civilian Eastern European workers and prisoners of war tried to escape. However, the fugitives in and around Hamburg were quickly seized again and taken back to NA. This was followed by punishments, "either by the Gestapo or by us".[56]

In 1944, NA expressly declined an offer to let approximately 1,000 to 1,500 prisoners from the Neuengamme concentration camp work for them.[57] Dr. Hermann Brill, who had been appointed "labor deployment officer" of the smelting works section for Hamburg in 1944, decided in the spring of that year that the company had no use for them.[58]

Norddeutsche Affinerie after the end of World War II

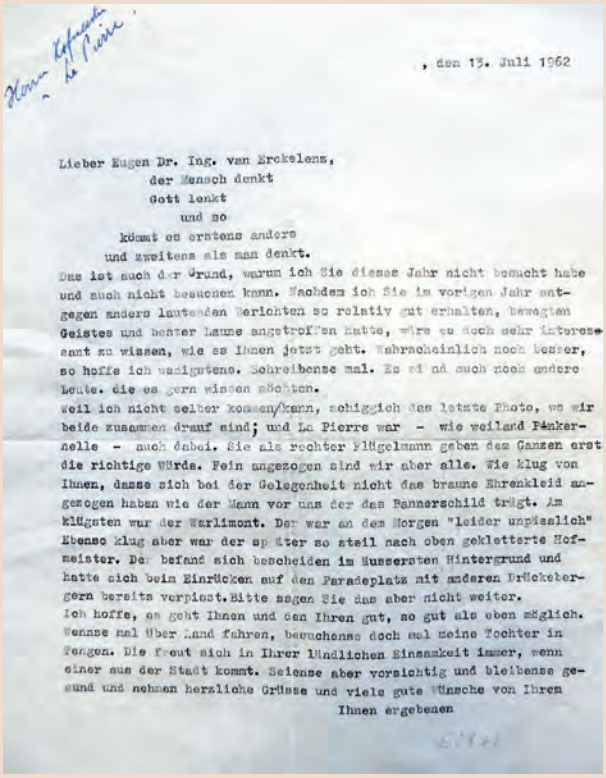
On May 3, 1945, the war in Hamburg came to an end. Production on Peute had already come to a standstill in the spring due to a steadily worsening shortage of both energy and labor since the beginning of that year: There was hardly any coal for the operation of the furnaces, electric power plants were destroyed and men of draft age were deployed in the war.[59] As a consequence, and following damage from air raids, part of the plant had been repeatedly forced to close down. The copper tankhouse had not been started up again after the air raid in early November 1944. In February 1945, wirebar casting was discontinued due to lack of coal. This was followed successively by the ore roasting house, the contact unit and the lead refinery, which all had to be turned off. Since April 19, the entire plant stood still.[60]

After the collapse of the Nazi regime, it was important for the management of NA to wait for the decisions of the Allies and then to take up production again as quickly as possible. It was vital to be on good terms with the new rulers. Without the Allies' goodwill – the British in this case – it would hardly have been possible to avert the end of NA. The company succeeded "relatively quickly in reaching a good agreement with the occupation authorities".[61] The Allied occupation authorities initially decreed the closure of all German industries that had been strategic to the war effort, which included NA. The legal justification led to a subsequent freeze on all

Letter about the May rally

A letter written by Dr. Josef Eitel to Dr. Eugen van Erckelens on June 13, 1962 shows that the management of NA was not particularly enthusiastic about taking part in Nazi propaganda shows. Eitel referred to two photographs taken at NA during the Labor Day rally on May 1: "How wise you (Erckelens) were not to wear the brown dress of honor like the man in front of us who was carrying the banner shield. Warlimont was the wisest of all – he was regrettably 'indisposed' that morning. (...) Hofmeister, however, was just as wise. He positioned himself unobtrusively right at the back and by the time they marched onto the parade ground he had (...) pissed off."[14]

Erckelens' refusal to march in uniform, Warlimont's sick leave and Hofmeister's quiet departure may seem quite insignificant at first glance. However, May 1 was one of the most important political holidays of the regime.



, den 13. Juli 1962

Lieber Eugen Dr. Ing. van Erckelens,
der Mensch denkt
Gott lenkt
und so
kömmt es erstens anders
und zweitens als man denkt.

Das ist auch der Grund, warum ich Sie dieses Jahr nicht besucht habe und auch nicht besuchen kann. Nachdem ich Sie im vorigen Jahr entgegen anders lautenden Berichten so relativ gut erhalten, bewegten Geistes und bester Laune angetroffen hatte, wäre es doch sehr interessant zu wissen, wie es Ihnen jetzt geht. Wahrscheinlich noch besser, so hoffe ich wenigstens. Schreibense mal. Es sind auch noch andere Leute, die es gern wissen möchten.
Weil ich nicht selber kommen kann, schicke ich das letzte Photo, wo wir beide zusammen drauf sind; und La Pierre war - wie weiland Fänkernelle - auch dabei. Sie als rechter Flügelmann geben dem Ganzen erst die richtige Würde. Fein angezogen sind wir aber alle. Wie klug von Ihnen, dasse sich bei der Gelegenheit nicht das braune Ehrenkleid angezogen haben wie der Mann vor uns der das Bannerschild trägt. Am klügsten war der Warlimont. Der war an dem Morgen "leider unpässlich" Ebenso klug aber war der später so steil nach oben gekletterte Hofmeister. Der befand sich bescheiden im äussersten Hintergrund und hatte sich beim Einrücken auf den Paradeplatz mit anderen Drückebergern bereits verpisst. Bitte sagen Sie das aber nicht weiter.
Ich hoffe, es geht Ihnen und den Ihren gut, so gut als eben möglich. Wennse mal über Land fahren, besuchense doch mal meine Tochter in Tengen. Die freut sich in Ihrer ländlichen Einsamkeit immer, wenn einer aus der Stadt kommt. Seiense aber vorsichtig und bleibense gesund und nehmen herzliche Grüsse und viele gute Wünsche von Ihrem
Ihnen ergebenen

Dr. Josef Eitel included this photograph with his letter to Dr. Eugen van Erckelens, which shows both men together in the front row behind the standard bearer. On May 1, the workers at NA were obliged to march in file to the central rally of the DAF. Membership in this Nazi labor organization was mandatory for all of the company's employees.

Jewish fates at NA

Richard Merton, who had been delegated to the Supervisory Board by Metallgesellschaft, was forced to resign, bit by bit, from his numerous public offices and positions.[15] On November 10, 1938, he was arrested and interned at Buchenwald concentration camp for three weeks; his assets were confiscated.[16] After his release, in 1939, Merton fled to Britain and stayed there until 1947, when he returned to his hometown of Frankfurt/Main.

Dr. Heinrich Wohlwill, chief chemical engineer at NA, was of Jewish descent but was not a practicing Jew. He had been raised by his parents without any religious affiliation. His father, Emil Wohlwill, had opted out of the Jewish community as a young man.[17] Despite this, Heinrich Wohlwill fell victim to the Nazi regime: On July 20, 1942, he was deported from Hamburg to Theresienstadt concentration camp. He was murdered on January 31, 1943.[18]

Julius Levisohn joined the Executive Board of NA in 1929[19] but had to resign from office during the first few months after the Nazis came into power. Nevertheless, Julius Levisohn continued to represent NA in various capacities until 1937. He was not formally dismissed until the end of March 1939. Levisohn emigrated to Britain in early 1940.[20]

company assets due to a law laid down by the military government.[62]

The freezing of assets was only lifted gradually from the end of 1950 onward.[63] The management had to obtain permission from the military government for every step in continuing production at the plant. Resources were scarce and the infrastructure was destroyed. The procedures were grueling. Both the need for manpower and maximum electricity consumption were laid down by the authorities as a rule. If contingents turned out to be insufficient, they had to be renegotiated. After either 6 or 12 months, approvals expired and had to be applied for again.

Repairing road damage at a railway crossing on the plant's northern bank in November 1944.

In July 1945, NA requested that the remaining workforce of only 400 should be allowed to carry out initial clearing and repair work.[64] The first priority was to avoid further damage, for instance to damaged roofs or electrical facilities and metallurgical furnaces which had to be weatherproofed. Another object was to prevent chemical equipment from suffering further "deterioration of this equipment due to corrosion from acid residues".[65] Building and working material had to be authorized, from cement and pipes, shovels and buckets, down to overalls and rubber boots.[66] The first significant production authorizations were not issued until the winter of 1945/46, initially for 5,000 t of copper wirebars per month, and for copper powder and sulfate.[67]

However, the start of regular production was out of the question. Added to this was the legitimate concern – into the summer of 1946 – that plant facilities might be completely disassembled and confiscated as reparations by the Allies. The "mood (was) against a continuation of copper production at NA", as was reported to Hamburg by British officer David Mathias, who was in charge of NA.[68] The reasons behind this were political as well as economic. It was not only the "idea that Germany should not be allowed to keep her own copper mill to prevent her from being able to produce copper domestically in a potential future war".[69] It was especially the Americans who, in 1946, were still interested in providing their own

copper producers with the best possible sales conditions in Europe. Setting up competitors was harmful to this objective.[70] It was not until the end of July that the Allied Control Council made the contrary decision to strike the copper smelter with a capacity of 40,000 t off their list of reparations for the time being.[71] A sense of relief was beginning to be felt again in Hamburg.

1942

NA employs Russian prisoners of war as forced laborers.

1943

These bronze figures of approx. 80 cm height, including one of Martin Luther and St. Boniface, were confiscated as "material vital to the war effort" to ensure metal supplies to the armament industry. However, NA employees saved them from the furnace and hid them on the factory premises. The figures were originally part of a neo-classical chandelier weighing 8 t, which graced the domed hall of the Reichstag.

1943

"Operation Gomorrha": British and American air raids on Hamburg from July 24 to August 3. The five night raids and two daytime attacks killed approximately 35,000 people and approximately 900,000 people were left homeless. Almost 80 % of the port was destroyed.

1943

On July 28, Peute is also hit: Production is closed down from August 1 until the middle of the month since there is hardly any labor available because of the heavy attacks on the metropolitan area and the evacuations. Production is restarted fully in October. In 1944, several waves of attacks cause further destruction.

January 17, 1945

Shortly before the end of the war, further damage is caused to the lead electrolysis plant, which, together with the copper powder facility, will not resume operation before the end of the war.

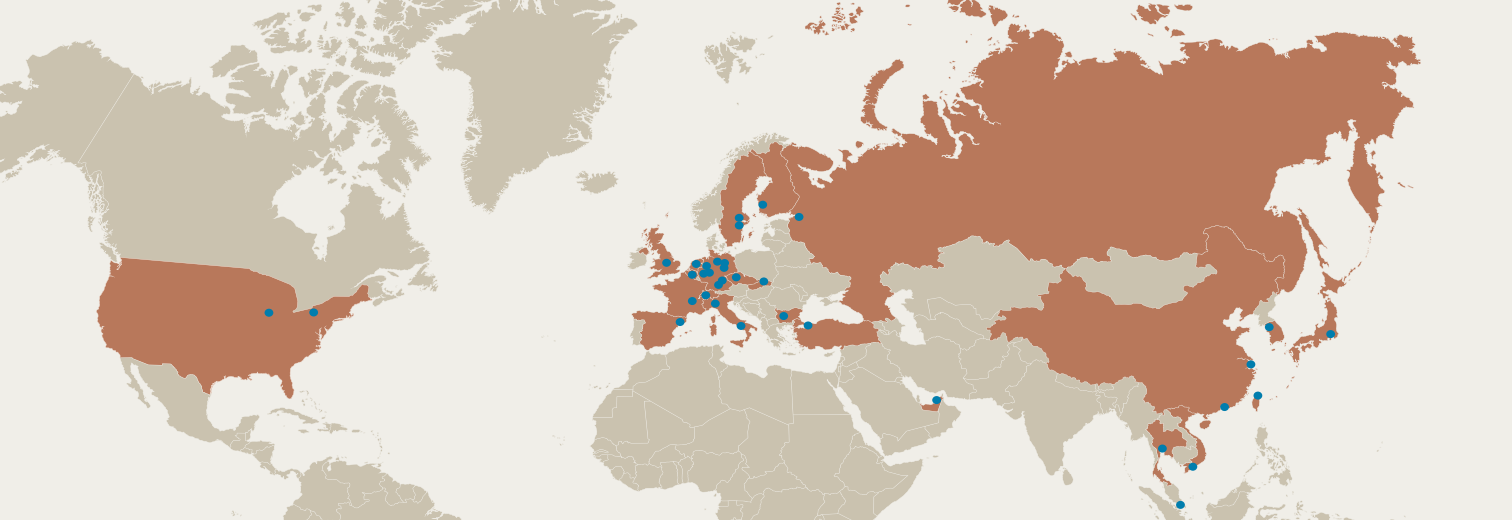
1945

The NA headquarters at Alsterterrasse 2 is irrecoverably destroyed during the last of six bomb attacks on April 13 and 14, 1945.

May 8, 1945

End of World War II in Europe.

We are international



Aurubis AG has grown many times over and positioned itself internationally since the end of World War II. The individual points on the world map show the Group's current sites.

Copper is international

One characteristic of a custom smelter is that its economic fate is largely determined by its purchasing. As a classic custom smelter, Aurubis is fully exposed to international competition with regard to its cost positions such as labor costs, energy costs and environmental protection costs. Norddeutsche Affinerie (NA) has always been a smelter on the market without any mines of its own and has therefore sought – and found – its very own strategy for sourcing raw materials. That was why "long-term contracts for ore concentrates became NA's landmine, so to speak".[1] As early as 1960, Paul Hofmeister identified this sourcing of raw materials as the greatest challenge and called it "our biggest problem" running through the history of NA "as the central theme".[2] One memorable example of this was Elbkupferwerk, which had failed due to insecurities in sourcing ores 100 years previously.

Then as now, materials were mainly procured from outside Germany, mostly even outside Europe. In this respect, Aurubis has always had an international focus because of the worldwide distribution of natural ore deposits. However, relations with suppliers have historically been quite varied.

In the past, equity stakes in mining companies, the support of exploitation projects in new ore extraction areas and the exploration of smelting projects were part of NA's efforts to establish networks on the raw material markets. They were replaced by the company's strategic premise which exists to this day: to conclude long-term agreements wherever possible.[3] A second aspect was required in safeguarding sourcing in different supply situations, namely the distribution of risks. To this day, a wide spread of contracts, i. e. a portfolio of different concentrates and mining partners, ensures supply security even across disruptive events such as unexpected losses of production, natural disasters or political changes in mining countries.[4]

There has always been a positive reciprocal effect between the long-term nature and the spread of supply relationships and the technological development of the Group. The most noticeable example of this is the construction of the eastern primary smelter in 1972. This would not have taken place if it had not been for the contract regarding the supply of concentrates which had been concluded previously with *Bougainville Copper*. Neither would the expansion of the smelter have been implemented without the agreement with Chilean *Escondida* in 1996.[5]

From currency reform to economic miracle

After World War II, NA succeeded not only in averting the stripping-down of its facilities but also in keeping parts of its workforce and protecting many of its raw materials.[6]

Snapshot of the inside of the northern smelter in 1951. Beginning in the first postwar winter of 1945/46, production was resumed step by step.

Yet at the end of the 1940s there were factors, both external and internal, that slowed down a new start.[7] The initial general ban on operations imposed by the Allies and the subsequently granted permissions for production for individual plants were only valid for certain periods of time and were hampered by a general economy of scarcity in postwar Germany. Even fuels and simple working materials were difficult to come by. However, if NA wanted to produce efficiently again, it had to overcome three further major problems: the sourcing of ore raw materials, the labor shortage and the question of sales opportunities in general. The issue of raw materials mainly stemmed from the fact that, as a result of the war, German companies – including NA – were cut off from many of their former supply channels and that international currency insecurities made it impossible to conclude contracts that secured sourcing, let alone long-term ones. Each order for raw materials had to be negotiated afresh and individually.[8]

May 3, 1945

Capitulation: Hamburg surrenders unconditionally to British troops. Large parts of the city are in ruins.

Winter of 1945/1946

The British military government grants permission to NA for a first resumption of production activities.

1948

Currency reform with introduction of the Deutschmark in the three western occupation zones.

1948

By the end of the year, all major plants at NA are running again.

1949

Founding of the Federal Republic of Germany and the German Democratic Republic. Economic miracle in West Germany. The economic boom lasts until the oil price crisis of 1973.

1949

Acquisition of *Pflanzenschutz Urania GmbH*.

1949

Start of the continuous casting plant.

August 12, 1961

The GDR begins the construction of the Berlin Wall.

February 16/17, 1962

Storm flood in Hamburg; more than 300 people are killed, including an employee of NA. The plant security service manages to prevent damage to furnaces by pumping out water from the premises around the clock. 75 employees lose their homes due to the flood.

Germany experienced an economic miracle in the 1950s. NA also recovered noticeably. Seven years after the end of the war, the plant already employed more than 2,000 people again.

With the currency reform of 1948, the German economy suffered a soaring rise in prices of 30 %.[9] The stable Deutschmark, the capital inflow from the Marshall Plan (the European Recovery Program) and the revitalization of international business activities resulted in an unimagined boom in West Germany, the so-called economic miracle.

Things were looking up in Hamburg, too. At the end of July 1948, NA had 1,404 people on its payroll and by August the number had risen to 1,542.[10] The number of people working on the island of Peute was now sufficient to tackle the necessary tasks and to go about carrying out the overdue repairs and the completion of old building projects. Until the end of 1953, i. e. within a good four years after the monetary reform, NA was systematically adjusted to the new requirements. To achieve this, the sum of approximately 20 million

Sourcing before and during World War II

Up to World War II, NA had sourced ores and ore concentrates mainly from Outukumpu in Finland.[1] Other sources were Cyprus and, especially during the war, Norway. Pyrite cinders were also sourced from either Outukumpu or deposits in Tharsis in southern Spain and Rio Tinto. The ore for copper and lead processing was mainly supplied from Otavi in Namibia and as mattes from Burma. The material for anodes was primarily sourced as blister copper from Bor in Yugoslavia and from Rhokana in former Northern Rhodesia, today Zambia, and supplemented by blister coming from Rio Tinto and Outokumpu.

Deutschmarks from building and fixtures accounts was newly invested, and around 18 million Deutschmarks was written off.[11] Just during a single meeting of the Supervisory Board on October 23, 1951, reinvestments amounting to 6.64 million Deutschmarks were approved. One of the first measures was the reconstruction of halls I and II of the copper tankhouse. Meanwhile, the number of employees continued to increase steadily and reached an average of 2,000 in 1952.

Material from all over the world – International suppliers and holdings up to the 1960s

In 1960, the supply to NA was covered by a network of about 880 individual contracts with 170 suppliers in 40 countries around the globe. Roughly 330,000 t of raw materials per year were delivered to Hamburg.[12] This network was created because of the difficulties NA was facing in reactivating old supply channels after World War II or in finding new partners which were reliable in the long term.

NA was looking for ways to exert influence on the raw material sales of mining companies via its network. This extended beyond the actual supply contracts and initially included acquiring stakes in mines and supporting development projects for new mining areas as well as the exploration of smelting projects. This was not a new strategy, however, as can be seen from the oldest – and probably most successful – example of its kind: The first attempt by the company to gain a foothold in copper mining was an ore mine in Chile. In 1929, NA together with *Gebrüder Vorwerk & Co. KG* leased the El Volcan mine and, in 1930, executed a buying option.[13] However, extraction was halted by the Great Depression as early as 1931. In 1935, ore mining and processing into concentrates was resumed. After a reorganization and capital widening, *Compania El Volcan*, in which NA now owned 53.5 % of stock, posted its first profit in 1936. However, the cooperation was severed by World War II. All in all, NA had benefited from the El Volcan project: It was able to claim large write-offs and had secured supplies of concentrates and blister.[14]

Historical photograph of the Outokumpu smelting works in Finland in winter. Until the end of the 1930s, NA had sourced most of its ores and ore concentrates from here.

After 1945, other connections remained cut off initially, especially to Otavi in Namibia.[15] However, suppliers in Norway, Rhokana/Northern Rhodesia (Zambia) and Bor/Yugoslavia were won back quickly. NA was able to acquire unwrought copper in England as well as from the *Paipote* smelter in Chile. Larger quantities of cement copper were supplied by the metallurgical works *Ertel, Bieber & Co.* in Hamburg. External anodes for electrolysis were mainly sourced from Duisburg in Germany but also from Hoboken in Belgium.[16] By the middle of the following decade, the sourcing of various raw materials required by NA was based on supplies coming from within Germany, Norway, Cyprus, North Rhodesia (Zambia), Chile and Peru.[17] The scale of imports from South America beginning in the 1950s, however, was something new.

Strategic development during the 1960s

During the 1960s, it became an increasing problem for NA to source its raw material needs on the world market, something the company depended on as a

Colonies, conflicts and copper: NA in Namibia and South Africa

At the beginning of the 20th century, large deposits of copper were discovered in the Otavi region, the former German colony "German South-West Africa". NA was the main buyer of this copper ore, which was found in the heartland. A railroad line was planned to ship the material to the harbor, and the *Otavi Minen- und Eisenbahn-Gesellschaft* (OMEG) was established solely for this purpose in 1900. The new railroad route went through Herero tribal territory and the Herero were expected to cede the land along the railroad line as well as the water rights without compensation.[2] In 1904, a Herero uprising ensued, and the construction of the copper railroad line was one of its causes. The German colonial administration put the rebellion down brutally, which resulted in the death of an estimated 80 % of Herero. The survivors were forced by OMEG to work on building the railroad line until its completion.[3] NA was the principal buyer of this copper ore and processed copper from the Otavi mine far into the reign of the South African apartheid regime and only gave up the Otavi copper business in 1989 by selling its crossholding in *Otavi Minen AG*, which had been held since 1969.[4]

NA also held half the stock of the South African company *Transvaal Alloys (Pty.) Ltd.* In addition, wages were far below the minimum suggested in the code of ethics of the European Union for companies and their subsidiaries in the Republic of South Africa.[5] When the workers called a strike, Transvaal Alloys sacked 232 black workers on November 21, 1983. Only three kept their jobs. The black labor union Metal and Allied Workers Union (MAWU) tried to take legal action against this procedure in South Africa but failed, and attempts by the MAWU to approach NA did not succeed. When a black worker was badly mistreated by a Transvaal Alloys executive during the same year, the situation was exacerbated further.

A share certificate from 1921 in Otavi Minen- und Eisenbahn-Gesellschaft based in Frankfurt, in which NA held a stake from 1969 until 1989. The colonial enterprise in what is now Namibia was confiscated during the war and its production was resumed in 1947 under American auspices and the new name *Tsumeb Corporation*.

custom smelter without any mines of its own. Due to a lack of capital, it was unable to acquire "any mines of its own and sufficient financial crossholdings with mining companies".[18] In retrospect, it is correct to say that there was actually no wish to have mines of its own, not only because of the price but also because of the entire risk portfolio attached to this.[19]

NA therefore had to concentrate on the raw materials offered.[20] Competition had intensified at a time in which the overall capacities of the metallurgical industry had exceeded the quantity of freely available raw materials. Two reasons were responsible for pulling ores and concentrates from the market: First, foreign custom smelters increasingly dropped out of normal competition since their countries were either sponsoring them, had bilateral agreements with supplier countries or had weak currencies.[21] Around 1960, for example, Japanese smelters were profiting from both import restrictions and from domestic copper prices that were about 30 % higher than in other countries, which enabled them to top prices paid to suppliers. The situation was similar in the controlled economies of the Eastern Bloc countries, whose smelters were able to calculate with extremely low smelting fees.

A rare picture: a staff photograph taken in 1908 at the Tsumeb copper smelter in the north of what is now Namibia. Shortly before this, large copper deposits were discovered in the Otavi region, then still part of the German colony of German South-West Africa. NA was to become the principal buyer of this copper.

Second, there were the increasing aspirations at economic self-sufficiency of formerly pure supplier countries to establish their own metallurgical industries, thus adding value to their respective ore extraction activities. This initially applied to Finland, Sweden and Yugoslavia, which had established their own smelting plants and were processing some of their raw materials themselves. Outokumpu had already had its own smelting plant since 1936, ceased the supply of concentrates temporarily in 1938 and entirely in 1945.[22] Supplies of blister were also declining after the Pori mine installed its own electrolysis facilities in 1941. The same thing had already happened at Bor in 1939, so supplies of Yugoslavian blister ceased in 1952 at the latest.

Similar tendencies could be seen in both Turkey and Chile in 1960. During these years of African independence movements, the management in Hamburg looked with apprehension at the mining regions in Namibia, South Africa, the Congo and North Rhodesia (Zambia), from which NA sourced most of its blister copper in 1960.[23]

Against this background, NA tried to expand its influence on supplier countries. This did not, however, have any lasting effect with regard to direct smelter projects. One example of this was the company's endeavor from 1956 onward to win the internationally tendered construction of a mine at Las Ventanas, Chile, which was due to be commissioned in 1962.[24] In 1961, the company again submitted a bid for the project of an additional copper tankhouse near the central Empresa smelter.

Everybody pitching in: men shunting an anode cart in the ELNO in 1973. The end of the economic boom in the 1970s posed entrepreneurial challenges to NA. These were met jointly, with rationalization measures and short-time work, for example, until the situation had eased again.

Both of these projects were intended to preserve the chances of obtaining the Chilean smelter's annual output of between 20,000 and 25,000 t of blister copper. However, none of NA's bids were accepted.

There were two other examples in the case of Norway, which was also building its own ore processing facilities. From 1964 onward, NA made profitability calculations for a smelter and refinery there. In 1969, a concrete plan with a 50 % stake was made. However, it had to be abandoned by 1971.[25] The company's actual financial stake in Norwegian copper mill *Vigsnes Kobberverk* from 1962 onward was a loss-making venture, and up to 1971 the capital investment had to be completely written off due to the continuing losses incurred.[26]

The interests of NA in international mining companies, for example in Africa, were more fruitful with regard to obtaining raw materials than the smelter projects had been. In 1966, the company acquired a small stake of 1.77 % in *Palabora Mining Company Ltd.*, Johannesburg, which was intended to secure supplies of copper anodes.[27] The involvement was lucrative with good dividends and a profit of more than five million Deutschmarks when the stock was sold in 1977. What is more, business relations with the purpose of securing supplies remained intact afterward. After Palabora had installed its own tankhouse, NA obtained cathodes from there until the 1980s and beyond.

Something similar applied to ore resources from the copper-lead-zinc deposits in the Namibian Otavi highlands. Between 1969 and 1989, NA had held a stake in Otavi-Minen AG headquartered in Frankfurt which had at times been 50 %, and through this involvement it acquired a 50 % stake in the Johannesburg subsidiary *Otavi Mining Company Ltd.* in December 1975.[28]

Simultaneously, it came into the possession of half the shares in South African Transvaal Alloys (Pty.) Ltd. This company was producing vanadium for steel refining in Middelburg, South Africa. After its complete takeover in the middle of 1980, it was the first international production directly connected with NA that was completely different from NA's traditional product range.[29]

During the 1970s, the Pacific Rim was becoming increasingly important for the sourcing of raw materials. Ore deposits had just been discovered and developed at Ertsberg in West Irian, the Indonesian part of New Guinea, as well as at Bougainville in Papua New Guinea.[30] At an early stage, NA succeeded in securing long-term supplies of concentrate from one of the mining companies involved, namely *Freeport Indonesia Inc.*[31] Agreements which also included a 5 % stake held by NA followed in 1969. The first supplies of concentrates arrived in Hamburg in the fall of 1973. The same was achieved with Bougainville Copper Ltd., which also started supplies to Hamburg in 1973. This agreement was groundbreaking for NA's technical and strategic development. The agreement with Freeport expired in the spring of 1981. After that, Bougainville Copper Ltd.became the partner for concentrates from the region.

The limits of growth? The economic challenges of the 1970s

During the 1970s, the Federal Republic of Germany experienced economic crises for the first time. The high rates of growth, extensive price stability and low unemployment which had always enabled the federal government to pursue a generous policy of expansion all became a thing of the past. Domestic demand was saturated and new production methods lowered labor input. Unemployment increased while incomes decreased. German gross domestic product dropped in 1974/75.

In 1972, the Club of Rome, an association of renowned scientists and industrialists, warned of the "limits of growth", according to which vital resources would be

Aurubis and world events

November 21, 1963

US President John F. Kennedy is shot.

1972

Commissioning of the first wire rod plant and start of production.

1973

The first oil crisis unsettles the global economy.

1975

Joint venture of NA with Chilean copper producer Codelco and Hüttenwerke Kayser (HK) from Lünen leads to the founding of *Deutsche Giessdraht GmbH*.

1977

"German Autumn": RAF (Red Army Faction) movement terrorizes West Germany.

1979

Development of the energy-saving Contimelt process at the RWO primary smelter.

April 26, 1986

Nuclear reactor disaster at Chernobyl, Soviet Union.

1989

The new copper tankhouse (ELWO) is commissioned.

October 3, 1990

German re-unification. The GDR accedes to the Federal Republic.

In March 1975, Deutsche Giessdraht (DG) GmbH was the first production joint venture which was established at Emmerich am Rhein. Both the Chilean Codelco Group and Hüttenwerke Kayser at Lünen became partners of NA. With its approximately 120 employees, DG is the specialist for producing wire rod within the Aurubis Group today.

Cablo Metall-Recycling und Handel GmbH was founded in 1949. As part of Aurubis, the plants at Fehrbellin (see photo) and Strass specialize in the separation of metals and plastics and the recycling of cables.

exhausted within a foreseeable period of time if the world population maintained its current behavior.[32] In point of fact, militant conflicts in the Arab region were followed by a dramatic rise in oil prices and a decrease in supplies. At the latest from 1975 onwards, the entire economy was in crisis mode.

NA soon felt the particular challenges. A massive drop in metal prices posed a great problem to the company.[33] At the beginning of the crisis, streamlining and cost-cutting measures were implemented. However, from the end of the 1970s, there were no further layoffs or short-time work.[34] The workforce rallied behind the company, and difficult situations were tackled and mastered together.[35]

In 1975, NA embarked on a special path when it entered into a joint production venture for the supply of raw materials for the first time after smelting plant projects and stakes in mines.[36] This was both a vigorous step and a very individual approach at that fraught time. In March 1975, together with Chilean copper producer *Codelco* and *Hüttenwerke Kayser* (HK) in Lünen, Germany, *Deutsche Giessdraht GmbH* (DG) was established at Emmerich am Rhein. NA and Codelco each held 40 % of the stock, while Hüttenwerke Kayser held an interest of 20 %. This joint venture can be regarded as the first production cooperation between NA and a foreign company and was an important forebearer of future internationalization.

This led to the "Rheinrod" brand being introduced in 1977. The focus of the Chilean partner was on marketing their unwrought copper in Europe. Kayser had the opportunity of offering wire rod on the market without any risk to the company. With its own plant in Hamburg, NA acted as a provider of know-how.[37] Rheinrod was sold by NA, Hüttenwerke Kayser, Codelco and by dealers in the same core market.[38]

The 1980s that followed and early 1990s were characterized by stricter environmental regulations as far as NA was concerned. The opening up of Eastern European markets after the fall of the Iron Curtain, however, was also of great significance. There was a considerable increase in the supply of copper scrap metals and NA became one of the biggest buyers of scrap copper. Due to its strength in combining the processing of concentrates and secondary raw material, which had been proved over decades, NA was initially in a technical position to take up and process these quantities.[39] In addition to making use of this strength, another strategic element followed later which was a major driving force in the acquisition of Hüttenwerke Kayser at Lünen: the merging of two companies' skills in raw material purchasing, which complemented one another.

What should be noted about these years is the fact that the management at NA seized the chance of long-term

Retorte, founded in 1949, produces selenium products for the glass and animal feed industries. The Röthenbach plant has been part of the Aurubis Group since 1974.

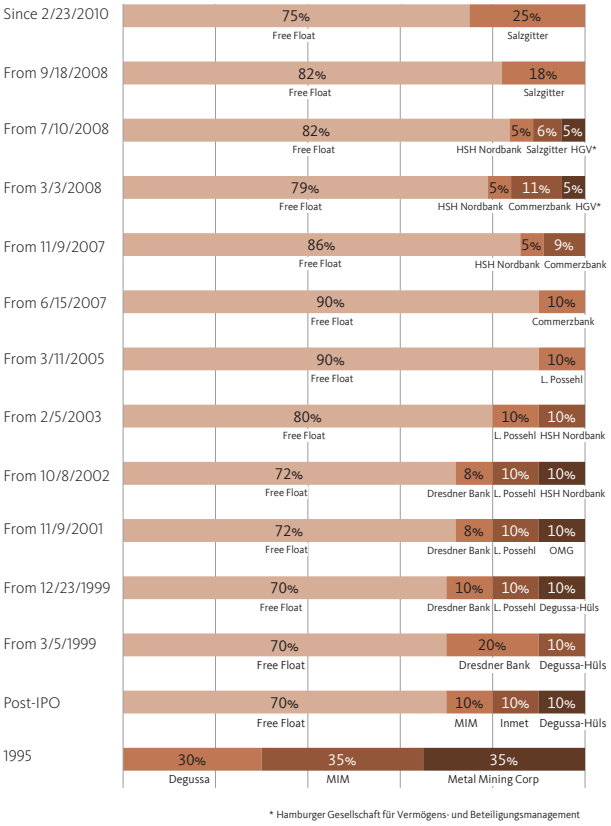
modernization instead of lamenting short-term profit losses. They focused on expanding the plant into the "most modern and eco-friendly copper mill complex in the world" and subsequently invested millions into measures to protect the environment.[40]

New freedoms after the stock market launch

In the summer of 1998, the major part of the stock of NA was placed for free stock exchange trading. However, there had been changes in the stockholder structure during the previous years. In 1993, Metallgesellschaft, which had been the traditional majority stockholder in NA since 1910, experienced turbulence due to its own forward contracts on oil. At that time, it had already restricted NA's entrepreneurial freedom by taking over vital corporate areas such as the purchasing of raw materials and parts of product sales. As a result, NA had been on the way to becoming just a contract manufacturer for Metallgesellschaft.[41]

There was no room for further strategic development at NA during the remaining years prior to going public, either, because 35 % each of its stock was held by Canadian Inmet Mining Corp., which had replaced Metallgesellschaft as co-owner, and Australian Mount Isa Holdings Ltd., while Degussa in Frankfurt held 30 %.

Stockholder history



* Hamburger Gesellschaft für Vermögens- und Beteiligungsmanagement

The international stockholders aligned NA according to their interests, which, in view of their own somewhat difficult financial situation, were focused on maximizing dividend income coming from the company.[42] Taking into account the situation at the time, this exerted very high pressure on NA's revenues with the result that its further development took a back seat. The two years prior to going public were determined by intense discussions, in particular with the German majority stockholder Degussa, about the right economic future of the company.

The NA management was able to persuade Degussa to agree to going public and thus to the company's release into self-determination. The international stockholders

Advertisement for going public.

were persuaded to go along with this, in their own interest.

Parallel to this, NA had already executed reductions in both labor and energy costs. This was another part of the endeavor to avert a possible change of its legal form, which the management believed would ultimately have led to the company closing down.[43]

When in the spring of 1998 the three owners announced they would sell shares and only retain a maximum of 10 % each, NA had been prepared for some time.[44] Prepared for the chance to utilize the new freedoms following a redistribution of shares for the pursuit of strategies of its own and to focus on copper as its core business. The consideration behind this step was thus not so much the typical intention of raising capital but an economic "act of liberation" which was to enable both an expansion and parting with peripheral activities.[45] It should not be forgotten that this IPO was not an easy one – and that it was repeatedly delayed even in the summer of 1998.

By mid-June it became certain that the shares would be placed on the market in July 1998 as scheduled.[46] The issue price of the 22.4 million individual shares was 25 Deutschmarks and the placement volume was 560 million Deutschmarks.[47]

NA's own advertisement stated, "The copper stock is coming." All in all, the company communicated its benefits quite clearly: At several press conferences, Dr. Werner Marnette pointed out that copper was indispensable as a metal of the future. He referred to the pivotal position of NA in both the German copper market (55 % market share) and the European one (18 % market share).[48] He also mentioned the company's strength in recycling, its compliance with strict environmental standards, the cultivation of close customer relations and the pursuit of a strategic plan for growth. The success of these efforts became apparent when the "copper stock" was oversubscribed several times during the period between June 24 and July 3.

After July 7, 1998, the first trading day at the Frankfurt Stock Exchange, the share of private investors was 41 %, while various major stockholders such as the *Possehl Group*, the former *Hamburgische Landesbank* and *Dresdner Bank* held 10 % each.[49] The stock market flotation was a success and an important step toward greater independence.[50] The listing on the stock market had paved the way for an expansion of the company's basis.

The acquisition of Hüttenwerke Kayser AG in Lünen in 1999/2000 and its integration in 2004 earned the Group a specialized recycling center. Starting in 2002, NA moved further along the value chain and closer toward the retail markets with its acquisition of Prymetall in Stolberg and its 50 % stake in *Schwermetall*

Aurubis is the world's largest copper recycler. The plant at Lünen near Dortmund is the Group's recycling center, which processes complex recycling materials.

Halbzeugwerk GmbH.[51] The takeover of *EIP Metals Ltd.* in Smethwick/UK, a slitting center for strip products, on January 1, 2005 ensured that the British market was attended to. Customer orientation in the Eastern European business was accelerated by the establishment of the new slitting center *Prymetall Slovakia* in Dolný Kubín in February 2007.[52]

North Rhine-Westphalian success stories – Lünen and Stolberg

The strategic room to maneuver gained by going public was used to acquire two companies in North Rhine-Westphalia. Both Hüttenwerke Kayser AG in Lünen and Prymetall GmbH in Stolberg perfectly complemented the production portfolio of NA.[53]

On January 1, 2000, NA acquired the majority of shares in Hüttenwerke Kayser from Lübeck trading enterprise *L. Possehl & Co.*, which had held them since the 1940s. In return, Possehl took over 10 % of stock in NA together with a seat on its Supervisory Board.[54] In 2004, Hüttenwerke Kayser was fully integrated into NA.

The merger with Kayser was more than merely a first step beyond Hamburg. NA had long been deploying the process technology of using recycling materials in

1998

"The copper stock is coming": NA goes public. The 22.4 million individual shares at an issue price of 25 Deutschmarks amount to a volume of 560 million Deutschmarks and are oversubscribed several times from the start.

1999/2000

Takeover of Hüttenwerke Kayser AG in Lünen.

September 11, 2001

Islamist suicide attackers commit terror attacks on the World Trade Center and the Pentagon in the US.

2002

The Group acquires Prymetall GmbH & Co. KG in Stolberg, today renamed Aurubis Stolberg GmbH & Co. KG. Commissioning of Kayser Recycling System (KRS) at the Lünen plant.

January 1, 2002

The euro is introduced as legal tender in Europe.

June 28, 2004

The acid tanker ENA 2 has an accident in the port of Hamburg and its cargo runs into the Elbe River. The damage caused is only minor because the sediments in the river water are able to buffer the sulfuric acid almost completely.

January 2005

Commissioning of new silver electrolysis plant in Hamburg.

2007/2008

Takeover of Belgian copper producer Cumerio. The smelter at Pirdop, the refinery at Olen, the wire rod production plants at Olen and Avellino and the specialty profiles production at Yverdon-les-Bains are all incorporated into the Group.

The melting down and refining starts at Kaiser-Recycling-System at Lünen, shown here before it was renamed. The plant uses not only copper scrap metals but also electronic waste and complex recycling materials.

regular smelting operations. In addition to the expertise gained by this, the company now acquired a separate recycling center together with the know-how that existed at the Lünen plant.

At the same time, NA was able to combine its prominent position in purchasing concentrates with the specialized buying of scrap metals and secondary raw materials at HK. This acquisition was one of the most important steps in the recent history of expansion at Aurubis.[55]

Today, the Lünen plant is the Aurubis recycling center and it is also thought to be the world's biggest copper recycler, with more than 550 employees processing complex recycling materials.[56]

History of Hüttenwerke Kayser

In 1861, C. Wilhelm Kayser founded Hüttenwerke Kayser in Berlin as a plant for processing industrial residues containing silver, copper and tin. In 1916, the company expanded its capacities by building a new production facility at Lünen near the industrial plants in the Ruhr area as well as the Sauerland and Siegerland regions.[6]

NA had been planning a takeover of Hüttenwerke Kayser as early as the end of the 1930s, hoping to monopolize the metal received from the campaign to donate metal objects. The intention was that Kayser was to carry out the preliminary work and then ship the copper to Hamburg for electrolysis. However, the banks rated the stock at too high a value and, in addition, the tankhouses would have had to be modernized at great cost. The acquisition attempt therefore failed.[7]

History of Prymetall

In 1530, goldsmith Wilhelm Prym established a business for the production of brass and copper in Aachen. Ever since that time, the Prym Group has been 100 % owned by the founding family and is considered to be Germany's oldest industrial enterprise.[8] Prym relocated to Stolberg in 1642. In the middle of the 19th century, the company expanded its industrial production of finished products made of brass, steel and iron and invented the patent fastener for clothing in 1883. Today, the Prym Group includes three subsidiaries which act independently of each other on the market: *Prym Consumer, Prym Fashion* and *Prym Inovan*. *Prymetall* split off from the group in 1993 and continued to focus on the production of rolled and drawn products made of copper and copper alloys.

In 2002, Aurubis expanded even further beyond the limits of the Hanseatic City: With the takeover of Prymetall GmbH & Co. KG, the Group acquired an additional location at Stolberg.

Together with its 50 % stake in Schwermetall Halbzeugwerk GmbH & Co. KG, with the other half held by strong

The Aurubis plant at Stolberg supplies strip, foil and shaped wire made from copper and copper alloys to the world market. Aurubis Stolberg GmbH & Co. KG has been part of the Group since 2002 and produces about 50,000 t of semi-finished products per year.

Stolberg is also home to Schwermetall Halbzeugwerk GmbH & Co. KG with a 300-strong workforce. They produce about 216,000 t of pre-rolled strip annually. The market leader for copper and brass pre-rolled strip is a 50 % subsidiary of Aurubis AG.

strategic partner *Wieland Werke* in Ulm, Prymetall was integrated into NA beginning in January 2002. Dr. Bernd Langner became its first CEO and worked to represent the plant's interests. This acquisition was another pivotal step in the direction of further processing and a strengthening of its position as supplier to the European semi-finished products industry.[57] In 2009, Prymetall GmbH & Co. KG was renamed Aurubis Stolberg GmbH & Co. KG. Today, about 400 employees at Stolberg produce an annual output of 50,000 t of semi-finished copper and copper alloy products.[58]

The takeover of Cumerio

In February 2008, NA acquired 91 % of shares in Belgian copper producer *Cumerio*. By mid-March the company held 95 % and was able to initiate the so-called "squeeze-out", the compensation of the remaining free stockholders.[59] On April 15, 2008, Cumerio was finally taken off the market and became wholly owned by NA. The transaction had a volume of € 777 million and Cumerio stockholders accepted the offer of € 30 per share.[60] The business was of great strategic significance to NA, as it represented the "first important step toward further international expansion" within Europe.[61]

Umicore S. A., a Belgian materials technology group, focused more on the product business and particularly on platinum group metals and their recycling. Its copper division Cumerio sa/nv was supposed to pursue its own copper strategy. During its first fiscal year, the company generated revenues of € 3.4 billion with more than 1,400 employees in Belgium, Bulgaria, Italy and Switzerland. Even before acquiring Cumerio, NA had already had ties to Umicore, a group which had been founded as a mining company in 1906, for the following reasons: On the one hand, Umicore had merged with their traditional supplier *Metallurgie Hoboken-Overpelt* in 1989 and the Belgian company, on the other hand, had taken over the precious metals division of Degussa, a co-owner of NA, in 2003.

In the summer of 2007, the intended takeover generated public attention when a regular "bidding war" began. Initially, NA did not seem to have any competition for Cumerio when the plan for the merger was made public on June 24. However, on June 27, Austrian-based international conglomerate *A-Tec* suddenly announced it had acquired 5 % of Cumerio stock, apparently with the intention of forming a "European copper conglomerate".[62] Only a few days later, A-Tec increased its stake and by July 5 achieved the blocking minority of 25 % plus one share.[63] Therefore, NA was no longer able to realize

Aurubis Bulgaria in Pirdop is located about 90 km east of the capital city of Sofia. A new copper tankhouse was commissioned in Pirdop on October 28, 2008.

Approximately 820 employees produce anodes, cathodes and sulfuric acid here. Today, Aurubis Bulgaria is the biggest copper producer in South East Europe.

At Aurubis Belgium in Olen, approximately 30 km from Antwerp, about 500 employees produce anodes, cathodes, wire rod and specialty wire.

Aurubis Italia at Avellino near Naples is the only manufacturer of copper wire rod in Southern Italy. About 100 employees produce just under 170,000 t of wire rod and 7,100 t of wire here annually.

its original intention of acquiring a stake in Cumerio of a minumum of 80 %.[64] On June 15, only two weeks before entering Cumerio, the Austrians had acquired the 10 % of NA stock which had previously been held by the Possehl Group from Commerzbank. A-Tec thus became a new major stockholder and later even expanded its stake.[65] As a trade-off for giving in with regard to the merger with Cumerio, however, A-Tec then demanded a stake of more than 25 % in NA as well as three seats on the Supervisory Board in Hamburg.[66]

The anti-trust authorities were concerned about such a three-way deal between A-Tec, NA and Cumerio. In the end, it was prohibited by the German anti-trust office on February 28, 2008, the day before the NA annual general meeting. The merger of Cumerio and NA, on the other hand, was permitted in principle by the European Commission.[67]

It was obvious that the competitors were guided by different motives. Both NA and Cumerio were driven by concerns about the copper industry, their own competitiveness and a sellout of company assets. A-Tec was apparently interested in a lucrative financial investment to consolidate its mixed group structure.[68] The industry viewed this in a similar way and the city of Hamburg came to the aid of NA by buying into its large local employer.[69] All of these factors, combined with an increase in capital stock of NA AG in November 2007, were a sign to A-Tec that their interference was unwel-

come.[70] In the end, the contender had no choice but to withdraw in the following February.

There were some significant changes within NA's Executive Board: On November 9, 2007, Dr. Werner Marnette, who had been chairman of the Executive Board since 1994 and was the driving force behind the "act of liberation" represented by the stock market launch and the initial steps towards the takeover of Cumerio, left the company by mutual agreement. He was succeeded by Dr. Bernd Drouven.

After February 29, 2008, it was ultimately the Hamburg company that rearranged the European copper market and rose to become its leader. Soon after, in the spring of 2008, more than 30 integration teams started to work on tapping the expected synergies.[71] These included the optimization of purchasing and sourcing, general group logistics, processes and utilization of capacities, together with knowledge transfers, specializations and the concentration of research and development.[72]

Two examples are cited to illustrate the initial measures.[73] First, the flash smelting furnace in Hamburg already had an annual capacity of 1.1 million t, However, the almost identical furnace at Pirdop was originally designed for a larger volume of throughput than the one in Hamburg. This previously idle potential could now be utilized simply and quickly by the transfer of know-how without any major investments. Second, the opportunity arose of centralizing the processing of anode slimes containing precious metals, which were accumulating at both Olen and Pirdop, centrally in Hamburg. The new custom-built anode slime facility was commissioned in 2013.

Both companies, NA and Cumerio, were able to see the benefits of the merger, which is why there were no "classic tensions" resulting from fear of plant closures.[74] In the spirit of cooperation, the integration of different plants was achieved, such as the smelter at Pirdop, Bulgaria; the refinery at Olen, Belgium; the wire rod production at both Olen and Avellino, Italy; as well as

Aurubis and world events

2008

World economic crisis caused by subprime mortgages issued by US banks.

October 28, 2008

A new copper tankhouse is commissioned at the Pirdop smelter of soon-to-be renamed Aurubis Bulgaria.

February 26, 2009

The shareholders at the annual general meeting adopt a motion to rename the group Aurubis AG.

March 11, 2011

Earthquakes in Fukushima, Japan destroy several nuclear power stations. Radioactive emissions contaminate the environment.

September 1, 2011

Acquisition of the Rolled Products Division (RPD) of the British Luvata Group is completed. With its subsidiary in Buffalo, USA, the first step is taken in the direction of international expansion outside of Europe.

August 2013

Commissioning of new anode slime processing plant, which processes all anode slimes produced across the Group in Hamburg.

2013–2015

Installation of a new lead refining facility at the Hamburg plant.

150 Years of the Future. Aurubis

April 28, 2016

Aurubis AG celebrates its 150th anniversary.

2009 was an important year for Prymetall GmbH & Co. KG: The Aurubis AG company logo was mounted onto the building. Today, about 400 employees manufacture semi-finished copper and copper alloy products under the name of Aurubis Stolberg GmbH & Co. KG.

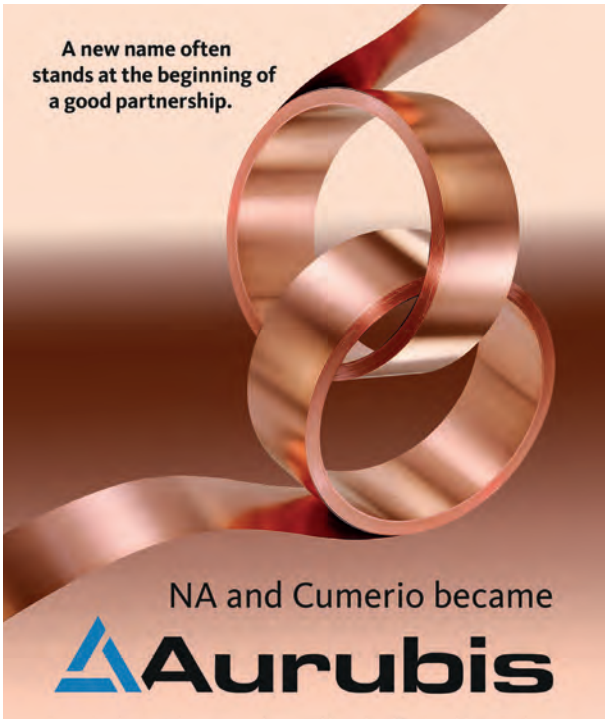
the specialty profile production at Yverdon-les-Bains, Switzerland.[75]

The Bulgarian example in particular demonstrated how the plants immediately benefited from investments in production technology when a new copper tankhouse started operating at Pirdop on October 28, 2008.[76] Local staff integration required initial visits by management, staff exchanges between locations, integration seminars and events.[77] From 2008 onward, about 4,800 employees at 12 production sites in seven European countries were covering major areas along the copper value chain with their expertise.[78]

A new name: Aurubis, "red gold"

On February 26, 2009, the participants of the annual general meeting of NA AG at the Hamburg Congress Centrum decided to rename the company Aurubis AG.[79] A new international name for the corporation had already been demanded during the takeover negotiations with Cumerio in 2007.[80] The name Aurubis is derived from the Latin terms aurum, "gold", and rubrum, "red", and can be freely translated as "red gold". The catchy name emphasizes the significance of copper as a metal of extraordinary value. It also reflects the new international character of the Group since 2008. Today, the change of name also underlines the cooperative merger and the new positioning in the Group's formal presence.[81]

Dr. Bernd Drouven, then chairman of the Executive Board, stated that, ultimately, the new name had been conducive to integration. The Executive Board nonetheless admitted that they had "slept badly" before the announcement and had wondered how this step would be received.[82] It was in Hamburg in particular where questions with regard to the company's own identity were asked: Will our own profile, which was built up in a long tradition, still be recognizable within a global corporation? However, there was hardly any time to ponder this question in the excitement of that Decem-



On September 1, 2011, the acquisition of the Rolled Products Division (RPD) of the British Luvata Group was concluded. Rolled products are used, among other things, as cladding for surfaces or roof structures in architecture but also in telecommunications and solar thermal power applications.

ber 17, 2008. The secret was revealed when, starting at five o'clock that morning, staff were given t-shirts and other merchandise bearing the name Aurubis.[83] Public displays and presences were altered immediately after the crucial annual general meeting, and conspicuous logos on the outside of plant buildings replaced the old ones beginning at the end of March.

Acquisition of Luvata's Rolled Products Division

On September 1, 2011, the Group expanded again to include new employees, products and expertise when the acquisition of the *Rolled Products Division* (RPD) of the British Luvata Group was finalized.

Rolled products are used as cladding or roof paneling in construction. Other very successful formats are strip products for connectors, solar thermal energy and telecommunications, or for engine and system cooling.

During the year prior to its acquisition, Luvata RPD produced 160,000 t of strip products, panels and sheets, generating revenues of about € 1 billion.[84] The 1,100 employees of Luvata's Rolled Products Division were mainly working at the four production sites at Pori, Finland; Finspång, Sweden; Zutphen, Netherlands; and Buffalo, USA.

After the takeover in the fall of 2011, Aurubis boasted not only 16 production sites worldwide but also four service centers, an extensive sales network and on-the-ground presence in 22 countries in Europe, Asia and North America. With the former Luvata subsidiaries, 11 companies were integrated into the Group.[85]

The divisions of both companies complemented each other ideally, so the product portfolio could be expanded in a way that made sense.[86] Aurubis already possessed expertise in flat rolled products with its Stolberg plant, which produces copper strip and high-performance alloys for special applications. Aurubis'

Luvata and the connection to Scandinavia

Luvata's roots are in Scandinavia. In 2005, the Finnish Outokumpu Group sold its copper division *Outokumpu Copper Products Oy* to British investment group *Nordic Capital*. Since then, the manufacturer of copper products has been active worldwide under its new name Luvata, which changed to Luvata International in 2014. Its product segments are heat transfer solutions, tubes and special products like superconductors, rods and sections. They also included rolled products until that division was sold to Aurubis in 2011.

The former parent company Outokumpu has specialized in stainless steels and other high-performance materials since 2005. The company continues to maintain its traditionally strong business ties with Germany in these segments, since Outokumpu, with its own ore mines, had already been a major supplier of copper to NA before World War II. From a technological viewpoint, too, the Finns developed into a first-rate business partner, since NA adopted the flash smelting process developed by Outokumpu (now *Outotec*) for its new smelter in 1972.

The Dutch Aurubis plant at Zutphen with more than 300 employees manufactures rolled products from copper and copper alloys. The plant became part of the Group with the acquisition of Luvata RPD.

With about 200 employees, Aurubis Finland Oy manufactures rolled products at the Pori plant. Its flat copper sheets are used by architects for implementing creative solutions for cladding and roof structures.

Business Line Flat Rolled Products was now expanded with further product segments and access to highly specialized technology such as vertical thin strip casting. Today, primary materials produced internally secure the supply of raw materials. In addition, preproduction capacities are better utilized.

In the course of restructuring the division, the Swedish production of copper thin strip was discontinued at the end of 2013 and was moved to the Netherlands and the US.[87] The consolidated rolling mills are now "dedicated mills", i. e. they specialize in certain product segments.[88]

Regarding revenues, Aurubis has a higher international presence, especially in North America and, via sales platforms, also in Asia. This has enhanced its opportunities for participation in the predictable growth of customer markets.[89]

The acquisition of Luvata served to strengthen the company's position within the strip industry.[90] There were subsequent explorations of further selective expansion projects; however, these were not actively pursued by Aurubis after further consideration. Since "the right acquisition objects simply weren't available", Peter Willbrandt, then chairman of the Executive Board, focused on internal solutions for growth.[91] Dr. Bernd

At the Aurubis Buffalo plant in the US state of New York, roughly 650 employees manufacture copper and brass sheet used for making numerous everyday products, among them zippers, electronics technology for connectors, circuit coolers and electronics batteries as well as rolled copper suitable for any architectural application.

Drouven subsequently continued to focus on this and pressed ahead with a “Step Up” program.

We are loyal

There would be no 150-year anniversary without the motivation and commitment of Aurubis' employees. About 6,300 people currently work at Aurubis worldwide and make up the company's central success factor.

Social responsibility

At Aurubis, the corporate Sustainability Strategy centers on people, economy and the environment.[1] Consistent safety and comprehensive occupational health, knowing about the importance of a good education and training and awareness of corporate responsibility outside the limits of the workplace are all areas in which the Group has always been and will remain actively involved – both in Germany and worldwide.

Social issues have had a long tradition here regardless of whether the subject is providing housing for employees, leisure activities, sickness and accident benefits or ensuring pension payments.

The employees are involved in operational processes, for example through the employee suggestion scheme. Other instances include the "Ergonomics Team" which was initiated as early as 1966 and the study group "People and the Workplace" on the optimization of workplace ergonomics, hygiene and psychology, which was installed in the plant administration in 1971.[2] Then, as now, it was mainly the Works Councils which, besides the personnel departments, were the interfaces for all corporate social issues at the individual sites. Since the fall of 2009, there have been meetings of the European Works Council twice a year. This organization coordinates supra-regional strategic issues across sites.[3]

Performance, Responsibility, Integrity, Mutability and Appreciation are the terms that make up the acronym PRIMA. These five corporate-wide principles were developed by staff from different sites in workshops in 2009.[4] These guidelines make up a Code of Conduct which is constantly monitored and enhanced and is closely linked to an active commitment to compliance, i.e. to law-abiding behavior and ethical conduct.[5]

Coming to Hamburg from all over the world – International labor at Norddeutsche Affinerie and Aurubis

Today, people from almost 40 nations work on the Hamburg plant premises alone. This diversity creates a new impetus for operational processes and the cooperation between international sites, and it is an enrichment not only for corporate culture but also for people living and working together. Aurubis has had experience in both international cooperation and the interaction of different cultures for decades.

The targeted hiring of international labor at Norddeutsche Affinerie (NA) started around 1960. Until the 1970s, both Spain and Turkey were the focus of recruitment efforts. The hiring of Greek staff started just as early on, while the recruitment of Yugoslav labor began in the 1970s.[6]

The targeted recruitment of workers from abroad at NA began around 1960. The first so-called "contract foreign labor" came from Spain, Turkey and Greece as well as from the former Yugoslavia.

Until the mid-1970s, the recruitment of "contract foreign labor" followed a similar pattern. NA notified liaison offices at either consulates or labor exchanges in the country of recruitment of their requirements. These offices recruited potential candidates from whom the company selected suitable workers.[7] In addition, relatives of foreign workers already employed by NA were specifically invited to apply for jobs on their recommendation.[8] Quite often, entire groups of mostly male workers came to Hamburg to be hired.[9]

From an early stage, the management was aware of its responsibilities toward every single recruited worker: "We are obliged to help him settle in."[10] However, the integration of foreign colleagues also brought challenges with it. The first one was their accommodation in either residential facilities, company-owned apartments or those offered by private landlords. Initially, there was definitely a certain pragmatism prevalent in finding accommodation quickly.

At the end of 1960, a Spanish newspaper reporter who visited a residential facility at Ehestorf – 17 km from the plant – provided some insights into the housing situation of foreign "guest workers": functionally furnished rooms with four beds each, a leisure room, two dining rooms, a garden and a small sports ground were available to residents. His conclusion was that "the workers (...) live under the best conditions here".[11] The "residential facilities for guest workers", such as the one in Veddel or

NA built housing estates with apartments for their employees, such as the one above at the Packersweide on Veddel Island in Hamburg.

Emmetal, were also surveyed by members of the Works Council.[12] The apartments at Georgswerder, which were completed in 1971, consisted of two or three rooms and had their own kitchens and bathrooms, central heating and a playground, so they offered suitable accommodation for families with children as well.

An additional challenge was the training of the new colleagues with regard to special processes and safety at work. Of course, language barriers and cultural differences occasionally led to misunderstandings which endangered both safety at work and work results.[13] For this reason, weekly German language lessons were arranged together with practical instruction in relevant work areas plus week-long induction courses focusing on accident prevention and plant and workplace safety.[14]

Labor migration to Germany during the 1950s

After World War II, the economy in West Germany grew rapidly. A downright "economic miracle" evolved as the result of a variety of causes such as the social market economy system, Ludwig Erhard's determined economic policy, free trade agreements both within Europe and with the US, the restructuring of global markets as well as the reorganization of international currency systems.

The Federal Republic of Germany had sufficient skilled labor, however, the economic boom resulted in a comprehensive lack of unskilled and semiskilled workers in industrial mass production, the heavy industries and the mining sector.[1]

The situation in the states surrounding the Mediterranean was completely different: In Italy in particular, there were large numbers of people unable to find work. To solve these problems, the Federal Republic of Germany entered into an agreement with the Italian government on December 20, 1955 with the aim of recruiting so-called "guest workers" for a limited period of time. During the 1960s, further recruiting agreements were entered into with Spain, Greece, Turkey, Morocco, Portugal, Tunisia and Yugoslavia.[2] As a result of the worsened economic situation and the so-called "oil crisis", the recruitment policy was stopped in 1973. The labor market was considered to be saturated. At the time, there were 2.6 million foreign "guest workers" employed in the Federal Republic of Germany. The largest group among these, numbering 605,000, was Turkish immigrants.[3]

The workplace safety engineer was supported by interpreters because linguistic subtleties were vital to a precise understanding of both risks and safety equipment.

NA also offered support with formalities such as obtaining residence and work permits, insurance and tax matters, in cases of sickness or with cash transfers to home countries. In order to tackle concrete problems, and on the initiative of plant managers, regular contact

In March 2013, the Muharrem Acar Bridge was inaugurated in Hamburg-Wilhelmsburg. It is pictured here with Works Council member and training supervisor at Aurubis, Deniz Acar, the daughter of Muharrem Acar, who started his career at Aurubis as a smelter in 1979. He was a member of the Works Council and showed great civic spirit in working for the Wilhelmsburg district. This pedestrian overpass was dedicated to his memory posthumously to honor his work as a social "bridge builder".

meetings with spokespersons for the three largest groups of foreign workers – Turks, Spaniards and Yugoslavs – were agreed in 1971.[15]

Many "guest workers" developed loyal ties to their new workplace and settled into their new surroundings. 1985 was the first year in which NA was able to congratulate two foreign employees, one from Spain and one from Turkey, on their 25th anniversary with the company.[16]

As early as the 1970s, the children of migrant workers were integrated into the training and apprenticeship system at NA. Unfortunately, the German language skills of many of them were initially not sufficient for a successful conclusion of their training. However, in the cases where they managed to "overcome language problems, the young people achieved good final grades".[17]

For many years, NA has been particularly active at the juncture of school education and occupational training. At the beginning of the 1980s, a program was initiated in cooperation with the Employment Office and the local Chamber of Commerce which offered foreign youngsters a one-year course during which they could prepare for regular occupational training after completing school.[18] Aurubis has expanded this commitment and has introduced a "Practical Education Day". Today, the share of apprentices with a migration background in the company is 36 %. In the course of public discourse about refugees in Germany, which has been immensely

important in 2015/16, Aurubis has agreed to expand its training programs for officially recognized and qualified refugees.

Our young talents are still at school: cooperation and hands-on education

Aurubis is Hamburg's largest apprenticeship provider in the chemical industry. The latest corporate apprenticeship ratio was between 7 and 9 %, i. e. above the German national average.[19] Nonetheless, the individual plants are continuously on the lookout for suitable young people for the various apprenticeships offered by the company, particularly in the industrial-technical sector. One reason for this is the dwindling proportion of young people among the population, which leads to a lower number of trainees available. According to Wolfgang Gross, head of basic and advanced training at the company, another reason is a decline in the quality of general education during the last 20 to 30 years, especially in core subjects like science and math, which are essential for technical trades.[20] Last but not least, Aurubis faces competition in the trainee market from renowned major enterprises, even in Hamburg. These are usually more widely known to the public because, unlike Aurubis, they supply the retail market and appear more attractive for job training to young people.

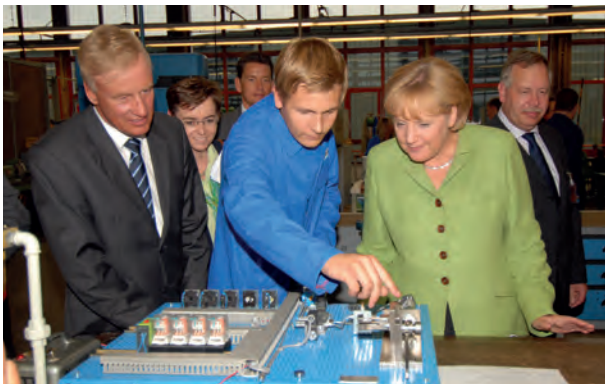
Aurubis and Schule auf der Veddel

For years, Aurubis has had close ties with Schule auf der Veddel, the former Slomanstieg-Schule. It is located near the Hamburg plant and since 1932 has been the social focus of the neighborhood, which is now characterized by cultural diversity.[4] Currently, around 90 % of the school's students have a migration background. The difficulties arising from this when it comes to achieving learning objectives are similar to those NA was trying to solve with regard to its own non-German employees and apprentices in the 1970s and 1980s.[5] This parallel was one of the reasons for initiating a successful cooperation in the early 2000s. In 2005, the cooperation became closer with the establishment of the "Förderverein der Schule Slomanstieg e. V.", a booster club for the school which is presided over by Aurubis.[6]

Aurubis counters these challenges with targeted measures. Cooperation agreements with schools and hands-on education are not only intended to spark the students' interest in technical occupations but also to enhance the qualifications of potential trainees before they leave school.

The first cooperation with a school in Hamburg started as early as the 1980s with the Gesamtschule Kirchdorf, now called Nelson-Mandela-Schule, in the form of an

On the occasion of the "Entrepreneurs Day" organized by the Association of North German Industry, former German Chancellor Gerhard Schröder visited NA in June 2002. NA apprentices presented the chancellor with a copper sundial which they had made themselves.



In August 2008, Chancellor Angela Merkel, together with Hamburg's mayor at that time, Ole von Beust, visited the plant fo find out about vocational training at Aurubis.

School projects for promoting talents

The **9-Plus Program** helps secondary school graduates who have failed to find an apprenticeship after receiving their school certificate to improve their chances of obtaining such an apprenticeship. During a 12-month internship, the participants acquire skills which give them a realistic chance of finding an apprenticeship position.

The 9-Plus Project, which is unique in Germany, was introduced at the end of 2008 at the Reichstag in Berlin. In the meantime, 9-Plus has been expanded to include other Hamburg-based companies. It is now called **AV10-Plus** and also encompasses the 10th grade.[7]

SCHULEWirtschaft is a nationwide German network of cooperation between schools and companies. Its objectives are to help students improve their occupational orientation, to facilitate teaching structures more in step with actual practice and to strengthen basic education in economics.[8]

The mint:pink program aims to introduce female students to the so-called **MINT** subjects (mathematics, information technology, natural sciences and technology). Girls as young as 12 or 13 years old are encouraged to overcome their reservations about MINT subjects. The objective of the program is to increase the share of young women both in science degree courses and in science and technology-oriented careers.[9]

annual "Vocational Information Day". However, the cooperation with Schule auf der Veddel, which was established in early 2000, is much better known.

In 2004, the "Practical Education Day" for eighth-grade students was initiated, which gives students a once-weekly insight into working life at the plant. Only a few months after its introduction, Aurubis was presented with the award "Vielfalt in Ausbildung" ("Diversity in Training") for innovative vocational training projects.[21]

Young talents wanted! Aurubis is looking for trainees in all areas.

In addition, in 2007, the 9-Plus Program was introduced, allowing students with a secondary school leaving certificate to receive vocational training at the plant three days a week. The program's success can be seen from the fact that around 70 % of participants since 2007 have been offered apprenticeships upon completion.[22] At the end of 2008, Aurubis was awarded the Hamburg school award "SchulMerkur" by the Chamber of Commerce for this initiative and in August 2010, the "Responsible Care" award by VCI Nord (the Chemical Industry Association of Northern Germany).[23]

Within the framework of the project Partners in Leadership, Aurubis has cooperated with two high schools since the end of 2012: Friedrich-Ebert-Gymnasium in Harburg and Gymnasium Rahlstedt.[24] In addition, the mint:pink program was initiated at both schools in the summer of 2014.[25]

Hüttenwerke Kayser Foundation

The Hüttenwerke Kayser Foundation was established on February 27, 1986 on the occasion of the 125th anniversary of Hüttenwerke Kayser AG. The purpose of the foundation is the encouragement of international experience to expand students' knowledge of foreign languages. Each year, grants are awarded to students from Lünen.[10]

Aurubis is also actively involved in promoting young talents at the Lünen plant. Cooperation agreements were signed with Käthe-Kollwitz-Gesamtschule in 2008, with Profilschule Lünen in 2011 and Gymnasium Altlünen in 2012. All of these cooperation agreements aim to make students fit for vocational training and to enhance their chances in the labor market.[26]

Aurubis also utilizes various trade shows and events to recruit suitable trainees. Moreover, for 20 years Aurubis has invited occupational counselors from the local Employment Agency to visit the plant in order to enable them to offer students more detailed information about the company and the different careers available.[27] Since 2001, the Aurubis plants at Hamburg, Lünen and Stolberg have participated in the annual nationwide "Girls' Day" on which girls are given the opportunity to accompany their fathers to work.[28] On popular request, Hamburg introduced a "Boys' Day" in 2011. In the meantime, both events are staged simultaneously under the name "Zukunftstag" ("Future Day").[29] In addition, for almost 30 years the Hüttenwerke Kayser Foundation has been awarding scholarships to students to support studies abroad.[30]

Furthermore, Aurubis Hamburg has been organizing a regular event for recruiting young talents since 2012 known as "Job Information Day" under the motto "Your Future Starts Here!"[31] The counterpart to Hamburg's "Job Information Day" at the Lünen and Stolberg plants is the annual "Night of Apprenticeships" event.

Aurubis has many occupational fields for which an apprenticeship is not sufficient qualification, which is why there is also focus on introducing young talent to the idea of either an engineering course of studies or a work-study program. Both university marketing and campus recruiting events such as the "International Students' Day of Metallurgy" and the "International Career Fair of Dortmund Technical University" are used to support applicant management at university level.[32]

Since 2012, Aurubis has supported suitable junior executives in the international young talent program EXPLORE!, which imparts topics such as project management, personality development, leadership and feedback culture to selected participants and works with real practice-related business projects.[33] In 2014, Aurubis Hamburg initiated a training program for qualified IT specialists completing a work-study program either at the Hamburg School of Business Administration (HSBA) or Nordakademie.[34] Furthermore, for several years Aurubis has been awarding scholarships for master's degree programs at the Northern Institute of Technology (NIT) at the Technische Universität Hamburg-Harburg (TUHH). The postgraduate management programs run for two years and are aimed at engineers.

Women, families and work – Equal treatment and work/life balance

Equal treatment and equal opportunities are a matter of course at Aurubis and are firmly embodied in the Group's Code of Conduct.[35] In 2014, Aurubis signed the

Marie Blümel and her sister Elisabeth Lux (right) in 1952 outside their kiosk at Hovestrasse 31a. They had both already helped out at the canteen at NA before 1952.

Kitchen staff in the plant kitchen at NA during World War I.

nationwide Charter of Gender Equality, which lays down equal pay and equal opportunities at work for men and women.

With approximately 12 % of the workforce being women, however, the ratio of female employees at Aurubis, especially in the industrial-technical sector, is still relatively low.[36] The proportion of women at the first two management levels below the Executive Board is just under 20 %, which can be rated as satisfactory given the Group's technical alignment.[37] "That has something to do with our processes," explains Renate Hold, chairwoman of the Works Council at the Hamburg plant and member of the Supervisory Board, not without remarking on the fact that for a long time, male applicants had been the preferred choice for jobs even in administration.[38]

Even though there are some fields in the white-collar sector where women are the majority, the company still aims to intensify its efforts to recruit women, particularly for technical occupations as well as management positions. In order to attract and qualify women, Aurubis focuses on targeted university marketing and its existing contacts with schools. Besides organizing the "Girls' Day" and supporting the mint:pink program, the Aurubis plant at Lünen, for example, also takes part in the "cross-mentoring" program initiated by the North Rhine-Westphalian federal state program as well as in the project "More Women in Management Positions".[39] The slight increase in female trainees in technical jobs shows that these measures are having an effect.[40]

Work/life balance is a highly topical issue for Aurubis, and initial management workshops on this subject were organized 10 years ago. Today, men also have the opportunity of taking parental leave.[41] The company wishes to offer its employees a good work/life balance to enhance motivation as well as long-term loyalty to the company.[42] Since October 2010, employees have been

able to call a hotline in the case of a family emergency and obtain professional support from an independent counseling service. In addition, an Aurubis Family Service was implemented at all German locations. It helps in cases of problems with the reconciliation of job and family, and with the coordination of work, childcare and family home care. Future room for improvement will mainly consist of greater flexibility of working hours and better home office arrangements.[43]

Health comes first – Hygiene and medical care

Comprehensive and consistent provisions for occupational health and safety have top priority for Aurubis and occupy a prominent position in company policy. Today, they are centrally controlled for all locations by a management system in the Corporate Occupational Health and Safety (C-OHS) Department.[44] Aurubis pursues Vision Zero, a program whose aim is the complete prevention of work-related accidents, injuries and illnesses.

Occupational health has a long tradition at Aurubis. Built in 1927, the social services building accommodated a medical ward, including a permanently staffed dressing station, as well as the office of the Company Health Insurance Fund established in 1884. There was also a laundry for work clothes there and a counter for paying wages. The building also included a locker room and washhouse to improve standards of hygiene and thus employees' health.[45] Workers were given a fresh towel

Company Health Insurance Fund

On November 29, 1884, the Executive Board of NA elected five assessors who were to manage the factory health insurance fund from that time on.[11]

The fund was based on a new law requiring compulsory health insurance for all trade and industrial workers. They were now entitled to benefits in kind such as free medical treatment, as well as cash benefits such as sickness allowances and death grants.[12] Initially, the contributions to the fund were split between employees (two-thirds) and the company (one-third). The health fund was given a new name in 1914: Betriebskrankenkasse der Norddeutschen Affinerie in Hamburg.[13]

Under the Nazi regime, the statutory democratic self-government of the fund was abolished and was only reintroduced in 1952.[14] Various laws regarding reforms in compulsory health insurance have been passed since then. The aim of this insurance is to organize healthcare cost-efficiently while assuring quality of care.

Lead workers during a medical check-up. The employees working in the lead processing plants were regularly sent on a two-week vacation by NA. These days, the biomonitoring program ensures that no more cases of lead poisoning or similar issues occur.

Taken for granted today: the plant doctor conducting a physical.

In 1927, NA built a washhouse specifically for its employees to help improve standards of hygiene and thus workers' health. After every change of shifts it was tidied up and cleaned.

Not just clean but immaculate: the washhouse with staff after the end of a shift in an award-winning photograph taken by Ralph Kleinhempel in 1952.

each week and two bars of soap a month, more if their job was particularly dirty.[46] 50 washhouse men who tidied and cleaned the washhouse after each shift were responsible for keeping the sanitary facilities clean.[47] A second washhouse was built on the southern river bank in 1952 to accommodate the rising number of staff after World War II; a third one was built later at Werk Ost.[48]

The washhouse was continuously adapted to new conditions and in February 2003 it was extensively modernized. On August 13, 2014, the groundbreaking ceremony for the construction of the new three-story building "Waschkaue Nord/Gesundheitszentrum" took place, which was completed in February 2016 and includes the modern washhouse as well as a respiratory protection workshop and the Medical Department.[49]

Yet what needs to be done if an accident does actually occur? In the old days it was not always possible to call the plant doctor right away. Dr. Korbach, a "panel doctor" who was employed by the Company Health Insurance Fund, started working for NA in the spring of 1885; however, he only visited the plant at irregular intervals.[50] It was not until 1936 that the city authorities arranged for a plant doctor to be assigned to NA. This doctor also had to work with other companies and was therefore usually only on the premises once a week. From the 1950s onward, however, the plant doctor was present for consultation at least four afternoons a week. He had a waiting room, a consulting room and a radiation chamber at his disposal.[51]

The current plant physician for the Hamburg plant is Dr. Thomas Schultek, who is also the corporate head of occupational health and in this capacity is in charge of

The company has always called on people's individual responsibility and appealed to them to be careful in their work, as can be seen here in large letters on the wall of the social services building around 1930 ("Be careful, think of your family!"). The time clock for recording working hours can be seen in the foreground.

the well-being of all who work for Aurubis. Today's health provisions include not only medical examinations and consultations but also preventive measures such as the prevention of addiction, medical checkups, back therapy training and "Apprentice Health Days". Some of these measures, however, are not as new as they seem: As early as the 1970s, NA initiated specific health campaigns, for example against smoking and alcohol abuse.[52]

When it started in 1971, the statutory health insurance offered an increasingly wider range of checkups for cancer prevention as part of its service. The Occupational Health Department at Hovestrasse also started a campaign to overcome "the dread of such checkups felt especially by men".[53] Its success is clearly visible: In 2012, about 380 out of approximately 520 men approached underwent checkups for prostate cancer prevention.[54]

In addition, there are regular skin cancer screenings. Another example of the effectiveness of the efforts by corporate health management is its addiction prevention work with a success rate of over 90 %.

Alcohol abuse

Until the end of the 20th century, alcohol in the workplace was a significant problem at NA. Beginning in the 1970s, the company actively attempted to take countermeasures against alcohol consumption at work.[15] The consumption of hard liquor was banned completely and NA tried to limit the excessive consumption of beer.

Employees who consumed large amounts of alcohol were a danger not only to themselves but also to their colleagues. To help them, NA called for increased awareness and asked for suspected cases of abuse to be reported. Both the plant doctor and the plant security service were entitled to ask employees to be breathalyzed. Over the years, society came to accept that alcoholism is a disease that can be treated. NA developed and initiated an addiction prevention program, which has been continuously expanded since the beginning of 1990. The focus of the program, which has been very successful to this day and which has been used by sufferers from all hierarchy levels, is close cooperation of all concerned, an open discussion of the illness and, as a result of this, a high degree of acceptance within the workforce. A strict ban on alcohol has been in force on the plant premises since 2004.

Besides prevention programs, another continuous focus is on monitoring risk areas at the plants. These days at Aurubis, there are no more occurrences of job-specific illnesses such as lead poisoning. To make sure that it stays this way, several thousand biomonitorings are carried out on staff each year in areas where there is a risk of heavy metal particles entering the body. Moreover, personal reward systems are used as a motivation for strengthening employees' responsibility for their own protection.[55]

Aurubis offers additional health-conducive activities worldwide at all Aurubis sites. At the American plant in Buffalo, US for example, electronic pedometers were distributed and employees meet during breaks at the "Walking Club" to walk together on the plant premises. Both Aurubis at Stolberg and Schwermetall offer their

Always at the ready: The vehicle fleet of the company Fire Department over the years (top left 1952, top right 1971, bottom left 2006). A part of the new washhouse commissioned in 2016 can be seen on the right behind the present fire fleet.

staff free use of an exercise machine for strengthening abdominal and back muscles. Numerous employees at the plant in Olen, Belgium have participated in "Diet@ Work", a weight reduction program lasting six months.

Safety concerns us all – Plant security force and safety at work

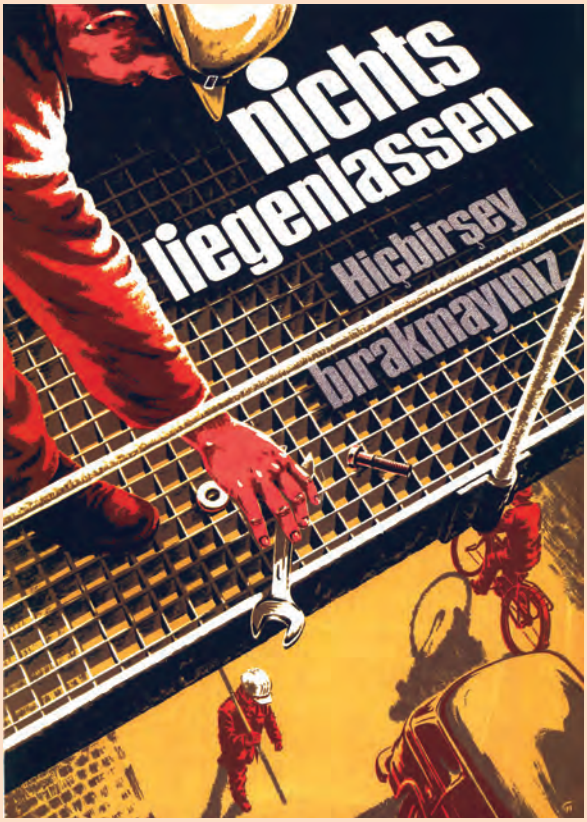
Security and safety at work have a very long tradition at Aurubis. On December 28, 1925, the company first organized its own plant security force consisting of eight former soldiers and policemen.[56] The original plan was that they should prevent thefts of metal from the premises, which had increased in frequency after World War I. After a rapid decline in the number of thefts, however, fire protection became the security force's primary task. Initially, it had to make do with only a few hydrants and fire hoses. A simple hose cart was acquired for greater mobility, while external training courses and further training was arranged at the Hamburg Fire Department.

Gas protection was introduced following a disaster at *Chemische Fabrik Stoltzenberg* on May 20, 1928. A highly toxic cloud of phosgene had moved across Wilhelmsburg from the Müggenburg lock, killing 10 people and injuring more than 300.

During World War II, the security force, equipped with large fire engines and better fire protection equipment

The first large-scale exercise of the Hamburg plant Fire Department was conducted with the municipal fire brigade in June 2012. The training scenario for an emergency was a gas alarm which was activated, and firemen rescued the "injured" from the roof of a tank wagon.

Valuable treasures: historical posters on workplace safety from the company historical archives at Aurubis AG. The silkscreen posters were designed and printed by former employee Fredo Naumann between 1970 and 1990. He worked in the department of workplace safety and as a lettering and poster designer, he was in charge of safety advertising at the plant. The posters were multilingual to ensure that all employees understood their messages.



and reinforced with additional manpower, was deployed outside the plant for the first time after air raids. In March 1971, a main supply line of the *Hamburg gas works* at Achtermannbrücke on Veddel Island developed a leak and a gigantic fire threatened the bridge. The plant security force was the first fire brigade to arrive at the scene.[57]

After the war, the field of activities carried out by the security force expanded on the whole. It not only included firefighting and preventive fire protection but also assistance after accidents, marshaling and investigation services, administration of weather and water level reports, supervision of washhouses and the provision of plant ID cards. Other tasks included escorting precious metal transports to the Hamburg airport until plane takeoff or salvage operations on the plant premises and in the waters running through them.

Since the reform of the Hamburg fire service law in 1972, NA has been obliged to maintain a full-time plant Fire Department.[58] This meant that the original plant security force turned into a plant Fire Department widely recognized to this day. Meanwhile, the plant fire brigade has 50 people on its payroll who have all undergone standard firefighter training including further training across all ranks and, in addition, a number of them have been trained as either emergency medical assistants or paramedics. They are the "department that never closes", on standby day and night, and are the first to arrive at the scene of an accident.[59]

The annual general meeting in 1964 already identified the safety of each individual employee as a "corporate task".[60] This perception was absolutely necessary because there had been more than 500 annual work-related accidents on average at NA during the previous years.[61] Sadly, there had also been up to two fatal accidents per year during this time. Dusts containing heavy metals and gaseous arsenic emissions posed a workplace hazard which workers were exposed to daily, with potentially far-reaching consequences for their health. As far as NA was concerned, this meant that it had to pay particular attention to the continuous

Protected from head to toe: Today the Group's Corporate Occupational Health and Safety Department centrally controls health protection and workplace safety at Aurubis for all locations.

enhancement of technical equipment, especially breathing apparatus and body protection; both safety and workplace convenience were of equal importance.

Other measures such as limits on working hours were recognized as conducive to safety as well. These were laid down in a labor management agreement on workplace safety on June 1, 1977; statistics showed that the number of accidents increased after the eighth working hour.[62]

In addition, there was an alarming increase in the frequency of accidents among new recruits between 1979 and 1980, and Dr. Peter Kartenbeck, then a member of the Executive Board, called for urgent action: "We will

have to improve the training of new recruits, particularly with regard to workplace safety."[63] Since the best protection against accidents is prevention, acting correctly comes from an awareness of specific hazards in different areas. After the technical and organizational measures implemented during the last few decades, the key to success is reflection on individual behavior. Thanks to all of these measures and the commitment of each employee, the company has been able to continuously lower the frequency of accidents. Today, occupational health and safety is, and will remain, one of the central issues of the company's care for its employees across the Group.

Girl power at Pirdop: The runners of the Aurubis Bulgaria sports group during the annual employee run. Some of the employees even took part in the Sofia Marathon 2015 last year.

Corporate sports program – Healthy and successful

Ever since the end of the 19th century, sports-minded entrepreneurs have considered corporate sports associations to be a good way of improving the state of health and thus the performance of their workforces. The "Sport Club NA", in which staff members played soccer and handball, existed as early as 1935.[64] The corporate sports program which had been neglected during the war was revived in 1952 with financial support from the company.[65] Straight away, nearly 250 employees stated their interest in the sports offered: track and field, soccer, handball, tennis and table tennis, swimming and the separate "apprentice sports program". With regard to soccer, for example, both an older team and a youth team were quickly established.[66] Even in their first year, the soccer teams were able to compete in matches "out of which they won an astonishingly large number against good soccer teams from other companies".[67] Beyond the pure physical training, swimmers were able to acquire certificates of proficiency from the German Lifeguards' Association DLRG (Deutsche Lebens-Rettungs-Gesellschaft).

NA soon became a member of the Hamburg Corporate Sports Association and was supported by the city's sports department. Friendly relations with neighboring sports clubs were established. In 1956, new kinds of

Corporate sports is an important topic at Aurubis. No matter whether it is soccer, squash or cycling – it is a social event, beneficial to health and an occasion to make friends. The photo shows the sailing crew, which is also celebrating an anniversary in 2016: 60 years of sailing at Aurubis.

sports were added such as bowling, badminton and sailing and, in the 1970s, chess and even stamp collecting. The Aurubis Sailing Club represents the third oldest division in corporate sports.[68] During the 1960s and 1970s, the handball team of NA, which has disbanded in the meantime, won eight Hamburg championships and five cup matches.[69] Over the years, new kinds of sports such as bowling and squash were integrated. At the plant in Pirdop, Bulgaria, in-house sports competitions in different categories are organized once a year, such as in soccer, cycling, running, tennis or fishing. What all corporate sports activities have in common, however, is that the key focus is not only on fun and counterbalanc-

With its 132 m tower, St. Michaelis Church (known as "Michel") is the landmark of the Hanseatic City. Approximately 45 t of copper sheet were required for the re-roofing of the complete roof, dormer and cornice areas.

"The world is my domain": the emigration museum BallinStadt on the Hamburg island of Veddel in the Elbe River. Aurubis supports the award-winning adventure museum, which was founded in 2007 and recreates the world of that time.

The popular "GladiOlen" music festival at Olen in Belgium is sponsored by Aurubis.

ing everyday job stresses but also on strengthening team spirit and enhancing physical fitness.

Sponsoring – Education, sports and charity commitment

For Aurubis, social commitment is an inherent part of the company's identity. Arts and culture, social issues, education and science, and team sports are areas of sponsoring in which Aurubis assumes responsibility not only as a business partner, employer and supporter of young talent but also simply as a "good neighbor", both in Germany and at the Group's other plant locations worldwide.

Aurubis' special focus is on projects relating to copper – projects that reflect the company's core area of expertise. In 2006, for example, the sculptor Adam Ostrowski, supported by a team of apprentices and welders, made a copper dragon 7 m long and 5.5 m high, modeled on a sculpture in the imperial Summer Palace in Beijing.

Another facet of Aurubis' social commitment is the preservation of architectural landmarks, such as Hamburg's principal churches. The company not only provided the material for re-roofing their copper roofs but also took over the recycling of the copper scrap – a circular economy in the best sense of the word.

Team VT Aurubis, the best-known Aurubis sports sponsoring commitment. From 2016 onward, Aurubis will focus its sports sponsoring on amateur sports as well as the promotion of young sports talents and will discontinue the sponsoring of professional sports.

The "Elbstromer" water sports project sponsored by Aurubis since 2006, pictured here as they set sail at the Müggenburg Harbor.

A joint achievement: In 2006, apprentices and welders, guided by a sculptor, made a copper "good luck dragon" of 7 m length and 5.5 m height.

Aurubis enriches the lives of people living in the vicinity of its plant locations by supporting city district festivals, school outings and cultural events. This includes special initiatives like mentoring the local Junior Fire Department in Lünen, which it has done since 2007, or supporting the Elbstromer Boathouse in Hamburg since 2006. This project enables young inhabitants of the Veddel Island in the Elbe River to practice canoeing and sailing together. Besides practicing water sports, young people can also acquire additional qualifications at the boathouse by attending courses for future youth leaders, first aid and life-saving education organized by the DLRG.

In Mortara, Italy, Aurubis supports the neighborhood school in organizing IT classes as well as a local cultural initiative in arranging concerts and exhibitions.

One special sponsoring highlight, which will start in the anniversary year 2016 and will be supported by Aurubis as the main sponsor, is the Learn4Life project by the non-profit association "Sport ohne Grenzen" ("Sports Without Borders"). As part of school P. E. programs in fifth and sixth grades, students will be taught basic values such as respect and team spirit as well as communication skills and conflict management. This will be achieved with a special sports education program that will continue to shape the children's lives even after the end of the project.

In 2009, a partnership project of the Hamburg youth fire brigade and the Fire Department in Tanzania's capital Dar es Salaam delighted the capital's population with the donation of a fully functioning fire truck which had been discarded by the Aurubis plant Fire Department and came complete with helmets and equipment.

Funding of cultural projects is another important aspect of Aurubis' sponsoring, as illustrated by its major contribution to the opening of the museum "BallinStadt – das Auswanderermuseum Hamburg" in 2007. This museum is situated in the immediate vicinity of the plant premises and presents the history of emigration to the New World as well as contemporary migration topics. Issues which seem very obvious to a company employing people from almost 40 nations in its Hamburg plant alone.

In 2008, Aurubis was presented with the Hamburg Chamber of Commerce's "KulturMerkur" award for its corporate cultural sponsoring. Moreover, the Lünen plant has been sponsoring the traditional local film festival since 1990, while the plant in Olen, Belgium plant supports music culture at the "GladiOlen" festival.

As part of its social and ecological commitment, a partnership project of the Hamburg youth fire brigade and the fire brigade in Dar es Salaam in Tanzania was delighted with the donation of a fully functioning fire truck by the Aurubis plant Fire Department in 2009.

The Aurubis plant at Stolberg also supports the annual communal vacation program for children organized under the auspices of the town's mascot "Stolbärchen" to enable children and youth from socially deprived backgrounds to participate in varied vacation activities.

In Bulgaria, the Aurubis plant supports the children's ward of the hospital at Pirdop as well as the orphanage at Zlatitsa by providing numerous items of medical equipment. Another sponsoring project was the "Grandmother-Child Foundation", which promoted the care of orphans by older women. The company also organizes cycle races in Bulgaria, which collect funds for local SOS Children's Villages for orphans.

At the Buffalo plant, Aurubis employees support students who take part in the "Future City Competition". The central issue in this competition is the question of how the world can become a better place, and the students discuss and work on future urban development.

For many years, the name Aurubis has also stood for sports sponsoring. The 7th Orava Long Distance

Until late 2015, Aurubis Bulgaria sponsored the "Grandmother-Child Foundation", which promoted the care of orphans by older women, as shown in this photograph.

One of the many offers to awaken children's interest in the work of an engineer: In 2012/2013, Aurubis Buffalo supported the "Future City Competition". The photo shows the team of St. Christopher School presenting its city model "Heliopolis".

When Aurubis replaced the plant's fire trucks in 2007, the company donated a discarded fire truck built in 1964 to the fire department in Hamburg's sister city of León in Nicaragua. In 2012, after many deployments, the truck unfortunately fell victim to a fire itself due to unfavorable winds and was completely burned.

Cooking bread on a stick in Stolberg. As part of its social and ecological commitment, Aurubis Stolberg sponsors the town's vacation program every year. This is organized by the local youth welfare office under the auspices of the town mascot "Stolbärchen" and supports local activities for children and youths.

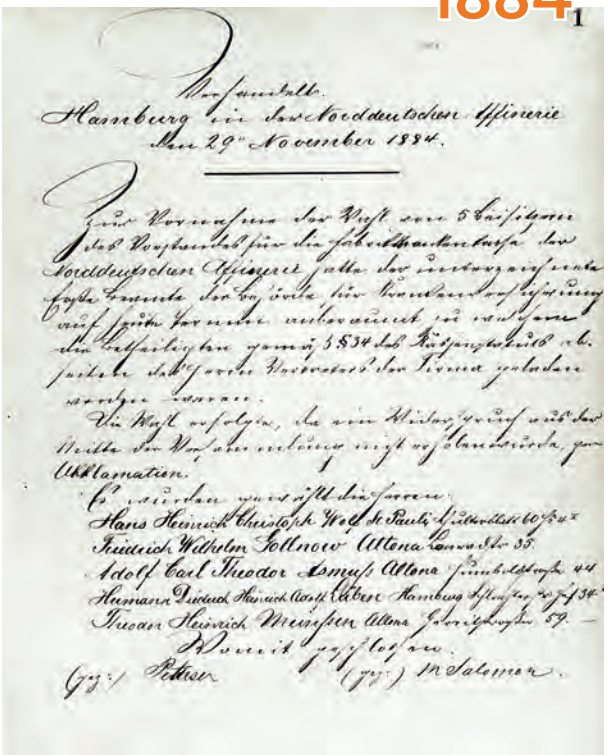
Mountainbike Race, which was one of nine in the Slovak XCM Tour, took place in the hilly Orava region. It started at Dolný Kubín, the Slovakian Aurubis plant, with Aurubis as the principal sponsor.

Aurubis Hamburg supports the integration of children and youngsters from different geographical and social backgrounds in its immediate vicinity by sponsoring the soccer club FC Veddel United.

However, the company's most widely known commitment in sports sponsoring will come to an end in 2016 since Aurubis is going to cease sponsoring professional athletes. Since 2003, NA has been sponsoring the women's volleyball team of the club TV Fischbek in Hamburg, which plays in the German national division. The company became its main sponsor in 2006 and gave the team its name. After the corporation was renamed, the team was also renamed "VT (volleyball team) Aurubis Hamburg" in 2009 and became very successful both at the national and international level.

Milestones

1884

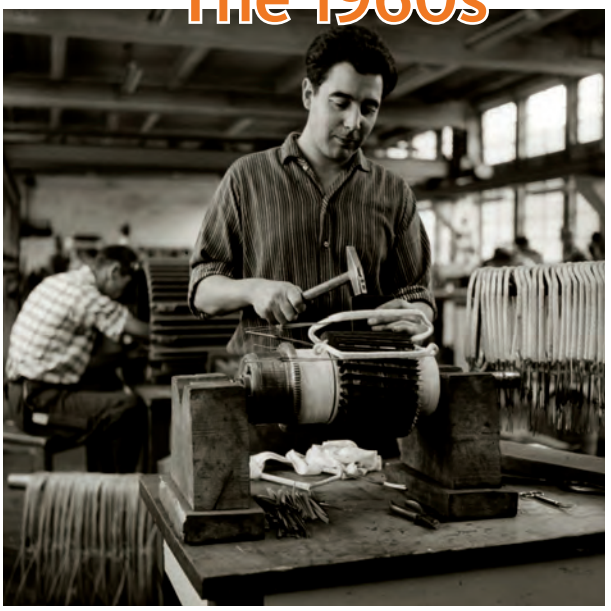


Establishment of the company health insurance fund

1925

Establishment of an in-house plant security force

The 1960s



Targeted recruitment and employment of foreign staff

2000

Beginning of the cooperation with Schule auf der Veddel

2014

Groundbreaking ceremony for the modern northern washhouse, the respiratory protection workshop and the health center

2008

Presentation of the “KulturMerkur” award of the Hamburg Chamber of Commerce to the company in recognition of its funding of arts and culture

We are innovative

Anode casting wheel at the primary smelter (RWO). The newly built primary smelter started operation on March 9, 1972 and has stood the test of time.

Innovation & progress

The innovative capacity of Aurubis has always been based on a combination of technical inventiveness, the courage to pursue large projects and economic prudence.[1]

The introduction of wet refining by the Beit brothers can be regarded as the first innovation in the history of Aurubis. Without this technical conversion, the company would never have grown to its present importance. Around the end of the 19th century, it was Dr. Emil Wohlwill who proved that he possessed genuine inventive talent when he developed the electrolytic refining method. The founding fathers of Norddeutsche Affinerie (NA) showed they had the courage to invest with Elbkupferwerk. The same was true for the leap onto Peute Island in 1907, for the expansion of the plant during the inter-war period from 1920 onward as well as for the establishment of the new continuous copper casting process starting in 1949.

In 1936/37, fundamental changes took place in the primary smelter in the northern part of the plant when a reverberatory furnace with an attached facility for producing sulfuric acid was installed. This was an early milestone and a genuine novelty with regard to environmentally friendly production.

Similar examples followed decades later. During the 1980s, new technologies for the production of copper salts were developed which allowed recycled copper to be utilized as a raw material. The main application for copper salts was crop protection. Subsequently, however, when this business no longer constituted a core activity of NA, the company was able to successfully outsource and sell it, not least due to these innovative methods. Only a short while later, in 1991, the northern primary smelter (Rohhütte Nord) experienced another innovation with the installation of an electric furnace for complex raw materials. It was the first time worldwide that the old shaft furnace technology for complex intermediate products with its environmental issues was replaced by a new electrically heated furnace. Although this conversion was made after public pressure, NA broke new ground with it. To this day, this technology is used by Aurubis, even though it requires optimization from time to time.

The commissioning of two central major facilities in Hamburg deserves a special mention: that of the new primary smelter in 1972 and of the new copper tankhouse in 1989. The eastern plant (Werk Ost) was developed on a site which had been acquired in 1967 covering 432,000 m² and which resulted in the plant premises almost doubling in area. Other comparable large-scale projects in recent times have been the takeovers of the Cumerio and Luvata locations. Some of these, like the one at Pirdop in Bulgaria, were given a general overhaul with regard to process technology. Finally, in 2013, after more than three years of planning and construction, a new anode slime facility was

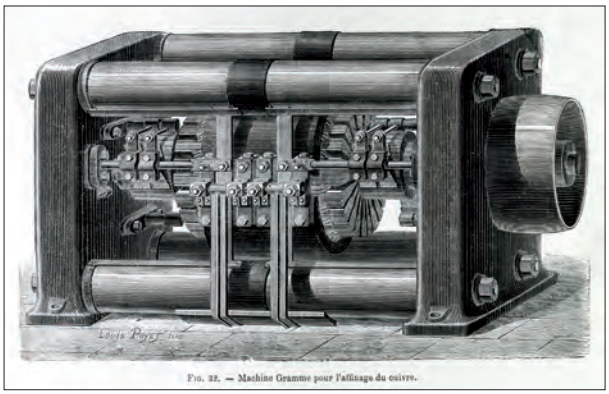


Fig. 32. — Machine Gramme pour l'affinage du cuivre.

In 1873, Dr. Emil Wohlwill, chief chemical engineer at NA, discovered an electrodynamic machine at the World Exhibition in Vienna, which he used for his electrically operated copper electrolysis facility. This machine helped Wohlwill to achieve his breakthrough in 1874 when he succeeded in separating auriferous silver in a hot sulfuric solution. In 1875, he transferred this process to copper electrolysis. Today, this machine is exhibited at the Deutsche Museum in Munich.

inaugurated. More than € 50 million was invested in this facility at the Hamburg plant, which is used for the central processing of all anode slimes generated during electrolysis across the Group.[2]

A typical feature of the introduction of new large-scale technical processes at NA was usually the purchase of existing modern methods, their application to the greatest possible extent, their continuous optimization and the ideal combination of both new and old processes.

The development and introduction of electrolytic refining processes

NA has Dr. Emil Wohlwill to thank for the most ground-breaking achievement in its history: the electrolytic production of precious metals and copper. The personal conclusion drawn by the company's chief chemical engineer of many years was that NA had "taken sizeable quantities of the purest electrolytic copper to market long before anyone else in Germany".[3]

The first steps toward developing this process date back to the ideas and experiments which Maximilian Herzog von Leuchtenberg had conducted since 1847. Almost 25 years prior to Dr. Wohlwill's new approach, however, he lacked a powerful current generator.[4] From 1871 onward, Dr. Emil Wohlwill carried out numerous extensive experiments regarding the electrolysis of metals. However, without an adequate source of electric power, he failed initially. It was not until 1873 at the Vienna World Exhibition that Dr. Wohlwill discovered an electrodynamic machine developed by Zénobe Gramme, a direct current appliance which appeared to be well suited to his electrochemical work.[5]

After the world exhibition, Société Gramme provided NA with one of these dynamos for experimental purposes. This helped Dr. Wohlwill in achieving a breakthrough during that year, as he succeeded in separating auriferous silver in a hot sulfuric solution. Things progressed fast after this: In 1874, the first facility for silver electrolysis was installed at NA, and in 1875, Dr. Wohlwill enhanced the process of electrolytic copper refining.[6]

On July 1, 1876, NA started the first large-scale copper electrolysis operation worldwide. For this process, wooden boxes were lined with refined lead and inside these boxes electrodes of opposite polarity, one made of unwrought copper and the other, the so-called starting cathode, made of pure copper, were switched in series within an electric circuit. The latter was inside an electrolyte solution of copper which was not heated. During this process lasting several days, the copper precipitated from the other metals, which either remained in the solution or accumulated on the bottom of the container as anode slime. The copper produced as a result was of previously unknown purity.[7] The product quickly turned out to be so successful that soon "every nook and cranny in the factory was filled with copper tanks", which posed a problem in the already cramped conditions at Elbstrasse.[8]

At the International Electricity Exhibition in Paris in 1881, NA was awarded a gold medal for the quality of its metals produced by electrolysis.[9]

However, NA was not the only company for which the first industrial copper electrolysis was of great impor-

Molds, so-called slag pots, filled with iron silicate stone.

tance. Since the high-purity copper had an excellent electrical conductivity, copper electrolysis brought enormous success to the entire power industry and shaped it in a significant way.

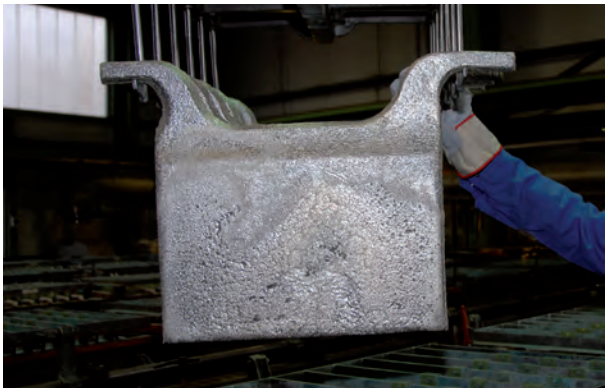
After the introduction of electrolytic refining, the copper production output of NA rose rapidly. Initially, the new technology produced approximately 200 t of copper per year. After one decade, in 1887, production had increased to roughly 1,200 t and to 2,000 t per year at the end of the 19th century.[10] Although American copper producers had outstripped the Hamburg-based copper electrolysis briefly at the beginning of the 20th century, one can still rightly say that, over decades, NA maintained their worldwide lead with regard to quantities produced. From 1909 onward, this was ensured by the new, much larger copper electrolysis facility on Peute Island, which was already expanded between 1911 and 1913. During the 1920s, the repeated expansions of production capacities under the management of Dr. Felix Warlimont resulted in an increase in the annual production of high-purity copper to 70,000 t by the end of the decade.[11]

In addition to copper electrolysis, a precious metal electrolysis facility for gold and silver separation was installed in Hamburg in 1878. The process of electrolytic gold and silver separation became a veritable bestseller. Degussa in Frankfurt was the first customer to acquire a license for 15,000 marks in 1895 even before a patent for the original direct current method was granted in 1896.[12] From 1900 onward, this was followed by national mints from all over the world purchasing licenses. So did private enterprises, especially after Dr. Heinrich Wohlwill, Emil's son, had developed the process further to one using alternating currents which interfered with one another.[13] All in all, the success of the electrolytic purification process resulted in further innovations in electrolysis implemented by NA. Besides copper, gold, silver and other metals have been produced by electrolysis in the past, for example lead, antimony and bismuth. It is only recently that Aurubis has replaced the electrolytic refining of gold by other methods, but silver is still refined electrolytically using the process developed back then.

The RWO: the construction of the eastern primary smelter (Rohhütte Werk Ost/RWO)

"If we were faced with the issue of building a new primary smelter again, we would not be able to make a better decision", Dr. Peter Kartenbeck stated at the time.[14] Only nine months after the new facility had been commissioned on March 9, 1972, his positive judgment summarized both the economic efficiency and the technical and structural aspects of the project. Both the new flash smelting process and the layout of the smelter had proved their worth, and there was only a partial need for improvement.

During the 1960s, it had been foreseeable that either an expansion of the existing smelter in Hamburg or a new building would be necessary. The facilities at the northern primary smelter were slowly becoming obsolete



Insertion of silver anodes into the tanks. The silver electrolysis process separates crude silver from other precious metals.

and would have led to a dwindling competitiveness and future environmental conflicts in the long term.[15] The reverberatory furnace technology was able to meet the environmental standards in force at the time, as it had been very progressive with regard to emissions when it was installed in 1936/37.[16] Moreover, the reverberatory furnace and its surrounding facilities had been modernized from time to time, and the smelter had been largely written off. Although it was profitable, it only had half the capacity of other plants which were more up-to-date at the time. It was not possible to meet growing customer demands with this equipment, and growth was precluded. In 1969, the prospect of new long-term supply contracts for copper concentrates emerged and this offered the opportunity to replace the technology for the in-house production of blister copper for refining and for increasing capacities at the same time.[17]

In 1969, the decision to build a new smelter under the responsibility of Ernst-Heinrich Landau, a member of the Executive Board, and his assistant Gerhard Berndt, and against a conversion of the existing northern primary smelter (Rohhütte Nord) was reached. It also had logistical reasons and offered "the greatest freedom for a perfect solution".[18] From 1970 onward, the new smelter was built on the southeastern site which had been acquired three years previously. Solutions at other locatons were rejected for financial reasons, such as the doubling of transports of concentrates and copper anodes. To develop the new plant (Werk Ost), major earth deposits were necessary as well as a 115 m long road bridge which connected the area with the existing plant buildings. The central part of the new smelter was a hot air flash smelter using the Outokumpu process, including a waste heat boiler. In addition, the construction work included quite a number of facilities: crane and conveying equipment, a distinctive, round storage building for concentrates with a diameter of 85 m, a bunker and rotary drier, the electroslag furnace, copper matte converter, anode furnaces and the anode casting wheel, the associated double catalysis facility for producing sulfuric acid, as well as social services and a new plant entrance. The total sum invested amounted to approximately 175 million DM.

When it came to choosing from the various production processes available worldwide, the flash smelting technology developed by the Finnish Outokumpu Group had been the favorite since 1961.[19] The new plant in Hamburg turned out to be approximately twice the size of the largest hitherto existing Outokumpu furnaces. The flash smelting process is both modern and environmentally friendly.[20] It offers several major benefits:

Precious metal electrolysis, a top seller

DC electrolysis (invented by Dr. Emil Wohlwill) and AC electrolysis (invented by Dr. Heinrich Wohlwill) are used in silver and gold separation. Some of the licensees have contributed to NA's reputation. The following are examples of early buyers:[1]

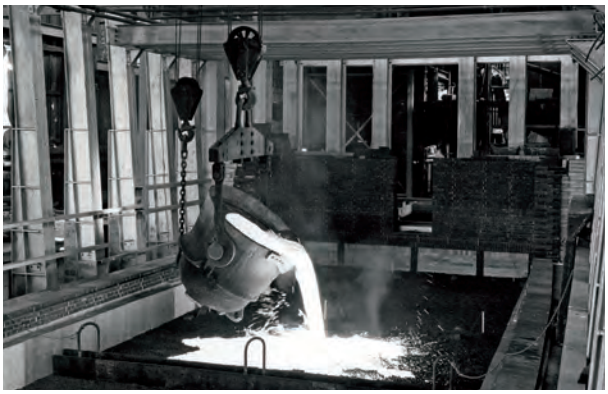
1900/02	US mints in Washington and Philadelphia
1902	Königlich Sächsisches Oberhüttenamt (Royal Saxon Smelting Board)
1908/09	Mints in the Russian Czarist Empire in St. Petersburg and Moscow
1911	*American Smelting & Refining Company*
1911/12	Imperial and Royal Mint, Vienna
1911/12	*Johnson Matthay & Co. Ltd., London*
1912	Mexican mint
1912	*Johnson & Sons, Smelting Works, Ltd., London*
1912	*Balbach Smelting & Refining Company*

Charging of the converter with copper matte.

Waste gases with a high sulfur dioxide content can be used for further processing into sulfuric acid and the heat released by oxidation during this process serves to melt the concentrate.[21] In addition, the concentration of copper matte can be adjusted arbitrarily. Therefore, the new contact plant with double catalysis started operation at the same time. This has enabled an increase in the output of sulfuric acid from approximately 300 t per day with the old single catalysis process to more than 3,000 t during the last few years.

In 1979, a new type of anode shaft furnace, the so-called ASO, was installed at the refining smelter at the northern plant. In 1981, NA caused quite a sensation with this furnace and with a new process for melting copper scrap metals which saved a lot of energy. This process was called "Contimelt" and had been developed in cooperation with Metallurgie Hoboken Overpelt (MHO) and supported by the European Community.[22] Until 1982, tests were carried out regarding the combination of the ASO furnace and the continuous polarity, i. e. deoxygenation, of the melt. The Contimelt process proved to have several advantages, such as the reduction of approximately half the primary energy, a more effective heat transfer and low emissions. Yet it had a higher melt rate, could be utilized in a variety of ways and tolerated contaminated copper.[23] Although the use of this process was discontinued after the takeover of Hüttenwerke Kayser and the subsequent concentration of recycling activities at Lünen, it was very successful initially and some smelting works showed interest in acquiring a license for Contimelt.

The melting capacities at the RWO primary smelter were expanded several times over the years. This was mainly achieved by converting the processing of concentrates to a method using a high oxygen enrichment of the process air.[24] Another innovation was the insertion of copper scrap into the converter to act as a cooling agent. That way the excess heat inside the converter is used to melt the scrap metals in an energy-efficient manner. In



Building work at the reverberatory furnace. Casting of the furnace floor with slag. Thanks to major repairs carried out in 1967, the furnace achieved a new record in 1972 with five years of continuous operation without any maintenance downtime.

Fit for the future: the primary smelter (RWO), the centerpiece of unwrought copper production at Aurubis Hamburg, as it looks today. Time and again, the primary smelter was rebuilt and expanded, improved and honed.

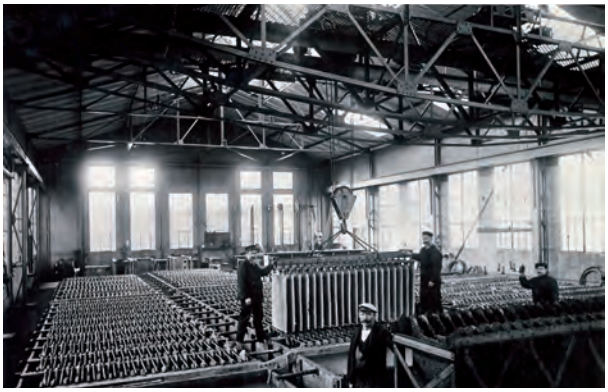
1999, after 27 years, when 5 million t of anode copper had been produced, the 10 millionth was already visible on the horizon for about 2010 since the strategic investment project RWO 2000 meant an increase in the concentrate throughput from more than 740,000 t per year to more than 1 million t, with the acid output of the contact plant rising to more than 900,000 t per year.[25] Therefore, on September 18, 2000, the smelter was scheduled to go out of operation for seven weeks. This was only the fifth time it had ever been closed down for major repairs or expansion and the first time in a record-breaking nine years.[26] The contact plant for producing sulfuric acid also had to be expanded by a third line. In 2009, the investment in the "Future RWO" project for a further increase in throughput to 1.25 million t of concentrate was approved.[27] Prior to this renewed increase in capacity, a further, fourth oxygen system for the supply of the reaction in the flash smelter had to be installed. This enormous throughput rate makes the eastern primary smelter the centerpiece of unwrought copper production at Aurubis in Hamburg.

The ELWO: the new copper tankhouse at Werk Ost

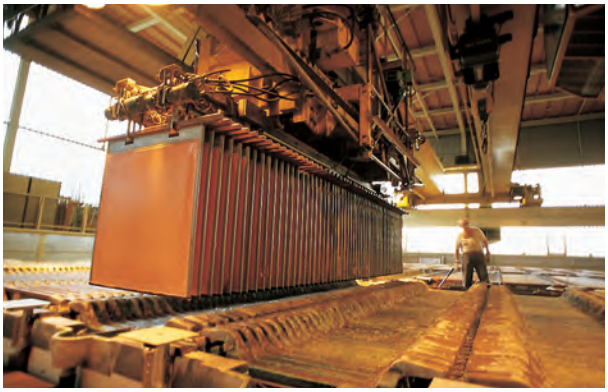
The new copper electrolysis plant (tankhouse) at Werk Ost was commissioned in the summer of 1989 – a success story second to none.[28] Until then, the old electrolysis facility at Werk Nord, which had been commissioned in 1910 and had last been expanded between 1958 and 1960, was serving its purpose. It was labor-intensive and prone to repairs, and hard manual labor was required to process comparatively small anode and cathode formats at a capacity which was too low. The plant was no longer up-to-date from a technical standpoint.[29]

From 1972 onward, a new site for a tankhouse was developed on the premises of the new Werk Ost plant, which was only just starting to operate with the new primary smelter.[30] Since it was not possible to install some of the equipment necessary for an efficient, modern tankhouse at the old location due to lack of space, a completely new plant was the only option worth considering.[31] During the first half of the 1980s, the project gathered pace with a focus on the question of which technical principle should be the basis of the new electrolysis system.

In October 1984, the decision was made to adopt the new groundbreaking process using permanent cathode sheets which had been introduced by the Australian *Mount Isa Mining Company* (MIM).[32] A time schedule was submitted and Dr. Michael Landau was appointed project manager by Gerhard Berndt, a member of the Executive Board.[33] On February 3, 1988, the Supervisory Board of NA was presented with the proposal of a



Two work environments then and now: the copper tankhouse on Peute Island around 1910 (l.) and in 2015 (r.), more than 100 years later.



After 21 days the anode copper has moved to the cathode side. The copper cathodes, which have been deposited on stainless steel sheets, are removed from the tankhouse cells every seven days.

motion by the Executive Board covering the sum of 140 million DM to be invested in the building of the tankhouse Werk Ost.[34]

After a record construction period of only 18 months between April 1988, and September 1989, the imposing building for the tankhouse cells was completed. What will be remembered is not only the work of driving 1,000 piles that carry the heavy-duty groundwork into the ground but also the influence of unconventional ideas on the construction work. Ideas were discussed within the team: The wooden ceiling structure in the main building, for example, which promotes an optimal building climate, can be traced back to a suggestion made by employees.[35] The nominal capacity of the ELWO plant was initially scheduled to be just above 140,000 t of annual copper cathode output produced in 20 groups of 30 tankhouse cells each, all of which have been fully supplied with anode material from the RWO primary smelter to this day.[36] Right from the beginning, there had been plans for an expansion to 720 cells with a higher current density and 200,000 t of cathodes produced. This was decided after only one year of the plant operating.[37] From the summer of 1992 onward, the ELWO was operating with 36 groups of cells with its capacity rising to more than 30,000 t of cathode copper per year. Since then, the suspension of further anode/cathode pairs as well as the upgrading of the current intensity have gradually increased the output to approximately 420,000 t per year.

It is the combination of the eastern primary smelter (RWO) and the tankhouse (ELWO) which has created an overall system that is meaningful with regard to both process technology and economic efficiency. The introduction of the ISA process under license is a prominent example of the commercial innovative strength of NA. The result is that Aurubis Hamburg boasts the world's largest and most efficient ISA electrolysis today, which has become a showcase for visitors from all across the world.

Copper in shape: continuous cast shapes and wire rod

The ELWO output of cathodes made of high-purity copper is mainly used by the Hamburg plant for further processing in continuous casting and wire systems. AURUBIS SHAPES product variations leave the continuous casting plant either as billets with diameters ranging from 89 to 500 mm or cakes with thicknesses between 140 and 335 mm and widths between 405 and 1,280 mm. Qualities vary in oxygen content and alloying additions, and the field of application of the subsequent end products used by customers in the semifinished products industry is the determining factor. Cakes are used for producing sheet and strip, billets for rod and tube.

In 2009, the tankhouse (ELWO) celebrated its 20th anniversary. In January 2005, the ELWO had already produced its five millionth ton of copper cathodes since its commissioning in 1989.

The Hamburg plant's expertise in continuous casting dates back to 1949, when the first experiments in vertical continuous casting were conducted.[38] After the pioneering work had been done, production on the original system began in fiscal year 1951/52. A new casting plant was installed on the southern bank in 1957. In 1973, this was followed by a second, which was the "largest continuous casting plant in the world" at the time.[39] The success of these formats can be explained by the higher quality of the continuous casting process, which gradually replaced the previous batchwise casting of wirebars.[40] In January 2000, the construction of a new continuous casting plant using anoxic OF copper and other copper alloys began. On September 20 of the same year, the modern machines, which are able to deal with unit weights of up to 35 t and unit lengths of up to 9.5 m, processed the first cast.[41] Today more than 500 product variations are offered under the AURUBIS SHAPES brand. This is achieved using multiple casting lines and casting furnaces which enable workpiece properties to be adjusted in a variety of ways.

AURUBIS ROD products leave the Hamburg wire plant rolled to coils weighing between 3.5 and 10 t. Other production sites are Emmerich (D), Olen (B) and Avellino (I). With diameters between 8 mm and 23.5 mm, wire rod is the precursor in the production of copper wire. Aurubis uses two major types of casting machines to shape the liquefied cathode copper into endless bars:

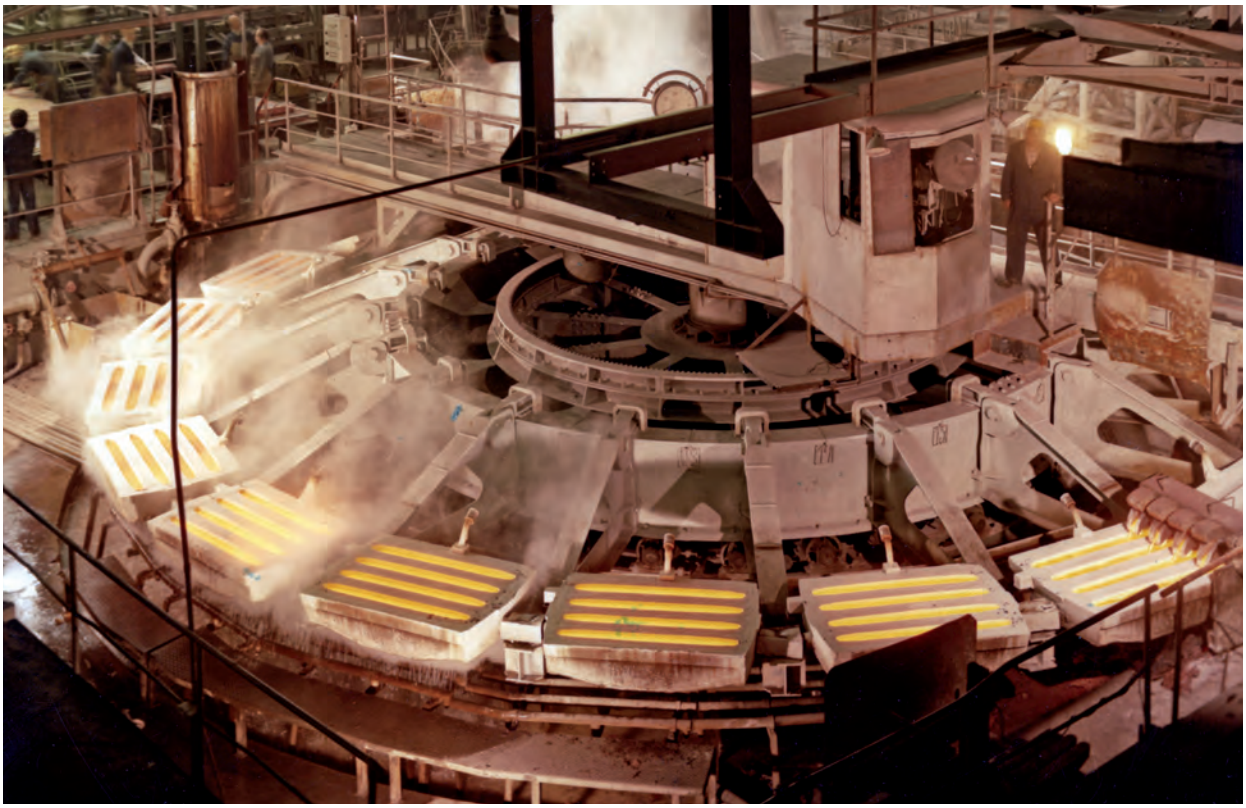
The development of the ISA process

This technical process which is used in electrolysis was named after Mount Isa Mines Limited (MIM), a company established in 1924. Mount Isa is one of the largest mining complexes in the world, situated in Queensland, Australia. Copper, lead, zinc and silver ore bodies have been extracted here since 1931. MIM, a former major stockholder of NA, was taken over by the Swiss *Xstrata Group* in 2003.

By 1978, MIM had developed a new technology for a part of copper refining which is known to this day as the ISA process.[2] The revolutionary aspect of this process was that the Australians hung cathode sheets made from stainless steel into the tanks instead of the simple, bendable starting sheets used before. High-purity cathode copper grows on both sides of the former during an electrolysis process lasting at least seven days.

The new sheets proved to be very efficient in several ways. Because of their torsional stiffness, they cause fewer short-circuit faults inside the tanks in which they are suspended alternately with the copper anodes to be refined. The stainless steel sheets are reusable – which is why they are also called permanent cathodes – and are relatively easy to separate from the high-purity copper obtained through electrolysis. A cathode stripping machine is used for this purpose, which was also developed by MIM and which is a part of the ISA process.

The method was first used at MIM's own copper electrolysis facility at Townsville, Queensland in 1978. Since then more than 100 licenses have been granted to other copper producers all across the world. In 1984, NA was planning a new copper electrolysis plant and decided to use ISA, including a cathode stripping machine. After its implementation in 1989 and various upgrading measures during the subsequent years, ELWO now boasts the most powerful ISA electrolysis facility in the world.



People at their workplace: a rotary casting machine for copper wirebars being operated in 1961.

the Hazelett and the Southwire design. In the Hazelett process the copper melt is cast into shape between steel strips running on rollers in the so-called "caster", while this is done via a large casting wheel in the Southwire process. Since the first wire rod plant started operating in Hamburg in 1973, it has been using the Southwire principle. The same applies to Deutsche Giessdraht at Emmerich, where the same process has been used since 1975. In 1980, the wire rod plant was replaced by a technically modified, more powerful new system.[42] Both the Olen plant in Belgium and the Italian plant at Avellino utilize the Contirod technology based on the Hazelett process. The difference between the two systems is that with Contirod, the cavity of the casting mold is formed by the steel strips at the top and the bottom with copper armor on the sides, while the same cavity in the Southwire system is shaped by the center cut-out in the contact surface of a copper casting wheel which is sealed with steel strip on the outside.[43] Thirteen roll stands in the rolling mill then reduce the red-hot continuous bar to the desired size in profile before it is pickled, cooled and wound to a coil. Today, the annual overall capacity of all four wire-producing Aurubis plants is approximately 1 million t of AURUBIS ROD.

Between 1999 and 2009, oxygen-free, low-alloyed copper wire branded TOP ROD was produced in Hamburg using the TOP CAST process.[44] With the help of a graphite casting mold and without further rolling, the wire was cast vertically upward directly from the melt to final diameters between 8 and 25 mm. The process was very flexible and economical even for small production lines.

Copper made from secondary raw materials: scrap metal, recycling, KRS

Aurubis is the world's largest copper recycler. The Group combines copper production from primary and recycled raw materials like no other company.[45] The "red gold" can

Electronic waste first passes through a crusher unit and is then either fed into the converter process at the primary smelter in Hamburg or charged into the KRS at Lünen. The high temperatures inside the concentrate melt cause a spontaneous and complete decomposition of the foreign matter.

Wire rod leaves the rod plant in Hamburg as AURUBIS ROD in coils weighing up to 10 t before it is used for producing copper wire. Other production sites include Emmerich in Germany, Olen in Belgium and Avellino in Italy. Together with Hamburg, they produce about 1 million t of AURUBIS ROD.

be 100 % recycled as often as desired without any loss of quality. It should be borne in mind, however, that copper has a very long lifecycle in its use, which means that the availability of recycled copper is limited. Since the production of secondary copper requires less than half the energy needed for production from primary ore raw materials, it is both lucrative and conserves natural resources.[46] It should be taken into account, however, that the annual processed quantity of more than 700,000 t of recycling raw materials from more than 60 countries is delivered to Aurubis in greatly varying quality: alloys with low copper content, large scrap metal objects, electronic and computer waste, cables, electric motors, catalysts used in chemistry, production residues and slimes.

Customer demands are taking shape: The continuous casting plant produces billets (above) and cakes (below).

The re-use of metals, which has been known under the term “recycling” since the 1970s, has a tradition dating back thousands of years. It acquired a new dimension both during and after the wars of the 20th century. Growing wealth led to rising demand for non-ferrous metals, while more waste metal was generated at the same time. Particularly since the 1960s and under the premises of economic optimization and stricter anti-pollution laws, technical processes for the stripping down, breaking up and separation of metals were continuously enhanced and improved. Since the end of the 1980s, for example, the simple thermal treatment of scrap metal cable has been banned in Germany. As a specialist for the separation of metals and plastics, *Cablo*

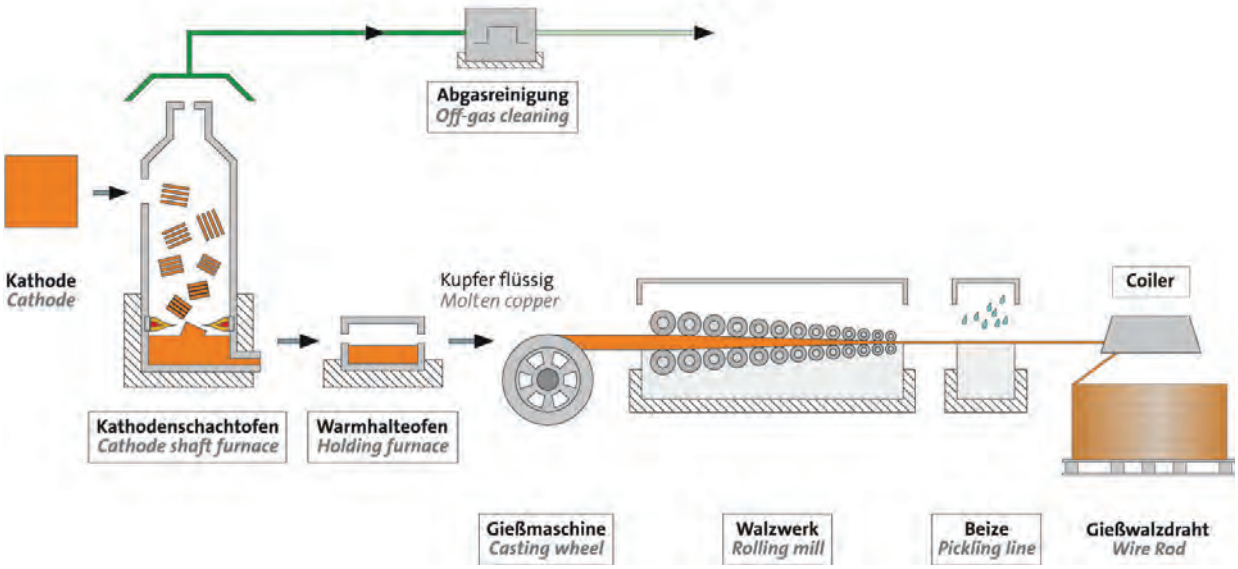


Diagram of a rod plant at Aurubis used for the production of AURUBIS ROD from cathode copper. The rod is produced with either Hazelett or Southwire casters today. Both production systems consist of a cathode shaft furnace, a holding furnace, a caster (pictured here: Southwire), a rolling mill and a pickling line which removes the surface oxides from the rod and cools it. Before the rod is rolled up in the coiler, it is finally covered with a protective wax coating.

Metall-Recycling und Handel GmbH in Fehrbellin and Strass breaks up these materials mechanically. Cablo feeds the extracted metals as granules into the Group's internal further processing operations, among other things.

The Group's recycling focus, however, is at Lünen in Westphalia. In February 2002, Hüttenwerke Kayser repositioned itself among the competition by commissioning the innovative Kayser Recycling System (KRS).[47] The process developed in-house for the recycling of copper saves both costs and energy and enables a wide range of raw materials to be processed.

The novelty of KRS lies mainly in the installation of a cell furnace as a modern smelting unit. Right from the beginning, the smelting process aimed to a large degree at working with mixed materials coming from used electronic and computer end products containing copper and precious metals.[48] In addition, it also processes industrial waste such as discarded catalysts for chemical processes, whose fabric backing is often interspersed with copper-based materials and which used to end up in landfills, as well as residues such as slimes and dusts. KRS is geared toward effectively absorbing or disintegrating harmful substances contained in secondary raw materials. Some synthetic and organic contents can even be converted into energy. Moreover, the entire KRS process is fully integrated into the traditional copper production in Lünen.

In September 2010, the construction work on the expansion project KRS-Plus began and in the summer of 2011 the investment object covering a volume of € 62.5 million was inaugurated.[49] The existing cell furnace has now been complemented with a top blown rotary converter (TBRC) with diagonal rotation, which has resulted in a considerable increase in capacity. Furthermore, a new filter system with a flue gas scrubber has been commissioned for this unit.

All three secondary raw materials suitable for recycling – scrap metal, waste electrical and electronic equipment, industrial residues – have been much sought-after on international markets for decades. The electronic waste which NA had been sourcing from *IBM* since 1977

Metal tapping at the Kayser Recycling System (KRS) in Lünen. The plant melts mixed materials containing copper and precious metals coming from used electronic and computer end products. During tapping, the plug of the furnace is opened so the liquid metal, whose temperature exceeds 1,000 °C, can run out.

Not just beautiful scrap but first of all valuable recycling material in a variety of shapes: electrical and electronic waste, wires, cable granules and industrial residues containing copper. At the Hamburg plant the copper scrap is pressed into packets weighing up to 600 kg, which are then melted down in the converter.

experienced an increase in demand a few years later because of the precious metals it contained.[50] That prompted NA to win over manufacturers of electronic equipment such as IBM, *Texas Instruments*, *Hewlett Packard* and *Sperry Univac* as suppliers.[51] In addition, military waste materials were examined for usability.[52]

These days, the electronic waste material is added to the converter process at the primary smelter after it has passed through the crusher that has been adapted in-house. The high temperatures of more than 1,200 °C inside the smelting unit lead to a spontaneous combustion of the decomposition substances, while more than 10 downstream waste gas cleaning steps ensure that emissions into the atmosphere are almost free of contaminants.[53] The share of recycling material in the production of cathode copper is still rising and is moving in the direction of 20 % worldwide.[54] At Aurubis, the share of recycling material in the production of copper is approximately 40 %.

The Group has always focused on both innovation and progress and has always installed the latest technologies. Aurubis has often been a pioneer in the development of process optimization projects. Besides the examples listed above, there are a number of others whose detailed description would go beyond the scope of this book. This includes not only the development of a drying technology for copper concentrates using steam but also the early, appropriate utilization of waste heat from waste heat boilers, the casting of oxygen-free copper shapes as well as the construction of the new silver electrolysis plant. A high degree of both flexibility and future orientation can be seen in the production of sulfuric acid, where the in-house development of different purification stages ensures a high purity of the

Taking samples, testing, enhancing: the test and development laboratory of the Research and Development Department at the central building on Peute Island at the beginning of the 1960s.

Various patents on solar cell technology were applied for between 1999 and 2002. With the CIS solar technology – copper (C) in combination with the elements indium (I) and selenium (S) – copper offers an efficient alternative to the established silicon solar cells.

acid. Another example of the company's innovative capacity and farsightedness is the development of a number of processes for the recovery of a great variety of by-metals from raw materials such as selenium.

Innovation management, research and new technologies

Aurubis is constantly searching for optimization potential in both technology and workflow. However, the Group does not solely rely on its Research and Development Department in this search but rather involves all levels. Every employee is asked to contribute his or her ideas for improvements within the corporate suggestion system. Since the end of 2008, a strategic group-wide innovation management project has been established for major processes.[55] Again, all employees were involved. Solutions developed during creative workshop sessions were presented in practice at roadshows at the different plant locations. One example of a successful outcome of a workshop was the support given to Aurubis subsidiary *Peute Baustoff GmbH* to help the company enhance its product iron silicate stone in 2011.[56]

Since the 2000s, processes for which patents have been applied for have fallen mainly into the categories of improvements of smelting and casting processes, options for repairs and reductions in particle load emitted into the atmosphere.[57] Aurubis has also entered unfamiliar territory: Between 1999 and 2002 it applied for various patents for solar cell technology.[58] At that time, photovoltaics was identified as a future market, and it was very convenient that copper, with its special properties, was presented as a metal of the future.[59] This is because copper offers an efficient alternative to solar cells produced from silicon. During fiscal year 2000/2001, CIS Solartechnik GmbH was founded in Hamburg with a stake held by NA. The aim was to develop a new type of flexible solar cell.[60] The fact that all three required elements were produced here and that the necessary know-how already existed was ideal.[61] Unfortunately, there were subsequent changes on the global solar cell market, such as a fall in prices and the outsourcing of production to Asia, which made the installation of serial production facilities no longer economically viable. The project was therefore discontinued in 2010/11.[62]

There is another example which illustrates that, besides technical equipment for the production of renewable energy, vehicle construction is, and will remain, a future market for Aurubis. Both the plants at Zutphen, Netherlands and at Buffalo, USA produce copper-based cooling technology for engines using the CuproBraze technology, a joint development by several leading copper producers for the promotion of their metal over aluminum. This may have been the preferred choice in heat exchange technology since the 1990s, but heat exchangers are another

Digitally supported control and monitoring of the new tankhouse at Pirdop.

example of items upgraded by the use of copper: They become more efficient, more resistant to higher strains and copper enhances their quality on the whole.[63]

The work of the Research & Development Department (R&D) takes on a new position when viewed against the backdrop of the realignment of the Group's strategy toward greater complexity.[64] The Group is becoming more proactive than ever before due to the need to anticipate changes in the processes used in dealing with complex raw materials, i. e. primary and secondary materials with a larger share of impurities, and the processes necessary to make them more robust.[65] This involves new developments. Furthermore, it has become necessary to look beyond individual units to include the entire processing procedure. There is an enormous increase in both the amount of data and the number of parameters. To allow for this development, the company is currently establishing a separate department of process simulation.[66]

All of this is accompanied by the perpetual search for differentiation potential, i. e. by the question of how to distinguish oneself from the competition.[67] In this search, the copper group is relying on speed – apart from traditional quality – as the new dimension. One example of this serves to show how much the increase in complexity encompasses all divisions within the Group: To meet customer demands for a faster execution of their raw material deliveries, sampling and analytic processes need to work more effectively – not an easy task if, at the same time, raw materials are becoming more complex in their composition.

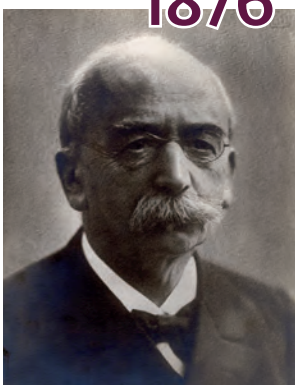
As a result, R&D work at Aurubis will be increasingly interconnected in the future. To achieve this, the knowledge network is currently being expanded. There will be cooperation with different companies, universities and institutes within this network, for example in the form of cross-industry expert workshops. This approach, which extends across companies and sometimes industries, will promote the development of future-oriented innovations at Aurubis.

Milestones

1824

Introduction of wet refining process for gold and silver by Raphael Salomon Beit

1876



Introduction of electrolytic copper refining process by Dr. Emil Wohlwill

1972

Commissioning of the primary smelter (RWO)

1973

Construction of the continuous casting plant (the world's largest at that time)

2002

Commissioning of the Kayser Recycling System (KRS) – KRS-Plus expansion in 2011

1989

Commissioning of the tankhouse Werk Ost (ELWO)

We are sustainable

Sustainability has a permanent place in the Group's strategy. The dark clouds of the past have cleared: the sky above Hamburg. Today the Group is a pioneer with regard to environmental protection.

Sustainability as part of the strategy

These days, the public perception of a company is increasingly determined by its responsible behavior. Success, including that on the stock market, is not only defined by sales figures but also by a positive image.

Responsible action covers a wide range of topics such as ecology and climate protection, energy efficiency and supply security as well as social responsibility and human rights. This is an area where a company's commitment goes beyond its immediate daily business and where the impact of the topics which overlap in many aspects is crucial.

Therefore, anticipatory action with regard to sustainability means being aware of the long-term effects of corporate action. Hence, Aurubis AG has aligned its Sustainability Strategy along the overarching aspects of the economy, environment and people.[1] These in turn represent eight fields of action which were precisely defined by corporate-wide working groups and mapped with objectives in 2013.[2] More than 40 employees from all sites were involved in identifying the intersections of value creation stages at Aurubis – raw materials, processes and products – with these three major overarching aspects. For instance, the sourcing of raw materials primarily touches on three ecological topics: preventing the pollution of water and air, an ecologically compatible energy supply and the efficient consumption of resources.

Maximum transparency is another of Aurubis' major concerns. This includes the insight that, with hindsight, errors have been made in the past. Such examples are the events surrounding the sourcing of Otavi copper, the approach to people working for the subsidiary Transvaal Alloys as well as the use of environmentally harmful processes. Aurubis has developed legally binding agreements and monitoring instruments to prevent the reoccurrence, both today and in the future, of actions taken in past decades. The Group publishes biennial sustainability reports, which state its objectives, outline the progress made and highlight aspects of its sustainable business activities that will become points of future focus.[3]

Under pressure early on: Beit's silver smelting plant and Elbkupferwerk

Neither environmental protection nor sustainability are topics which first emerged in the 20th century. There has been an awareness since ancient times of the finiteness of natural resources and there have been examples of sustainable action and of attempts to conserve nature even after that. Such activities, however, were not taken up across society as a whole, nor were they institutionally categorized as they are today. Certain aspects of the debate which intensified during the last quarter of the 20th century were, thus, not new to the Hamburg copper smelter.

Noise, emissions, smell. For centuries, production and living quarters in Hamburg were very close, such as here at Spielbudenplatz in the district of St. Pauli.

Operating a smelting plant is inevitably accompanied by emissions. Historical sources, however, only ever mentioned the discharge of harmful substances if there were complaints or there was a scandal. During industrialization in the 19th century, pollution resulting from production processes was usually tolerated unless something extraordinary happened.

Until the middle of the 19th century, only few complaints regarding pollution caused by smelting plants were recorded for Hamburg. One concerned several workers at Hamburg smelters who developed lead poisoning in 1822. At the time, the authorities put only part of the blame on the plants and also attributed the symptoms to the workers' excessive consumption of brandy.[4]

When Beit and Godeffroy founded Elbkupferwerk in 1846, the Hamburg Senate only granted permission under strict constraints. Above all, it banned the processing of copper ore containing arsenic and stipulated that the plant would have to close if there were adverse effects on the neighborhood.[5]

During the following years, however, these considerable limitations on the concession were successively revoked.

From 1853 onward, Elbkupferwerk attempted to have the ban abolished, especially since it also intended to establish a silver smelter and the ores used for this contained higher amounts of arsenic.[6] In return, the company offered to close the subsidiary plant at St. Pauli, where there had been an increasing number of complaints by residents. At the same time, the company planned to install condensation chambers for flue dust and smoke for waste gas purification at the parent plant – an established technique at the time. Furthermore, it wanted to connect all furnaces to a central smokestack more than 30 m high. Any harmful substances in the smoke would then be diluted in the air to such an extent that they would no longer pose a danger.[7] Such rationale was quite common at the time. It was based on a belief in the self-healing processes inherent in nature: Any harmful substances only had to be diluted sufficiently, i. e. dispersed in air or water, to render them innocuous.[8]

The Hamburg Technical Commission strictly refused to grant an extension of the concession, citing the expected burdens on both man and the environment. It also feared a collapse in the price of land near the plant.[9] However, the city's Health Council arrived at a much more positive assessment and viewed the risks as calculable and manageable.[10]

In 1856, the Senate decided to approve the expansion of production on Steinwerder, albeit with some constraints. Beit and Godeffroy both demanded concessions, in particular with regard to the requirement to build a smokestack 280 ft high (approximately 85 m) and threatened to close the plant. They did not prevail, however – when it was built, the new smokestack of Elbkupferwerk was the tallest in Germany.[11]

Conflict surrounding the smokestack at Elbstrasse and the failed expansion of the main plant

Norddeutsche Affinerie (NA), the result of the merger between Elbkupferwerk and the Beit parent plant in 1866, increased its focus on metal refining.[12] The plant still produced mainly at Elbstrasse in the midst of a residential neighborhood. It was not until 1885 that NA

switched part of its production to Steinwerder, keeping the parent plant for the time being.

In those days, Hamburg was generally considered to be Germany's most unhygienic city and the housing situation of workers living in the midst of industrial estates was largely abysmal. Robert Koch, the medical scientist, talked about "plague caves".[13]

The conflicts with the residents of Elbstrasse which had been simmering for some time escalated in 1901 when NA applied to the local building authorities to receive permission for an additional shaft furnace. After the building authorities had required that the height of the existing smokestack should be increased from 43 m to 53 m, major protests broke out among the residents affected, who were supported by the minister of the parish of St. Michaelis. They demanded that the smokestack should be at least 100 m tall, since an increase of 10 m in height was only a cosmetic correction which would foil the company's previous efforts at improving the emission record, which included a new steam engine and a "smoke burning apparatus".[14] NA withdrew its application and decided to forego its plans for expansion, as it considered a raise of even only 10 m in the smokestack's height not to be technically feasible.[15] Only a few years later, however, the company gave up the Elbstrasse plant with its cramped conditions and consolidated all operations at the new plant on Peute Island in the Elbe River.

The conditions for operating a smelting plant on Peute Island were very favorable at the time, not just from a logistics point of view. Apart from sulfur trioxide (SO_3) emissions, there were no quantitative limitations of other emissions. The SO_3 threshold approved by the Hamburg Senate as part of the operating license (10 g/m³ of waste gas air) was twice as high as the national one commonly applied to industrial plants such as power plants. Power plants, though, did not use any sulfidic copper concentrates but used coal and therefore their SO_3 emissions were considerably lower.[16] According to the concession document of 1908, the plant was obliged to have the acid content of the waste gases


Nr. 16. — 6 —

Prof. Dr. Eugen Poppenheim †.

Die Sprengung eines Fabrikschorn-steins bei Hamburg.

A landmark of Hamburg's port weighing 60,000 hundredweight disappears: the blasting of the 85 m high smokestack of the Elbkupferwerk plant on Steinwerder Island at the end of 1901. For a long time, people believed that if a smokestack was sufficiently tall, its emissions would be distributed in the air, diluted and thus rendered harmless.

leaving the smokestack checked by a chemical engineer on a daily basis and record the results. The industrial inspectorate was allowed to request access to the records.

The other environmental constraints were extremely vague: It was permitted, for instance, to discharge wastewater into public waterways. It only needed to be treated "properly" and any harmful components discarded "if possible".[17] However, neither the necessary treatment processes nor appropriate measuring methods existed for statutory rules and the definition of quantitative threshold values; these were not developed until the second half of the 20th century.

Several smokestacks were already in use in 1918, nearly 10 years after the move to Veddel Island.

Flue gas pipes at the Hamburg plant in the 1920s.

The above stipulations, however, were always under the proviso that they must be practicable without impairing a company's overall economic viability. This so-called "principle of proportionality" is applied in both European and German legislation to this day.

Ecology as a result of efficiency considerations

The reorganization and modernization of the NA plant during the 1920s resulted in a significant expansion of production. At the same time, new technical methods for reducing emissions in accordance with the possibilities available at the time were employed. Waste gas purification previously had only been utilized sporadically with the help of coarse particle collectors, but from 1920/21 onward, coolers and fabric filters were used for the first time and electrostatic waste gas purification equipment followed from 1923 onward.[18] Since the 1920s, an in-house measuring squad has taken emission measurements at the smokestacks.[19] In addition, and without any legal requirements or pressure from the public, the plant modified parts of its production processes step by step, indirectly benefitting the environment as well. This mainly occurred when NA expected increases in efficiency from modified procedures. One such example was the fitting of filter equipment for collecting flue dust, which had been increasingly enforced during the 1930s. This enabled the collection of 11,000 t of valuable raw materials during fiscal year 1933/34 alone, which were then pelletized and fed back into the production process.[20] It was not for nothing that emissions were still called "chimney losses" in the 1920s.[21]

Because of its close proximity to the city, NA used a new production process starting in 1936/37 in which some of the roaster gases which were rich in sulfur dioxide (SO_2) were separated and supplied to an affiliated sulfuric acid plant, where they were converted to sulfuric acid with the help of a catalyst.[22] It was not until many years later that this contact plant which had been commissioned in 1936 became the benchmark for the international copper industry.

Recycling processes have always played a major role in copper production. They were used where possible to feed any collected residues and waste products back into the production cycle and also to reprocess intermediate products purchased from other plants. In 1958, for example, NA concluded an agreement with the mineral oil industry regarding the processing of acid tars which were accumulated during the production of lubricating oil and which the company reprocessed.[23]

Beginning in the 1930s, flue dust systems not only kept the air cleaner but also held back sizeable amounts of valuable particulate raw materials which could thus be recovered.

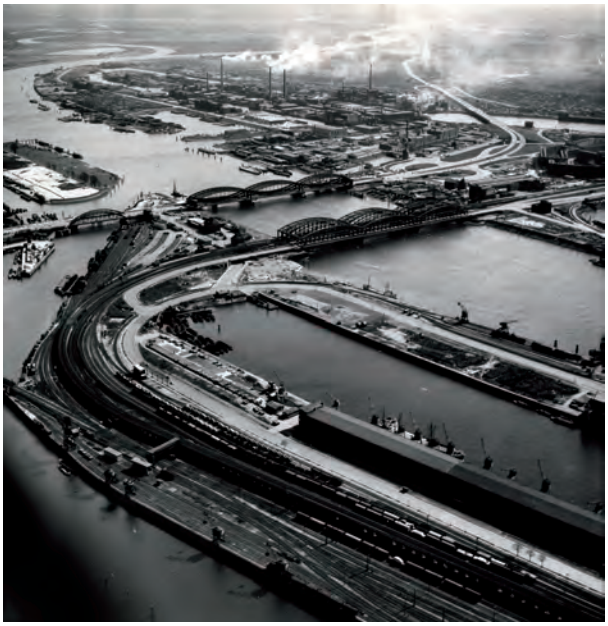
Discharge of pollutants into the Elbe during the 1920s and 1930s

Around the end of the 1920s, there were complaints from the population of Hamburg and Altona about the quality of the communal drinking water, which was partly sourced from bank filtrate of the Elbe River.[24] The State Institute of Hygiene stated that the quality of the water was "hygienically impeccable", while the press viewed the bad taste of the water, an objective fact, as just a "minor flaw".[25] The cause of this taste was believed to be the sugar refineries in Magdeburg, upstream of the river. By today's standards, the water quality of the Elbe River was inadequate. It suffered from considerable salinization due to industrial discharges and also from mining along the upper reaches of the river. In addition, untreated domestic wastewater deteriorated its quality and even caused epidemics.[26]

In January 1929, the Hamburg Communist Party (KPD) tried to mobilize the public with a water sample taken directly from the discharge point of NA at the Hove Canal. The reasons for taking this sample were complaints by residents regarding the destruction of fish stocks in the canals. The sample which was handed over to the health authorities proved to contain considerable concentrations of noxious substances (arsenic, sulfuric acid and sulfates). Although the figures actually established by the health authorities were even higher than the ones stated by the KPD, the authorities denied that there was any danger to public health.[27] They claimed that the discharge of harmful substances was neutralized within a distance of only 50 m downriver from the discharge point and that a major part of the pollutants was no longer traceable after this point. On January 29, 1929, the subject was debated at the Hamburg City Assembly, during which all parties except the KPD rallied behind NA.

On December 4, 1929, the Hygiene Institute submitted a secret evaluation report which concluded that due to wastewater discharges by NA, considerable amounts of arsenic had sedimented in the Müggenburg Canal which bordered the plant premises. The health hazard was still considered to be low since the substance in question was an insoluble iron arsenic compound. However, because of an incalculable residual risk, the health authorities suggested that the canal should be dredged as soon as the smelter had commissioned a wet metallurgical plant for processing the electrolyte for the copper tankhouse, which was being built and was due to open in the spring of 1930.[28] The question of cost was the subject of another debate which raged inside the administration for years. The Senate hoped to avoid having to dredge the canal, particularly since there was no suitable waste disposal site for the calculated 90,000 m^3 of sludge.

In the spring of 1934, NA was of the opinion that it was not liable for the costs. After all, the company had adhered to the concession granted in 1908 and had filtered out as many pollutants as was technically feasible. Moreover, it denied the harmfulness of the substances by pointing to the widespread use of calcium arsenate in pest control. The State Institute of Hygiene rejected NA's reasoning and countered by citing examples of the substance's hazardousness.[29] In the end, in September 1934, the Senate, which was by now dominated by the Nazi party, voted to dredge the Müggenburg Canal as well as the ones bordering it. The sludge containing arsenic was deposited after being mixed with unpolluted rubble. The work was concluded in 1936 with NA not having to contribute to the cost since the



View across the Müggenburg Canal and Peute Island in 1956: The plumes of smoke above the smokestacks are clearly visible. From the 1970s onward, many industrial plants in Hamburg became the focus of environmentalists.

discharge of pollutants had been carried out legally based on the concession document.

Vegetable farmers versus Norddeutsche Affinerie

An ecological awareness in the modern sense of the word took a long time to develop both among the population and at NA. At the beginning of the 1960s, Hamburg farmers who grew vegetables brought legal proceedings against the company based on arguments which were dominated by purely commercial considerations. The farmers had sued NA for damages because their crops had perished as a result of the company's emissions of sulfur dioxide. The people in charge at NA advised the farmers to grow vegetable crops with a greater resistance, which at first glance sounds cynical.[30] Although the Hamburg district court ruled that NA should pay (partial) damages amounting to 100,000 DM, the harmful emissions by NA were within lawful limits. In other words, they were legitimate according to Section 906 of the Civil Code, which stated that reasonable impairments had to be tolerated by the public as long as relevant thresholds or target values were adhered to. Moreover, the court argued that the plant had already fitted all technically and economically feasible appliances for emission control, whereas further constraints – such as the retrofitting of filter systems for the complete removal of SO_2 from waste gases – would make the plant unviable.[31] The legislation was subject to the aforementioned "principle of proportionality".

The ecological transformation

In Germany, the great change in the public awareness of environmental aspects began at the end of the 1960s. This had been preceded by national initiatives to protect the environment as a result of a massive increase in environmental problems in the Western world during the late 1960s. In the United States, the conservative Nixon administration took up the issue, and in Germany, it was the social democrat-liberal coalition headed by Federal Chancellor Willy Brandt, which had been in office since 1969.[32] It was chiefly the Federal Minister of the Interior Hans-Dietrich Genscher who was in charge of environmental legislation and who set the course.[33] An awareness of the environment was awakened in the public, who henceforth exerted pressure on policy-makers, industry and the administration.

Such pressures applied all the more to a company like NA, for one thing because the copper production process generates a considerable amount and variety of harmful substances, and for another because the location of the Hamburg plant in close proximity to residential areas resulted in both increased requirements and public attention.

On the way to pollution control

The 1970s saw the beginning of greater conflicts surrounding the operation of the plant on Peute Island. These conflicts eventually assumed proportions that

threatened the survival of the plant and resulted in the establishment of a modern environmental management. Considerable pressure was necessary, both from the public and from civil society, above all on the political level, to ensure that things moved forward with regard to pollution control.

On October 3, 1972, when sulfur trioxide was discharged into the atmosphere unfiltered for five hours due to a technical failure at the NA contact plant, a cloud of irritant gas moved through the streets of Hamburg.[34] Fourteen people had to be treated at hospitals for breathing difficulties. Gerhard Berndt, a member of the NA Executive Board, qualified the explosive nature of the event in the media: "A few good coughs in fresh air and everything will be okay again."[35]

The fact that NA had not previously been listed among potentially hazardous plants in the disaster management plans of the Hamburg Senator of the Interior was considered to be serious at that time. Nobody had been prepared for this kind of incident.[36] There was no pollution control legislation in Hamburg, in contrast to North Rhine-Westphalia, where it had existed since about 1962.[37] Like many other federal states in Germany, the authorities made do with the trade law. However, this only offered partial protection from industrially induced environmental risks.

And yet, NA was rightfully proud of its novel flash smelting process with subsequent waste gas purification at the double contact plant – a worldwide novelty at the time. In March 1972, the new primary smelter was commissioned after a planning and construction phase of three years, which contributed to a considerable reduction in the emission of pollutants.[38] A first discussion of ecology between the Executive Board and the mayor of Hamburg took place in 1974; no concrete results are known.[39] In 1978, the old reverberatory furnace and the roasting house which had been used for processing intermediate products containing arsenic since the 1930s were decommissioned, constituting an immediate benefit to the environment.[40]

However, the introduction of lower-emission processes did not solve the old problems, such as long-term emission inputs and earth deposits in the port area which caused the soil to remain contaminated with harmful substances to a considerable degree.

Measures to protect the environment following pressure from civil society

Against the backdrop of the ecological transformation and a change in environmental awareness among certain sectors of society, a students' initiative was founded in Hamburg in 1975, known as the Physics/Earth Sciences Ecological Group.[41] From 1979 onward, the group began to take independent measurements to monitor air and water quality and to publish the results.[42] They laid a particular focus on NA's wastewater discharges. Their analyses showed that considerable concentrations of cadmium, zinc, lead, copper and arsenic had accumulated again in the Müggenburg Canal, which had last been dredged between 1934 and 1936.[43]

This impetus, as well as the changes in general social awareness, triggered a response from NA. The first concrete measures to protect the environment were initiated at the beginning of the 1980s: In 1981, a voluntary "emission declaration" was issued and agreed between the Hamburg Senate and local industry.[44] In the early 1980s, NA established its own company division for environmental protection, initially with a staff of only three, which has gradually expanded to 16 in Hamburg alone today.[45] Before 1982, there had only been an environmental protection officer and a measuring squad.

Following this, a number of construction measures were implemented at the plant: A bunker for the storage of dust-creating materials was built in 1982 and a process of slag granulation without wastewater was introduced in the same year.[46] In 1983, the gas purifying system of the contact plant at Werk Ost was expanded and a new system for the chemical treatment of precipitation was commissioned.[47] In 1984, the primary smelter was fitted

When the third line of the sulfuric acid plant was commissioned, it marked the implementation of the environmental protection program agreed with the Hamburg Senate. In November 1991, Dr. Werner Marnette (left) and Dr. Klaus Göckmann (right) presented the new facility to Dr. Fritz Vahrenholt (middle) who was Senator for the Environment at the time.

In the summer of 1986, Rüdiger Nehberg organized an environmental expedition called "the bulky waste raft" on the Elbe River, together with Hamburg youths. The aim of the campaign was to draw attention to the pollution of the river by both local industries and by contamination coming from the former GDR upstream.

with a system for collecting the dust of the waste gases emitted by the anode furnace. This system was a real novelty in copper refining technology. These measures focused not only on the reduction of pure waste gas emissions but also on the identification and prevention of various fugitive and non-fugitive sources of emissions.

The Hamburg scandal of 1985 and the consequent cleanup program

At the beginning of February 1985, a special edition of the leftwing alternative daily paper taz caused a scandal which generated widespread publicity. In an article headed "Mortal Danger Caused by Copper Smelter", it claimed that the Hamburg authorities were keeping investigation results of the Institute of Soil Sciences under wraps and that soil samples from the industrial quarters between Veddel and Billbrook, but also in the adjoining residential areas, contained peak values of up to 918 mg of arsenic per kg of soil – almost 50 times the level which the Federal Biological Research Center considered to be hazardous to health.[48] NA's decades-long emissions were identified as the main source of the contaminations.

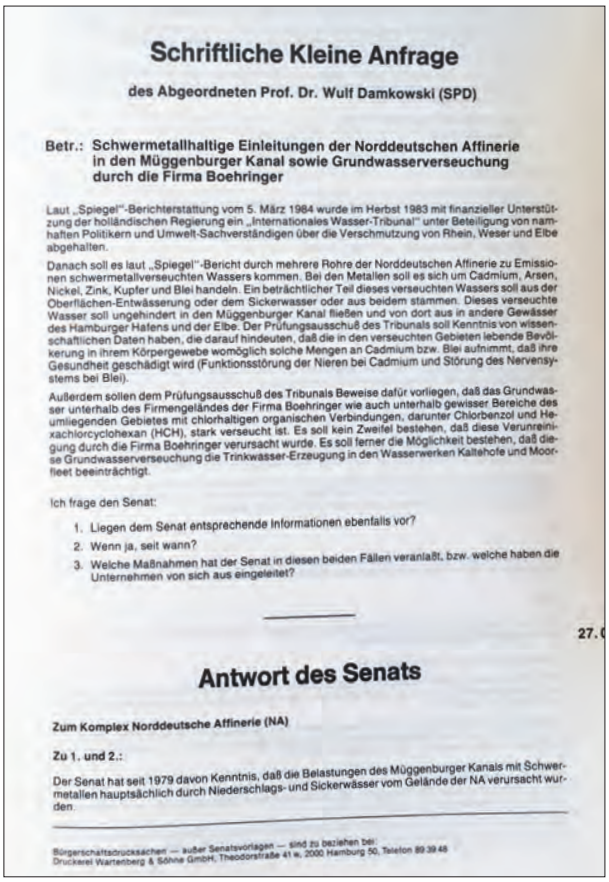
The representatives of the Green/Alternative Group in the Hamburg City Assembly demanded the shutdown of the plant on Peute Island.[49] This caused an uproar among the workforce, which led to some bizarre incidents: During a meeting of the City Assembly to discuss the events at the copper smelter, Benno Oldach, chairman of the Works Council, threw raw eggs at the spokesperson of the Green/Alternative Group from the Senate gallery.[50]

Quite early on, CEO Gerhardt Berndt had declared the company's potential willingness to contribute toward the cleanup costs in those areas contaminated with arsenic. At the same time, however, he disputed the company's exclusive responsibility regarding the earth deposits in the port area and pointed out that any "economically indefensible environmental constraints might lead to considerations of shifting the production in the medium and long term in order to preserve the plant's viability".[51]

Eggs against plant closure

The year 1985 was eventful for NA because of an arsenic scandal which not only afflicted the management but also caused frayed nerves throughout the workforce.

Things came to a head during a debate at the City Assembly on February 13, 1985, when a councilor of the Green/Alternative Group, Elbe River fisherman Heinz Oestmann from Finkenwerder, uttered strong protests against environmental damage caused by NA and repeatedly demanded the closure of the plant. Several raw eggs were hurled from the Senate box, where representatives of the NA Works Council were sitting at the invitation of Mayor Klaus von Dohnanyi, landing right in front of the seats of the Green/Alternative Group. Benno Oldach, chairman of the Works Council, turned out to have thrown the eggs after losing his temper at the prospect of the plant closing and 2,000 workers being laid off. But Benno Oldach had not planned the attack. Like every Thursday morning, he had bought his weekly supply of fresh eggs, which were still in his bag during the debate. Although the protest was a spontaneous act, it was greeted with cheers by his co-workers the next day. In any case, the protest ended up costing the Works Council chairman a hefty sum: He was fined 1,385 DM for disturbing the parliamentary peace.[1]



Schriftliche Kleine Anfrage

des Abgeordneten Prof. Dr. Wulf Damkowski (SPD)

Betr.: Schwermetallhaltige Einleitungen der Norddeutschen Affinerie in den Müggenburger Kanal sowie Grundwasserverseuchung durch die Firma Boehringer

Laut „Spiegel"-Berichterstattung vom 5. März 1984 wurde im Herbst 1983 mit finanzieller Unterstützung der holländischen Regierung ein „Internationales Wasser-Tribunal" unter Beteiligung von namhaften Politikern und Umwelt-Sachverständigen über die Verschmutzung von Rhein, Weser und Elbe abgehalten.

Danach soll es laut „Spiegel"-Bericht durch mehrere Rohre der Norddeutschen Affinerie zu Emissionen schwermetallverseuchten Wassers kommen. Bei den Metallen soll es sich um Cadmium, Arsen, Nickel, Zink, Kupfer und Blei handeln. Ein beträchtlicher Teil dieses verseuchten Wassers soll aus der Oberflächen-Entwässerung oder dem Sickerwasser oder aus beidem stammen. Dieses verseuchte Wasser soll ungehindert in den Müggenburger Kanal fließen und von dort aus in andere Gewässer des Hamburger Hafens und der Elbe. Der Prüfungsausschuß des Tribunals soll Kenntnis von wissenschaftlichen Daten haben, die darauf hindeuten, daß die in den verseuchten Gebieten lebende Bevölkerung in ihrem Körpergewebe womöglich solche Mengen an Cadmium bzw. Blei aufnimmt, daß ihre Gesundheit geschädigt wird (Funktionsstörung der Nieren bei Cadmium und Störung des Nervensystems bei Blei).

Außerdem sollen dem Prüfungsausschuß des Tribunals Beweise dafür vorliegen, daß das Grundwasser unterhalb des Firmengeländes der Firma Boehringer wie auch unterhalb gewisser Bereiche des umliegenden Gebietes mit chlorhaltigen organischen Verbindungen, darunter Chlorbenzol und Hexachlorcyclohexan (HCH), stark verseucht ist. Es soll kein Zweifel bestehen, daß diese Verunreinigung durch die Firma Boehringer verursacht wurde. Es soll ferner die Möglichkeit bestehen, daß diese Grundwasserverseuchung die Trinkwasser-Erzeugung in den Wasserwerken Kaltehofe und Moorfleet beeinträchtigt.

Ich frage den Senat:

1. Liegen dem Senat entsprechende Informationen ebenfalls vor?
2. Wenn ja, seit wann?
3. Welche Maßnahmen hat der Senat in diesen beiden Fällen veranlaßt, bzw. welche haben die Unternehmen von sich aus eingeleitet?

27.

Antwort des Senats

Zum Komplex Norddeutsche Affinerie (NA)

Zu 1. und 2.:

Der Senat hat seit 1979 davon Kenntnis, daß die Belastungen des Müggenburger Kanals mit Schwermetallen hauptsächlich durch Niederschlags- und Sickerwässer vom Gelände der NA verursacht wurden.

Bürgerschaftsdrucksachen — außer Senatsvorlagen — sind zu beziehen bei: Druckerei Wartenberg & Söhne GmbH, Theodorstraße 41 e, 2000 Hamburg 50, Telefon 89 39 48

There have been numerous minor and major written inquiries to the Hamburg City Assembly with regard to environmental issues. These occurred more frequently during the 1970s and 1980s. Later, things grew quieter around NA thanks to increased environmental protection measures at the plant.

Mayor Klaus von Dohnanyi commissioned Prof. Dr. Fritz Vahrenholt, who was state secretary of the Hamburg Environmental Agency at the time, to negotiate a cleanup plan with NA. His counterpart at the plant was Dr. Werner Marnette, executive assistant at the time, who later rose to the position of chairman of the Executive Board, which he held for many years. Before the end of 1985, a cleanup program to the tune of 130 million DM was agreed between the city of Hamburg and NA, which was intended to result in further emission reductions.[52] This first environmental program, which was implemented step by step by 1991, included some milestones such as a new energy policy; the development of new waste gas purifying systems for the Thomas furnace; the expansion of the waste gas system for the Contimelt plant; the installation of a new filter system for fugitive emissions at the eastern primary smelter; and a system for the removal of mercury from SO_2 process waste gases.[53] From the very beginning, NA pursued a policy of integrated environmental protection, i. e. one that was not limited to downstream filter technology but strove to make production processes more environmentally compatible. The company soon became a pioneer in some areas, such as the identification and prevention of fugitive emissions. A result of the cleanup program was that by 1991, arsenic emissions had been reduced to 6.6 g per t of copper produced. During the 1970s, these emissions had amounted to more than 200 g per t of copper produced.[54]

In September 1990, members of the environmentalist group "Robin Wood" climbed up a smokestack at NA, occupied it and unfurled posters as a protest against environmental pollution caused by the company.

The second environmental protection program between 1994 and 2000

NA continued to make considerable investments in measures to make production more environmentally compatible. In 1994, an agreement was concluded with the Hamburg Environmental Agency regarding the further reduction of emissions, particularly fugitive dust emissions which occur during copper concentrate processing. The objective of this second agreement with the city was a reduction in emission values of another 40 % compared to 1992. This amounted to an investment volume of approximately 257 million DM. A number of effective individual measures were implemented within the scope of this program.[55]

In 1994, NA was awarded the European Business Award for the Environment for the installation of its electric furnace as part of the eta competition. Due to the conversion from coke to electricity, the company had succeeded in reducing its annual energy requirements by more than 4,000 t of crude oil equivalents.[56] As early as 1997, Dr. Prof. Fritz Vahrenholt, Hamburg's environmental senator, had described NA as "the world's most environmentally compatible and modern smelter".[57] Without his commitment, together with Dr. Werner Marnette, for a change of direction in NA's environmental awareness since the middle of the 1980s, NA would probably not be producing in Hamburg any longer. In 2001, the company published its own environmental statement for the first time, in which new projects were announced.

Since 1981, approximately 30 % or more than € 400 million of the entire capital expenditure volume has gone into measures which can be described as environmentally relevant.[58] And they succeeded: It was possible to improve all relevant environmental key data considerably. Specific sulfur dioxide emissions, for example, dropped by 83 %, specific dust emissions by even 93 %.

The present – global environmental protection at Aurubis AG

Today, the company which has operated under the name Aurubis AG since 2009 is a global player with locations worldwide. Environmental protection is an inherent part of company strategy at all the Group's sites. One example par excellence is Pirdop: Since the takeover of Cumerio in 2008, the Pirdop plant has been modernized fundamentally. Approximately one-third of total investments, € 59 million, went into environmental protection measures.[59]

Moreover, due to a lack of suitable plant technologies on the market, Aurubis has developed a variety of its own innovative solutions, including some concerning environmental protection. Today, the majority of these have become state-of-the-art globally and have been defined as "BAT" (Best Available Techniques) within the non-ferrous metals industry in European reference documents on the Industrial Emissions Directive.[60] This includes, for example, the secondary hood system for Pierce-Smith converters developed in the middle of the 1980s, which is still considered to be an innovative system for identifying fugitive emissions. The company's environmental policy is in line with both national and international standards, while the ecological guidelines are laid down by the corporate headquarters in Hamburg. There is a separate organizational unit concerned with environmental issues at each plant or each site. The

Things are becoming green again on Peute Island: Freshly-cast anodes from the primary smelter are waiting to be suspended in tankhouse cells. The plant would not exist anymore if it had not been for the modification and restructuring work carried out during the 1980s.

Lovely surprise: In the spring of 2014, a young peregrine falcon hatched at Aurubis Belgium in Olen. The parents raised the nestling in a birdhouse at the smokestack at a dizzying height of 65 m; the smokestack had been up since 2004.

sites regularly report their measured data to Corporate Environmental Protection, which in turn reports to the Executive Board. The measured data is published in annual environmental protection reports to ensure maximum transparency. This includes real-time online access to the plant's emission data by environmental authorities.

Energy: climate protection versus cost-effectiveness?

This question has been worrying industry at least since the political initiation of the so-called "energy turnaround" in Germany during the 2000s and has escalated publicly with the changes related to the German Renewable Energies Act (EEG) from 2009/2010 onward and the nuclear power phase-out in 2011. Is it feasible to meet our electricity requirements in an environmentally sound way without limitations in supply and cost explosions? And, with regard to energy-intensive industries, will their international competitiveness and the safeguarding of domestic locations be put in jeopardy when energy policy is accompanied by additional costs for a local market without any accompanying measures being offered? The questions raised here for the electricity supply will apply in the future to the gas market in a similar fashion.[61] The alleged contrasts in the question, however, are not mutually exclusive.

Aurubis AG is faced with specific challenges. Its production is energy-intensive. The smelting technologies used and the tankhouse require enormous amounts of electric current. Aurubis is one of Hamburg's biggest energy consumers, consuming much more electricity than the urban railway system, for example. Energy has thus always constituted a considerable expense factor for the Group which, when changes occur locally, cannot be compensated by higher sales prices for its products – copper, the Group's principal product, is priced centrally on the metal exchanges, whether in London, New York or Shanghai. "It has been recognized at the political level that one special aspect of Aurubis' business is the fact that additional local costs cannot be passed on to customers," stresses Ulf Gehrckens, head of Corporate Energy & Climate Affairs.[62] There is an additional aspect with regard to the opposite side, the suppliers: When raw materials are purchased, these extra costs cannot be cited in negotiations with mines, either, if competing companies seeking to buy concentrates do not have such costs. If one considers all these issues, then it is in Aurubis' own interest to use the sourced energy efficiently, to save it and to recover it from processes wherever possible. This results in reduced consumption, which benefits both the balance sheet and the climate. With these measures, it has been possible to reduce the specific energy consumption at the Hamburg site by 46 %.[63]

An employee of the Environmental Protection Department taking water samples.

Working together for the environment at Aurubis Bulgaria: In April 2011, 130 employees planted a forest of Austrian pine near Pirdop as part of the "Green Month" campaign.

A restructuring of the electricity supply to the Hamburg plant was due in the middle of the 2000s. The initial planning for an internal power plant using RDF technology, i.e. refuse-derived fuels, came to nothing since further CO_2 emissions were politically undesirable and the decision to build the coal-fired Moorburg power plant had already been made.[64] In the spring of 2007, a compromise with the operator Vattenfall and the city of Hamburg was found, which meant that Aurubis dropped its plans for a power plant of its own and acquired a cost-based "virtual slice" of the Moorburg power plant in return based on approximately one billion kWh/year and a runtime of 30 years starting in 2010. Since then, all German Aurubis plants have been supplied via this power plant "slice". As coal plays a dominant role internationally in electricity price fixing, this step has stabilized Aurubis' relative competitive position.

It is, however, not the mass alone but the constant availability of electricity which is the deciding factor for the functioning of the types of processes used by the copper group. Even minor fluctuations in the supply voltage may impair individual units in extreme cases, leading to shutdowns which in turn result in immense costs.[65] Conversely, however, by being a constant consumer, Aurubis is making a positive contribution to the stability of electricity networks and to system reliability in a physical/technical sense.[66]

Volatile energies, i.e. those that fluctuate in their availability such as ones derived from either solar or wind power, diminish the efficiency of energy input. They require the possibility of flexible utilization, which in turn demands scheduling in adaptable process windows. As energy management is a further aspect of the new Group strategy of increasing complexity, this strategy is set to assist in mastering the transformation of the energy industry from fossil to regenerative energy sources.

Efficiency and security of supply are the two dimensions, apart from ecological aspects, that are the determining factors of the energy issue from an economic perspective for Aurubis. As a start, the company is making its own contribution to efficiency: All relevant plants work with energy management systems, carry out energy audits and have been certified to DIN standards. This enables the systematic operation of energy-efficient plants as well as the identification of further energy-saving measures.[67] The results are openly communicated, which earned Aurubis the "Best Newcomer Germany" award for transparency in climate protection activities from the investors' initiative "Carbon Disclosure Project" (CDP) in 2015.[68] Another distinction in 2015 was the "Best Practice in Energy Efficiency" label awarded by the *Deutsche Energie-Agentur GmbH* (dena/German Energy Agency GmbH).[69] Aurubis is part of several energy efficiency networks to optimize compe-

NA aid project Ape Gama ("Our Village") in Sri Lanka: NA employees collected € 75,000 to help build a village for the victims of the tsunami in Sri Lanka. Dr. Werner Marnette, chairman of the Executive Board, promised to triple each euro donated. As a result, a total of € 225,000 was donated, which was used to provide new homes for many people.

tencies, for example the network of the Metal Trade Association. Today, Aurubis AG has an overall reputation as a benchmark for clean and efficient copper production.[70]

Moreover, its product is regarded as the material for the energy turnaround par excellence. Wind mills, solar technology, network technology, electric cars and, last but not least, energy efficiency require the excellent properties of copper.

The second dimension, security of supply, requires initiative and decisions at the political level, as the future of the energy supply lies in renewable resources. The key concepts in this context are the expansion of power grids and of storage technology and the facilitation of back-ups through state-of-the-art conventional power plant technologies.

The high security of supply in the past, although it was paid for with higher electricity prices, was a locational advantage for energy-dependent industry.[71] The chairmen of the Executive Board of recent years, starting with Dr. Werner Marnette and followed by Dr. Bernd Drouven and Peter Willbrandt, had to work closely with political echelons in order to safeguard grid security and to make sure that special local regulations did not cause additional costs resulting in precarious implications. The objectives of the Aurubis energy and climate management are not subsidies but sustainability and the maintenance of competition.

Responsibility within the supply chain

Aurubis meets its social responsibility not only within the immediate business environment and day-to-day operation, for example with regard to the environment, workplace safety and health, training, support for women and families, and similar aspects. Aurubis also sets an example in areas where no direct access is possible, such as the sourcing of raw materials, where the Group has a clear position of observing human rights and the needs of indigenous peoples and rejects discrimination of any kind, forced labor and child labor.[72] Accordingly, Aurubis expects all its supply partners to comply with the laws in force in the countries of origin of their materials with regard to production as well as export. Suppliers are contractually obliged to observe all United Nations conventions and sanctions with respect to human rights, the environment and safety.

Sounding out the Group

Nevertheless, Aurubis AG has had to face critical comments regarding the way it has dealt with social and ecological problems in producing countries, even quite recently. There were reports about raw material mining conditions in general and specific human rights conditions in Peru, South America in 2012 and 2013.[73] As recently as the annual general meeting in February 2014, this criticism was taken up and questions were asked regarding the Group's position on "disappointed hopes, (...) environmental problems and a high potential for conflict with land users and people who had to be resettled" in connection with mining in Peru.[74]

As a matter of fact, Peru, situated in the "copper belt" of the Andes like Chile, has been one of the most important countries of origin of copper concentrates for

Bird's-eye view of copper scrap yard with new recycling materials being delivered.

At the beginning of the 20th century NA sourced some of its copper ores from the Otavi region, the former colony of German South-West Africa.

Aurubis to this day. During fiscal year 2013/14, Aurubis sourced approximately 12 % of its copper concentrate supply from various Peruvian mines. This volume, however, only comprises about 8 % of the entire Peruvian concentrate output.[75] The mining sector, which accounts for more than half of Peru's exports, has repeatedly been the subject of critical reports and studies during the last few years.[76] The fact that the majority of the population does not benefit from the mining sector's success is only part of the issue. Studies deplore the fact that the expansion of the mining industry in Peru is accompanied by a massive increase in regional conflicts, often about land use rights.[77] Certain aspects of copper surface mining such as the issue of the resettlement of local residents and in particular the shortage of potable water as a result of contaminations have been recognized as violations of the human rights to water and health.[78]

In 2001 and 2002, even before Peru came into focus, similar discussions took place with regard to another country, Indonesia. This is still the case more than 10 years later. At the time, the Southeast Asian island state was the third most important supplier country for NA. The copper ore mines at Batu Hijau on Sumbawa and at Grasberg in Western Papua were notorious for their practice of disposing so-called "tailings", i.e. ore extraction residues, either in a bay or in rivers in the vicinity. This was accompanied by grave violations of human rights on the part of Indonesian authorities, the military and private security contractors, including restraints on the freedom of speech and of assembly, the arbitrary exercise of power and infringements of the special rights of indigenous peoples. During the 2002 annual general meeting, the management of NA had to face critical questions on these issues.[79]

Before the end of 2014, Aurubis initiated a series of discussions with NGOs.[80] Apart from the talks on environmental subjects, the exchanges with both Misereor (a charity organization of the Roman Catholic Church) and the Peruvian organization Human Rights Without Borders, which took place on the Hamburg plant premises, proved to be fruitful. Aurubis AG succeeded in making clear that, despite its lack of direct influence on suppliers of raw materials, it dealt extensively with sensitive aspects of sustainability. The dialogue with the organizations will continue and will include local discussions in the mining regions.

A new evaluation tool for sustainable standards

Aurubis has always been careful in choosing its suppliers. In parallel with criticism regarding Peru, Aurubis started to develop an evaluation tool in 2013 which has been in effect since 2015. This enables a more syste-

Ok Tedi – Environmental problems resulting from mining in Papua New Guinea

The Ok Tedi copper ore mine is situated in the western highlands of Papua New Guinea near the river from which it takes its name. It was opened up during the 1970s with the intention of becoming the economic foundation for the country after its independence in 1975.

The mine, however, did not only bring wealth, with its sales of raw materials making up approximately 20 % of the country's exports – it also turned out to be both an environmental and a social problem for the Pacific state.[2] Although the development of the region was accompanied by improvements in the public domain such as schools, infrastructure, healthcare and employment, the lack of care in dealing with the effects of ore extraction on the environment took its toll. The fine-grained ore residues in the form of sludge, so-called "tailings", were disposed of into the sea via the Ok Tedi River and the region's water systems, later complemented by a pipeline. The construction of a retention dam which was destroyed by an earthquake in 1984 was discontinued because the seismic risks were too severe.

Agriculture and fishing along the lower stretches of the rivers suffered, and with them the lives of inhabitants of the adjacent villages, while large areas of rainforest were damaged. In the middle of the 1990s, the local indigenous people sued the mine operator BHP, which had to pay them US$ 28.6 million in damages. Another claim for a payment of US$ 5 billion is pending. In the meantime, BHP has completely withdrawn its stake and the mine has been state-owned since 2013. Plans for closing the mine in 2013 were discarded by the majority of the local population. An association of 156 villages in the region voted for the mine operation to continue until 2025. It was agreed that about a third of profits should go into development programs for the region. The remaining two-thirds will be paid into a long-term fund which is to improve the social and economic situation of the population for a period of at least 50 years after the closure of the mine.

Over the years, NA has sourced approximately 13 % of its copper concentrates from Ok Tedi, with the procurement volume scaled back successively after an initially higher volume.[3]

In 2000 and 2001, NA became the subject of harsh criticism by environmentalists.[4] The company entered into a dialogue with the environmentalists, the mine operators and the government of Papua New Guinea. Part of this dialogue was a joint visit to the mining area in November 2000 by NA management, the company medical officer, the Works Council and environmental activists. This visit was followed by further regular visits to the area by the company and has resulted in the financing of concrete aid projects which are continued and supplemented to this day. Among these projects is a health center for the training of health workers at Rumginae. Medical diagnostic devices such as an ultrasound unit, an X-ray apparatus and a rescue vehicle have been provided.[5] There have been efforts in Papua New Guinea to support the communities along the water system with the Ok Tedi Development Foundation (OTDF), which was founded years ago; the Bige Dredging Program for the disposal of sediments in the river and for revegetation; and the "zero harm" program.

A view of the giant Ok Tedi opencast copper mine in the western highlands of Papua New Guinea.

matic screening of all business partners with regard to their integrity concerning social and ecological criteria. This "Business Partner Screening" program does not just focus on identifying critical raw material sources but aims to scrutinize all raw material suppliers and customers before contracts are entered into.[81] In practice, standard corporate IT software which has been specifically configured is used for this purpose.[82] It records any financial, tax and criminal law risks as well as any risks relevant to issues of sustainability. The result is a profile that leads to further examinations in the case of increased risks. Aurubis will not enter into any new unevaluated business relations, and existing ones are examined at regular intervals.

This evaluation system was already used in the precious metals sector in 2013: A survey of suppliers of raw materials containing precious metals, particularly gold, indicated that Aurubis was not sourcing any conflict-prone gold-bearing raw materials.[83] This early application of the screening program was part of a Gold Supply Policy which was developed corporate-wide in 2013 and is based on the OECD guidelines regarding due diligence with respect to conflict-prone minerals as well as the stipulations of the UN Global Compact, which Aurubis joined in 2014.[84] As a result, the company's gold production was certified as "conflict-free" in accordance with the standards of the Gold Guidance of the London Bullion Market Association (LBMA) in December 2013.[85]


LBMA

The London Good Delivery List of Acceptable Refiners

RESPONSIBLE GOLD CERTIFICATE

We hereby certify that

Aurubis AG

of

Hamburg

complies with the LBMA Responsible Gold Guidance.

An independent third party audit of the company's supply chain due diligence was completed on

12th December 2014 for the period 1st Oct 2013 - 30th Sept 2014

Chairman, Physical Committee

Chief Executive

London Bullion Market Association

www.lbma.org.uk

Aurubis has been successfully certified for the processing of "conflict-free" gold-bearing raw materials in compliance with the London Bullion Market Association (LBMA).

Aurubis makes a commitment

Aurubis is committed to the guidelines for sustainable economic activity laid down by international organizations. The following guidelines are of fundamental importance:

» The Due Diligence Guidance issued by the OECD developed as a voluntary instrument in 2011. This guidance includes a responsible global supply chain management for the processing of so-called "conflict-free" raw materials.

» The UN Global Compact created by former Secretary-General Kofi Annan in 2000. It calls upon companies to proclaim their commitment to 10 principles for a social and ecological shaping of globalization. The central concerns are human rights, working standards, the protection of the environment and the fight against corruption.

» The core labor standards set down by the International Labor Organization (ILO), as declared in 1998. They are intended to help guarantee humane working conditions and workplace safety worldwide. The standards are a combination of conventions, some of which have been in force for decades, for example those against forced labor, for the equality of pay, against discrimination in the workplace and against child labor.

Milestones

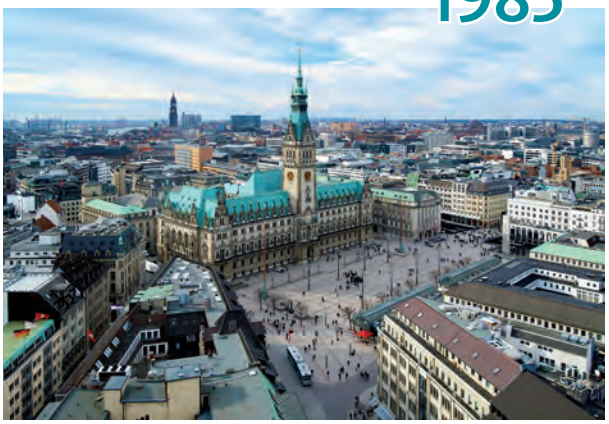
1920/21

First utilization of coolers and fabric filters

Beginning of the 1980s

Beginning of the 1980s: NA sets up a separate environmental protection division with three employees (for comparison: Today, the Environmental Protection Department at the Hamburg plant alone has 16 employees)

1985



Conclusion of an emission control agreement with the Hamburg municipal authorities and initiation of a comprehensive modernization and environmental protection program to reduce emissions

1990

Decommissioning of old shaft furnaces and replacement with an environmentally friendly, low-emission electric furnace at the northern primary smelter (Rohhütte Nord)

2005

Commissioning of the modernized secondary smelter (house-in-house system; in accordance with a 2003 agreement with the Hamburg Environmental Agency to reduce fugitive emissions)

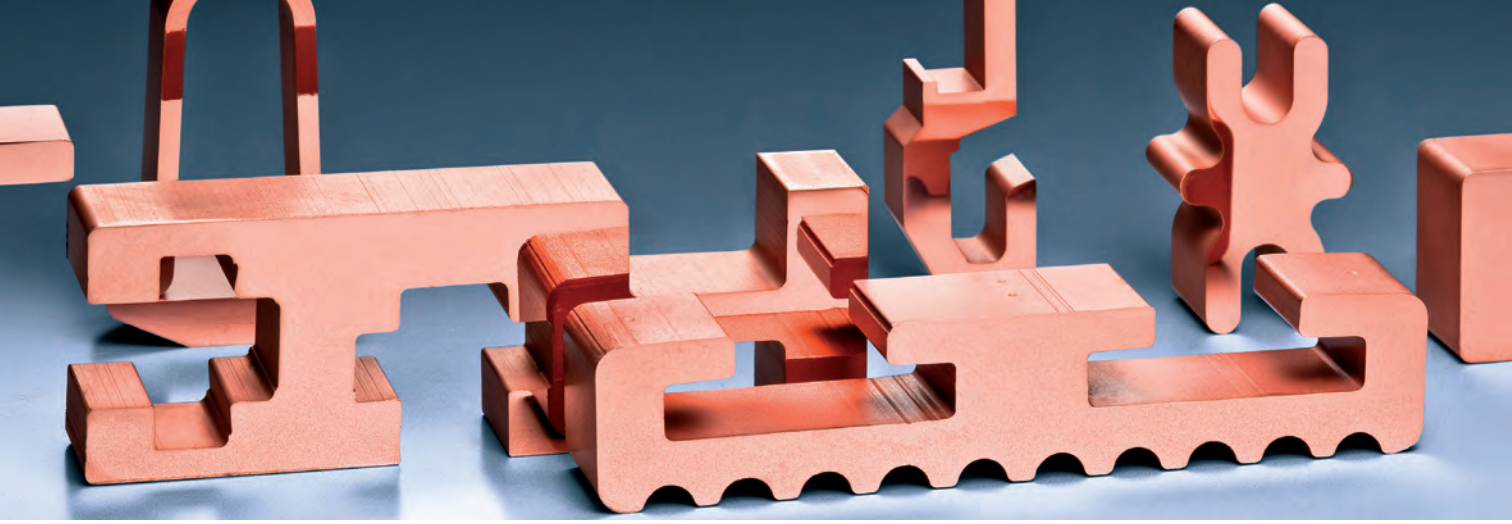
1994–2011

1994: First agreement with the Hamburg Environmental Agency to reduce emissions by a further 40 %. Additional agreements followed in 1998, 2001, 2003 and 2011 (pictured here)

2013

Development of the Business Partner Screening program, beginning with raw material suppliers

We are future-oriented



Material of the future: Copper enables technical progress and modern life. The picture shows futuristic-looking copper sections which are used for switching devices and electrical distribution systems.

Copper is future-oriented

Copper is the oldest metal used by man for everyday objects, yet it is as young and up-to-date as no other metal. As long as 10,000 years ago, both tools and crockery were made of the "red gold". There is almost no other material that can be used in such a variety of ways. To this day, we come across copper daily, even though its is not always visible, for example in cellphones and household appliances or when activating a vehicle's electric windows. There would be no interconnection through telecommunications without this metal, no energy supply and no transport.

There is no progress without copper – this is also and especially true of the current century.

The versatile metal of the present and the future

Copper has outstanding physical properties, first and foremost a high electrical and thermal conductivity. Moreover, it can be 100 % recycled, is relatively resistant against corrosion and highly ductile. These properties make copper the material of choice in our modern lives. Copper is usually involved whenever electric current or data flow.

The present long-term transformation processes, the so-called "megatrends", call for copper, too: Forecasts therefore assume that the current annual demand for copper of approximately 22 million t will increase to 30 million t in 2030. The fact that many regions, particularly emerging markets with low standards of living and poor infrastructure, have a pent-up demand is illustrated by the following figures: While annual per capita consumption of copper in industrialized economies such as Germany and the US is between 6 and 8 kg, it is not even 1 kg in many Asian and African countries.

Energy shortage megatrend: This leads not only to an increasingly decentralized energy supply but also to the necessity of developing appropriate energy storage facilities and a higher degree of utilization of renewable forms of energy. Without copper, neither the nuclear power phaseout agreed on in Germany nor the new climate protection objectives can be implemented. No matter whether it is wind turbines, solar panels or power cables: Copper is needed everywhere. More than 200 km of copper wire is used in one wind turbine generator alone. Added to this is the copper content inside the cables which carry the produced current from the wind turbines into the power grid, or from offshore wind farms to the mainland. Copper acts primarily as an electric and thermal conductor, not only in solar panels but also in heating boilers, geothermal heat pumps and electrical lines.[1] Copper plays a key role in restructuring measures moving in the direction of sustainable energy

This is how we will live in the future: In the smart home, air conditioning, light, alarm systems etc. can be controlled remotely.

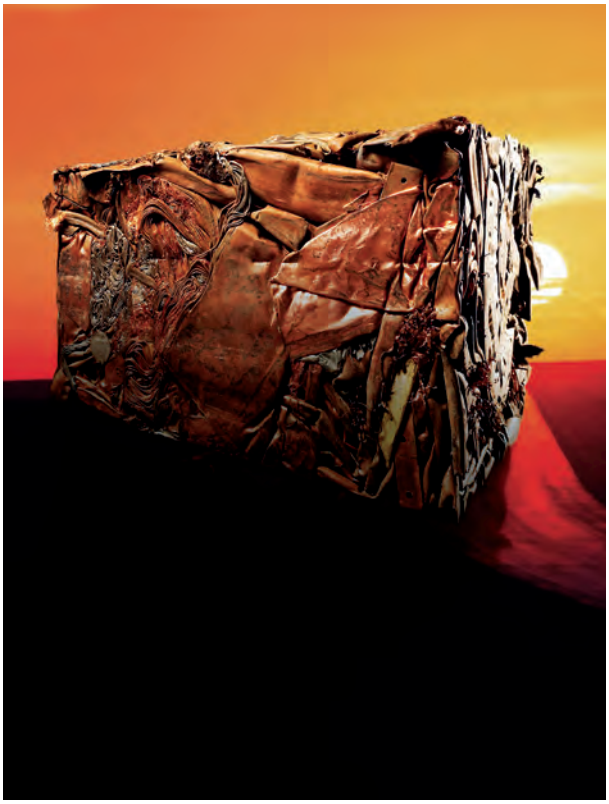
Everything revolves around copper: The generator of a modern wind power plant alone contains approximately 200 km of copper wire.

generation. Energy management is another central challenge. The increasing role played by renewable energies in the energy supply leads to uncertainties in the base load, which is critical for the failure-free operation of most facilities. "Industry will adjust to that since we are in the middle of an energy transition anyway," says Dr. Stefan Boel.[2] Aurubis is working on controllings its production depending on the available energy. This includes the question of what time would be the best for scheduling maintenance work, for example.

Mobility megatrend: The advantage offered by copper should not be underestimated. A mid-size car contains as much as 25 kg of the metal already. This can easily more than double for a luxury car – the better the equipment, the more copper is included. Additional demand for copper is created by electric drives, which will become increasingly important in the future. Not only electric vehicles themselves contain approximately 100 kg of copper; the necessary charging stations and their wiring will raise the demand further. Furthermore, each high-speed train has about 20 t of copper-bearing material built into it, mainly in voltage transformers and propulsion engines. A special copper alloy has been developed for contact with overhead contact wires, which ensures an electricity supply even at constantly increasing train speeds.

Urbanization megatrend: We are often surrounded by copper, not only when we are on the move but also at home. Because of their durability and ease of handling, copper pipes have been used for the installation of water and heating systems for a long time. In addition, there are all the electric power lines made of copper which connect light switches, lamps and sockets and carry the necessary current. There are some new applications, too. Air conditioning systems which were initially only used in the public domain and in warm regions are becoming more and more popular for private apartments today. However, they are also an ideal breeding ground for both mold and bacteria. Copper possesses unique antimicrobial properties. If the pipes in an air conditioning system are made of copper, the growth of bacteria and fungi can be reduced by more than 99 % compared with aluminum pipes.[3] Energy efficiency can be increased considerably if specially designed copper pipes with microgrooves on the inside are used.

The increasing connectivity of all domestic appliances and installation systems leads to the "smart home": lamps, heating systems, air conditioning and alarm systems, as well as the stove, refrigerator, dishwasher and stereo equipment are centrally controlled – even with remote internet access. Besides an increase in the quality of life, the focus here is mainly on safety aspects as well as more efficient energy use.



Made for eternity: Copper is a material which is not only environmentally friendly but also has an optimum recyclability. Waste copper is always processed as a secondary raw material as well.

Ideal conductor: Copper has an excellent conductivity amongst metals and is therefore used in electric cables. A copper sheathing is even used for aluminum cables to enhance their conductive properties.

Whether it is lamps, shelves or bathtubs: Copper look designs are very trendy, both for indoor and outdoor uses.

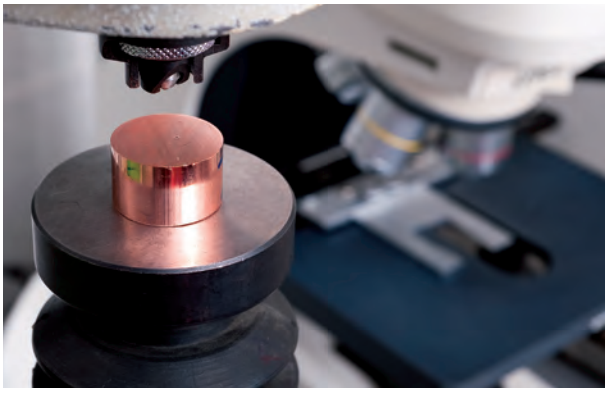
Yet copper is not only needed inside buildings – it is also appreciated by architects as a resource. What is more, copper has increasingly turned into a favorite material for designers.

Sustainability megatrend: This is closely related to resource efficiency and recycling. Copper has a special advantage here, as it is one of the few metals which can be recycled time and again without any loss of quality. It is therefore quite possible that a latest generation smartphone contains copper that was used by our ancestors for making tools thousands of years ago.

Aurubis is the biggest recycler of copper worldwide. The company already sources about one-third of its produced copper from processing old copper pipes and cables, for example. It also uses so-called “urban mining”, which views densely populated cities as giant “mining locations” to obtain copper, precious metals and other resources from recycling electrical and electronic waste and feeds these back into the loop.

The steadily progressing miniaturization of cellphones and other technical devices continuously requires new technologies for processing and extracting the individual materials. Today, Aurubis is no longer just a recyler of copper but a multi-metal recycler, since the number of different metals and materials rises in line with both miniaturization and the development of new electronic devices. Recyclable materials are becoming more and more complex – and they are not alone: Our primary raw materials, copper concentrates obtained from

A true all-rounder: The moldability and stability of copper is such that it is particularly easy to process and can be used in almost any industrial sector. That is why these days copper is indispensable in the automotive industry and in energy distribution, for example.



Small is beautiful: The versatility and flexibility of copper is demonstrated in its use in both micro- and nanotechnology.

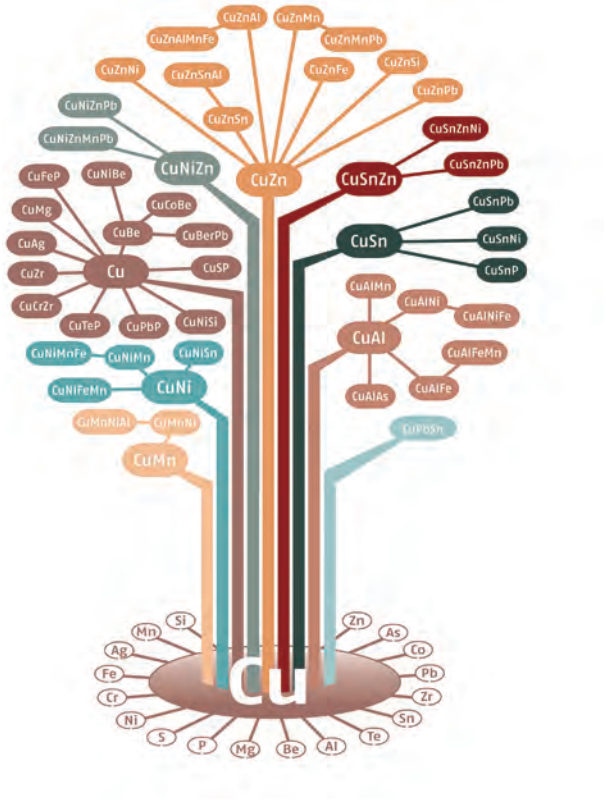
Copper in construction: Copper is also popular with architects as a raw material which is characterized by its excellent durability. Furthermore, when it is used for outer facades, weathering processes create interesting surface structures.

copper ores, also require improved technologies for extracting metals.

"In this environment, the 'closing the loop' concept offers Aurubis new opportunities in recycling which can be used for creating value. Its objective is to offer customers completely closed cycle systems of recoverable materials, for example by recycling copper-bearing manufacturing waste which accumulates in the processing of copper into end products. By doing that, our customers become suppliers at the same time," says Erwin Faust, Executive Board spokesman at Aurubis AG.[4]

Complexity megatrend: In the past, Aurubis had achieved growth primarily by enhancing the specific performance of individual production units or by continuously expanding production volumes. There are, however, technical and natural limitations to these aspects which have been almost reached. These days, Aurubis is faced with a permanently rising complexity in the composition of its raw materials when sourcing copper concentrates and recycling materials, leading to a need for not only new production processes but also for innovative IT-based planning tools.

Because of progressive extraction in the mines, the copper content of the ores which the Group purchases worldwide, for example, is almost always much lower these days than it was 10 years ago. On the other hand, there is an increase in both the number and the share of



Versatile product, multi-purpose raw material: The elements with which copper forms a permanent bond are just as diverse as the intermediate and end products made of copper.

other elements such as fluorine, nickel and lead, which require efficient yet environmentally friendly processing techniques from Aurubis. The chemical similarity of these elements makes it difficult to separate them from one another. This poses a challenge to the handling process, since separate solutions have to be found for each element. An improved harmonization of individual process steps is required to extract these by-metals which are of great economic importance.

The same is true for recycling materials: The content of both copper and precious metals is dwindling, while the number as well as the share of other materials such as plastics and glass is rising.

No surface for diseases: Copper offers another advantage. While even small amounts of the metal are toxic for micro-organisms, it has an antibacterial effect on vertebrates and thus on humans. More and more hospitals are therefore using door handles with copper alloys for their patients' rooms.

Challenge and opportunity for Aurubis

In this perspective for the future, Aurubis feels well positioned with its core metal copper. The increasing complexity of raw materials will be a special challenge to Aurubis in the coming decades – and an opportunity at the same time.

Anyone looking at Aurubis and its copper production more closely these days will notice that the Group is already reacting to this and is setting the course for the future. The objective is "to optimize the path of copper based on values", says Dr. Bernd Drouven.[5] This is supported not only by a fundamental analysis of current production processes but also by a consistent focus on the central challenge and opportunity for Aurubis at the same time: complexity. "This complexity requires our flexibility."[6] In particular since it is does not involve a steady reduction in complexity but actually an increase – as has been explained with regard to the subject of raw materials.

"However, the task sounds easier than it actually is. We have to harmonize our corporate variables in such a way that their respective individual advantages will improve the overall process and thus increase the company's success."[7] That means, for example, that in some cases a particular raw material, although it would be ideal for a

Cosmetics and technical applications: Copper is also used as a component in skin creams to protect the skin and generate warmth. Hidden behind the technical term hot thread compound is the better known copper paste. The special paste made of copper powder and specific fats is used as a separating agent, for example in airplane turbines. The paste withstands temperatures between -30 °C and 1,300 °C.

In copper coins, too: Copper has a wide range of uses in euro coins. While coins between 10 and 50 cents have the highest copper content with an average of 89 %, one and two euro coins have a copper-nickel alloy in their center and outer rings.

plant, will not be used because it would be detrimental to the company's overall success. Whether this concerns the use of primary or secondary raw materials, the production, the utilization of the available energy, dealing with the specific limits of production facilities, the deployment of staff or the areas of logistics and customer service – all of these aspects determine business at Aurubis day in, day out.

The Group has integrated a series of additional downstream production processes which permit greater flexibility in the material input mix, at the point where the processes used by classic metal smelters stop. This complex production infrastructure requires comprehensive experience as well as a great deal of expertise – both of which Aurubis has been able to acquire during the past 150 years. This distinguishes Aurubis from many other metal producers – a genuine competitive advantage. Complex compounds of raw materials are therefore good for the company despite their more elaborate processing, and this is going to add to the strength of its supply partners.[8] For example, if mines follow natural ore deposits in extraction and these deposits are becoming more and more demanding in their complexity, they will benefit from the fact that Aurubis is able to provide both processes and plants which can handle these materials in an environmentally compatible way.

Aurubis is therefore in a position where it can offer solutions to its suppliers and is also able to develop solutions in close cooperation with them. The additional cost of processing complex raw materials is rewarded with higher treatment and refining charges. As far as society is concerned, Aurubis makes an important contribution to sustainability as well as to an environmentally sound recovery of raw materials.

Focusing on complex raw materials and process optimization poses further challenges. It makes demands on all facets of the business and can only succeed "together and involving all sectors of the Group".[9] When the limits of technical processes and their interplay are re-explored, new concepts are tried out, tested and measured – successes and failures, in trials and during implementation. Both analytical and sampling processes

Well positioned for the future: Aurubis' young talents gain experience in different departments and divisions of the Group during their apprenticeships. This helps them to understand the complexity of the overall processes, to learn to look beyond their own workplaces and to take the needs and demands of both upstream and downstream divisions and departments within the process chain into account.

are becoming more sophisticated. Research and Development also take up new trends and methods. The Group's customers rightly expect Aurubis to know their needs. For instance, the company works very closely with its customers when it comes to implementing certain alloys for new products or to managing "just in time" deliveries.

First and foremost, it is the people working for Aurubis who are immediately affected by the impact of the challenges the future holds in store for the Group. It is absolutely vital for the company to take its employees on board as it moves along a path which may bring changes for each one of them but which will open up many new opportunities for the Group, all in all. It is up to the Group to explain the contexts and future scenarios to its workforce and to point out the complexity of overall processes. The employees, on the other hand, are faced with increasing demands to not only look at their own production section but to understand and bear in mind the needs and the integration of both upstream and downstream plants within the process chain.

Well positioned

From urbanization to live streaming via the internet, e-mails around the globe, vehicle production, mobility and energy distribution: Copper accompanies us in every situation in our lives. Its excellent conductivity ensures the reliable transfer of information as well as energy. "It is exactly this copper of the highest purity and quality which is produced by Aurubis. Our constant focus is not only on innovative and intelligent solutions for our customers but also on sustainability and responsibility."[10]

Unique purity: The focus of Aurubis is on customer orientation, sustainability and responsibility. That is the reason for producing copper of highest quality and purity.

Besides this material of the future, the foundation of work at Aurubis consists of a high productivity and processing depth, a consistent market orientation and close customer relations. The natural result of this is the development of innovative products in combination with a diverse customer structure: companies in the electrical, telecommunications and chemical industries as well as those in the construction, automotive and engineering sectors. Another important requirement is the need to further develop the available expertise consistently – not only in primary copper production and recycling but also in the products sector and in niche markets, which have contributed so much to the success of Aurubis to this day. In the future, Aurubis will continue to be more than just a copper producer: experienced, aware of the past, international, loyal, innovative, sustainable and future-oriented.

The founders of Norddeutsche Affinerie

Dr. Ferdinand Beit (1817–1870)

Son of draper Philipp Raphael Beit

1846 Technical director of Elbkupferwerk

1857 Co-founder of Elbhütten-Affinir Handelsgesellschaft

1866 Charter member and president of Supervisory Board at NA (1866–1870)

Karl Friedrich Ludwig Freiherr von Westenholz (1825–1898)

Founder of Friedrich Westenholz & Co.

1858–1872 Member of Supervisory Board at Norddeutsche Bank

1866 Elected vice-president of Supervisory Board at NA

1870–1898 President of NA

George Ferdinand Gorrissen (1821–1904)

Employment in paternal business "Gorrissen & Lutz" in Hamburg until his appointment as grand ducal consul general

1869 Ennoblement

1898–1904 Member of Supervisory Board at NA

Ferdinand Jacobson (1822–1905)

Merchant and founder of a trading company in Hamburg named after him

1856 Charter member of Norddeutsche Bank

1866–1902 Member of Supervisory Board at NA

1861 President of Commercial Deputation

1895 Conversion of his trading company to a bank

Chairmen of the Executive Board

Dr. Felix Warlimont (1879–1950)

1915 Joined Metallbank and Metallurgische Gesellschaft in Frankfurt/Main as an engineer

1920 Dispatch to Hamburg to write an expert opinion on the economic problems of NA

1920–1942 Chairman of the Board of Directors

1942–1950 Chairman of Supervisory Board

Kurt Heide (1898–1980)

Joined Metallbank in Frankfurt/Main

1942 Joined Executive Board at NA

1943–1945 Chairman of Executive Board

Ernst La Pierre (1895–1971)

1921 Joined NA as assistant to financial management

1930 Appointment to Executive Board

1951–1961 Chairman of Executive Board

1955 Award of German Federal Cross of Merit

Paul Hofmeister (1909–2002)

1927 Joined NA

1938/39 Worked for NA in Chile

From 1947 Member of Executive Board

1961–1976 Chairman of Executive Board

1976–1981 Chairman of Supervisory Board

1981–2002 Honorary Chairman of Supervisory Board

Walter A. Gleich (1924–1999)

1942 Joined NA

1947 Rejoined NA as administrative apprentice following captivity as British prisoner of war

1961 Deputy member of Executive Board

1966 Associate member of Executive Board

1976–1986 Chairman of Executive Board

Gerhard Berndt (born 1928)

1953 Joined NA, work at Rohhütte Nord smelter

From 1964 Technical assistant to the Executive Board; management and planning of RWO

1972 Deputy member of Executive Board

1975 Ordinary member of Executive Board

1986–1990 Chairman of Executive Board

Dr. Klaus Göckmann (born 1942)

1975 Joined Metallgesellschaft

1987 Transfer to Cominco Ltd. in Vancouver

1990 Member of Executive Board at NA

1990–1994 Chairman of Executive Board

Dr. Werner Marnette (born 1945)

1978 Joined NA as assistant production manager

1980 Rejoined NA after working one year for Korf Stahl AG

1986 Appointed plant manager

1990 Appointment to Executive Board as deputy member

1992 Ordinary member of Executive Board

1997 Chief human resources officer

1994–2007 Chairman of Executive Board

Dr. Bernd Drouven (born 1955)

2001 Joined NA as chief operating officer of subsidiary Spiess-Urania Chemicals GmbH in Hamburg

2004 Head of strategic planning/international relations

2006 Appointment to Executive Board as chief financial officer

2008–2011 Chairman of Executive Board

2013 Member of Supervisory Board

Peter Willbrandt (born 1962)

1988 Joined NA as assistant production manager

2004 Head of Business Unit Primary Copper

2007 Appointment to Executive Board as deputy member

2008 Ordinary member of Executive Board

2012–2014 Chairman of Executive Board

Jürgen Schachler (born 1954)

Until 1993 Various positions in the chemical and metalworking industries, including at Solvay

1993 Joined Usinor Group Paris as managing director of Sprint Metall Deutschland

1999–2016 CEO of various companies of ArcelorMittal in the United States, Thailand, Canada and Europe

July 1, 2016 Starting as chairman of Executive Board

Other significant personalities

Marcus Salomon Beit (1734–1810)

Son of wealthy Jewish draper Salomon Isaac Beit

1770 Founder of gold and silver smelting works at no. 43, 1 Elbstrasse

Lipmann Raphael Beit

Nephew of Marcus Salomon Beit

1846 Co-founder of Elbkupferwerk on the Elbe island of Steinwerder

Johann Cesar Godeffroy VI. (1813–1885)

Shipowner and merchant from old Huguenot family

1837 Joined J. C. Godeffroy & Sohn

1846 Co-founder of Elbkupferwerk on the Elbe island of Steinwerder

1856 Co-founder of Norddeutsche Bank

Siegmund Robinow (1808–1870)

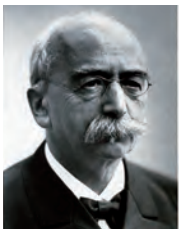
Son of Marcus and Emma (née Beit) Robinow

1846 Co-founder of Elbkupferwerk on the Elbe island of Steinwerder

1856 Co-founder of Norddeutsche Bank

1857 Stockholder of Elbhütten-Affinir- und Handelsgesellschaft

Dr. Emil Wohlwill (1835–1912)



Pioneer in the subject of electrolytic refining

1855–1859 Studies in experimental chemistry, organic chemistry, experimental physics, mineralogy, geology and botany. Conferral of PhD in Göttingen with dissertation "Über isomorphe Mischungen der selensauren Salze"

1860 Self-employed trade chemist

1875 Development of tankhouse principle for copper electrolysis

1877–1900 Senior chemist at NA

Dr. Heinrich Wohlwill (1874–1943)

Son of Emil Wohlwill

1898 Joined NA

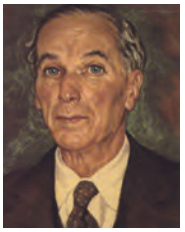
1903 Invention of electrolytic method for production of cuprous oxide (Cu_2O)

1913–1933 Member of Executive Board and technical director at NA

1942 Deportation to Theresienstadt concentration camp

1943 Murdered

Richard Merton (1881–1960)



Industrialist and politician; son of Wilhelm Merton, founder of Metallgesellschaft

1917 Chairman of Supervisory Board at Metallgesellschaft

1935 Member of Supervisory Board at NA

1938 Enforced withdrawal from all functions within companies and institutions

1950–1955 Chairman of Supervisory Board at Metallgesellschaft

1950–1958 Chairman of Supervisory Board at NA

Notes

The history of copper processing

1_Ronald Frank Tylecote, Überblick über die Geschichte der Kupfer-Gewinnung und Kupfer-Verwendung in den Ländern der Welt von urgeschichtlicher Zeit bis zum Mittelalter, in: Norddeutsche Affinerie (publ.), Kupfer in Natur, Technik, Kunst und Wirtschaft, Hamburg, 1966, p. 23.
2_Franz Kirnbauer, Kupfererzbergbau und Kupfererzverhüttung im Mittelalter und in der Neuzeit bis um das Jahr 1900, in: Kupfer in Natur, Technik, Kunst und Wirtschaft, p. 51.
3_Ibid., p. 57.

We are experienced

1_Since 2010, Aurubis AG has been listed in Florian Langenscheidt, Bernd Venohr (publ.), Lexikon der deutschen Weltmarktführer. Die Königsklasse deutscher Unternehmen in Wort und Bild, Cologne, 2010.
2_Minutes of Senate meeting, September 26, 1770, Hamburg State Archives, 111-1 Senate, Cl. VIII No. Xa 1770 Fol. 561.
3_Manfred Asendorf describes the early days of the Beit Company, including the motives for its foundation, in a publication marking the 125th anniversary of NA, cf. Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre Norddeutsche Affinerie Aktiengesellschaft, Hamburg, 1991, p. 2 ff. Twenty-five years previously, Dr. Karl Prior had outlined this in a rather similar fashion in a centennial publication: Norddeutsche Affinerie (publ.), 100 Jahre Norddeutsche Affinerie, Hamburg, 1966, p. 9 ff. Both authors (Prior more, Asendorf less) drew on detailed research carried out by former board member Dr. Eugen van Erckelens between 1952 and 1955. Following a verification process, this knowledge also forms the basis of this and the following sections of the current chapter.
4_Comprehensively detailed for the first time in Adolph Soetbeer, Beiträge und Materialien zur Beurtheilung von Geld- und Bank-Fragen mit besonderer Rücksicht auf Hamburg, Hamburg, 1855. Summarized in Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 2 ff. cf. following section.
5_For a relevant account of Hamburg's financial history, see Erich Achterberg, Kleine Hamburger Bankgeschichte, Hamburg, 1964.
6_"Beit, Leffman Salom. […] Gold und Silber" in Neue(s) Hamburger und Altonaer Address-Buch auf das Jahr 1790.
7_Henceforth Norddeutsche Affinerie (publ.), 100 Jahre, p. 10 ff.
8_For information on the early history and the work of the society, see Sigrid Schambach, Aus der Gegenwart die Zukunft gewinnen. Die Geschichte der Patriotischen Gesellschaft von 1765, chapters II–V, Hamburg, 2004.
9_Hamburg State Archives, 512-7 St. Michaeliskirche, Journal Lit. E. Fol. 113.
10_Neue(s) Hamburger und Altonaer Address-Buch auf das Jahr 1792. The Hamburg State Archives, 621-1 company archives, are in possession of some records on Jonas H. A.
11_Hamburgisches Adress-Buch für das Jahr 1834.
12_Pursuant to the so-called "Jews' Regulations" of 1710 and the regulations concerning the reporting of Jewish backgrounds after a council decision in 1764, a construction to bypass these rules became established whereby a Jewish buyer only appeared as a user and a Christian citizen pro forma as owner. Cf.: Annett Büttner, Hoffnungen einer Minderheit, Suppliken jüdischer Einwohner an den Hamburger Senat im 19. Jahrhundert, Münster, 2003, pp. 70 ff.
13_Purchase document dated July 3, 1795, Hamburg State Archives, 111-1 Senate, Cl. VII Lit. Lb No. 18 vol. 2.
14_Address books were not used in Hamburg until 1787. For 1795 an entry in Neues Hamburgisches Adressbuch auf das Jahr 1787 lists "Beit, Raph. Salomon, Elbstrasse". An entry in one of the predecessors of the address book, the Hamburger Kaufmannsalmanach, lists "Beit, Marcus Salom., Comtoir Marcktstrasse" for 1784. It was not until 1790 that Marcus Salomon was listed as "Beit, Marc. & Raphl. Salom., […] gold and silver separators", i. e. stating his occupation, at "1ste Elbstr. […] No. 43" in Neue(s) Hamburger und Altonaer Address-Buch auf das Jahr 1790. Up to 1856, the address books listed the Beits as residing at Elbstrasse; from 1806 onward, it is no longer possible to ascertain whether this address was solely the business or also a private residence.
15_Building inspection report by the Michaelis Parish Masters, July 14, 1783, Hamburg State Archives, 324-1 Baupolizei, E1 vol. 3 ff. A vivid description of this episode is included in Norddeutsche Affinerie (publ.), 100 Jahre, p. 9. The story of this fire was long considered to be the oldest record of the Beit business until the permission by the Senate from 1770 was discovered at the Hamburg State Archives in 1983. Kirchspielherren (parish masters) were civic councilors exercising secular functions within their church parishes (Kirchspiels).

16_Marcus' death notice in Hamburgischen Correspondenten: Staats- und gelehrte Zeitung des Hamburgischen unpartheyischen Correspondenten, no. 139/1810, on microformat at Hamburg SUB.
17_Norddeutsche Affinerie (publ.), 100 Jahre, p. 12.
18_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 18.
19_Regarding the technical methods in general, see Dr.-Ing. Eugen van Erckelens, Geschichte der Norddeutschen Affinerie Aktiengesellschaft in Hamburg, Hamburg, 1955, previously unreleased, p. 22 f. Several copies of the manuscript are lodged with the Aurubis Company Archives.
20_van Erckelens, Geschichte der Norddeutschen Affinerie, p. 23.
21_For this definition, see van Erckelens, Geschichte der Norddeutschen Affinerie, p. 22.
22_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 7.
23_Norddeutsche Affinerie (publ.), 100 Jahre, p. 13.
24_"Beit, J. R. et L. R., Gold- u. Silber-Affinerie, B. Cto. 1ste Elbstr no. 41" in Hamburgisches Address-Buch für das Jahr 1826.
25_Norddeutsche Affinerie (publ.), 100 Jahre, p. 13 ff.
26_Dr.-Ing. Karl Prior. The predecessor companies had already [...] been processing [...] Chilean copper ore, March 3, 1965. This is a brief outline of the supply of the "Elbkupferwerk" in the Firmengeschichtliches Archiv (Aurubis Company Archive) 12.8/23-I, Material zur Geschichte der N. A.
27_Neues Hamburger und Altonaer Adreßbuch, 1843.
28_Letter to a partner in Valparaiso (Chile) in van Erckelens, Geschichte der Norddeutschen Affinerie, p. 32.
29_For details on the alimentation, i. e. supply of raw materials, cf. van Erckelens, Geschichte der Norddeutschen Affinerie, p. 30 ff.
30_Regarding this appraisal, see van Erckelens, Geschichte der Norddeutschen Affinerie, p. 30 ff.
31_Figures from van Erckelens, Geschichte der Norddeutschen Affinerie, p. 33 ff. However, one descendant of the Godeffroys, Oscar Godeffroy, stated in 1952 that large parts of the old company records of Godeffroy & Sohn had "fallen into the Russians' hands at his property and [...] been destroyed". Oscar Godeffroy to "The Management of Norddeutsche Affinerie", February 22, 1952, in FGA, 12.8/23-I.
32_Notes by Siegmund Robinow, undated, pp. 3, 14, 22, 173 f. Excerpts from these notes in journal style exist as copies in FGA, 12.8/23-I.
33_Ibid., pp. 26 f., 34.
34_Ibid., p. 71.
35_As judged by investors a decade later: Prospect der Allgemeinen Deutschen Credit-Anstalt Leipzig, June 1857. Available as a copy in the FGA, 12.8/24, collection of material.
36_Hamburg State Archives, 311-1 Kämmerei I, Kontraktenbuch YY, pp. 709, 714, 719; Kontraktenbuch ZZ, p. 295.
37_The relevant authority was the "Landherrschaft der Marschlande". For more on constraints and approvals, see Hamburg State Archives, 416-1/1 Landherrschaften-Hauptregistratur, XXXX Gewerbe und Industrie, document/license no. 4721 Kupferfabrik, April 24, 1847.
38_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 18.
39_van Erckelens, Geschichte der Norddeutschen Affinerie, p. 34.
40_Regarding the dynamics of reputation and success accompanied by insecure supplies and hence expansion of production, see van Erckelens, Geschichte der Norddeutschen Affinerie, p. 37 f.
41_For details, see van Erckelens, Geschichte der Norddeutschen Affinerie, p. 39 f.
42_Contract dated January 1, 1857 in Hamburg State Archives, 311-1 Kämmerei I, Kontraktenbuch EEE, p. 711.
43_The banco-mark was still the check money used for borrowing transactions in Hamburg. The amount made up about two-thirds on average of the total capital circulating at the Elbkupferwerk in the first few years. Figures summarized in van Erckelens, Geschichte der Norddeutschen Affinerie, p. 38 ff.
44_Publicly announced in June 1857. Copies of documents in FGA, 12.8/23, 12.8/24.
45_Regarding capital, corporate purpose, composition of board of directors, etc., cf. Statuten der Elbhütten- Affinir- und Handelsgesellschaft in Hamburg, December 1856, Hamburg State Archives, 111-1 Senat, Cl. VII Lit. Ff. No. XXXV b vol. 1.
46_For an abstract of source-based statements, see van Erckelens, Geschichte der Norddeutschen Affinerie, p. 53 ff.
47_Excerpt from the minutes of the founding meeting, April 28, 1866, Hamburg Municipal Court, company register B 1775 vol. 1.

48_Statuten der Norddeutsche Affinerie, 1866, Hamburg Municipal Court, commercial register B 1775 vol. 1; excerpt from the minutes of the founding meeting, April 28, 1866, loc. cit. For copies of both documents, see FGA, 12.8/23-I.
49_From the minutes of the inspection by the Building Inspection Department, 1859, Hamburg State Archives, 324-1 Baupolizei. For a copy, see the FGA, 12.8/24.
50_van Erckelens, Geschichte der Norddeutschen Affinerie, p. 63.
51_For van Erckelens' own compilation from old company records in the Aurubis Company Archives, see Geschichte der Norddeutschen Affinerie, p. 64 and annex 11 et seq. Hence, in 1871, the profit in the new currency was 122,000; in 1874, it was 597,000 marks. The dividend during the same period rose from 11.5 to 45 %.
52_The initial contribution in banco-marks was worth 825,000 new marks. "Aktienkapital und Dividenden […]", survey in van Erckelens, Geschichte der Norddeutschen Affinerie, annex 11.
53_The relevant building licenses and contracts are kept in the Aurubis Company Archives, in particular FGA, 12.8/23.

Notes on infoboxes

1 _Acta Senatus et Civum In Conv. Iovis d. 18 Jan. 1770, Hamburg State Archives, 731-1 collection of manuscripts, no. 595 vol. 18, 518 ff.
2_Altogether: Sigrid Schambach, Die Geschichte der Patriotischen Gesellschaft von 1765, Hamburg, 2004, chapters II–V.
3_van Erckelens, Geschichte der Norddeutschen Affinerie, p. 19 f.

We are aware of the past

1_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre Norddeutsche Affinerie Aktiengesellschaft, Hamburg, 1991, p. 47.
2_Cf. the descriptive articles in Lebendiges Museums Online, publ. by Stiftung Deutsches Historisches Museum, Stiftung Haus der Geschichte der Bundesrepublik Deutschland and the Federal Archives (Bundesarchiv), here: Burkhard Asmuss, "Shortage of raw materials, 2011", https://www.dhm.de/lemo/kapitel/erster-weltkrieg/industrie-und-wirtschaft/rohstoffmangel.html.
3_Later, from 1916 onward, the naval blocade and other factors led to the wartime economy of Germany and its allies falling behind that of their opponents, a development that gave the war its decisive turn.
4_Stefanie van de Kerkhof, Public-Private Partnership im Ersten Weltkrieg? Kriegsgesellschaften in der schwerindustriellen Kriegswirtschaft des Deutschen Reiches, in: Hartmut Berghoff, Jürgen Kocka, Dieter Ziegler (publ.), Wirtschaft im Zeitalter der Extreme. Beiträge zur Unternehmensgeschichte Österreichs und Deutschlands, Munich, 2010, p. 125.
5_Agreements between Kriegsmetall AG and NA, 2/1 and 2/2 and 5/25/1915, FGA, 2.5/66 II.
6_Eugen van Erckelens, Geschichte der Norddeutschen Affinerie Aktiengesellschaft in Hamburg, Hamburg, 1955, not published, p. 155 ff.
7_Handover of bells during World War I. http://www.evpfalz.de/gemeinden_cms/fileadmin/user_upload/werke/zentralarchiv/dateien/1917Glockenabgabe.pdf.
8_"Report about a new project regarding processing of bronze (…)", Hamburg, 1/8/1917, FGA, 2.5/66 II. This happened until 1924; the method was then sold to two other smelters. 100 Jahre Norddeutsche Affinerie, Hamburg, 1966, p. 52 f.; van Erckelens, Geschichte der Norddeutschen Affinerie Aktiengesellschaft in Hamburg, p. 156.
9_NA to Building Inspection Department, Hamburg, 3/1/1917, FGA, 2.5/66 II.
10_FGA, 2.5/66 I.
11_Norddeutsche Affinerie Aktiengeselschaft (publ.), 125 Jahre, p. 47.
12_van Erckelens, Geschichte der Norddeutschen Affinerie, p. 155 ff.
13_Ibid., p. 163.
14_Ibid., p. 159.
15_Ibid., p. 161 ff.
16_The information regarding the plant expansion below is largely based on the article "Sein oder Nichtsein, Felix Warlimont und der Ausbau des Werkes nach dem 1. Weltkrieg", in: Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 48 ff. For more details, see van Erckelens, Geschichte der Norddeutschen Affinerie, pp. 170–177, 194–216.
17_Ten years later, in 1936 and 1937, annual output rose again to reach 90,000 t after the new reverberatory furnace for ores went into service.
18_In 1929, the price of copper at the London Metal Exchange stood at about 100 pounds sterling per ton, which dropped to below 30 by 1931. Hermann Dannies, Die Norddeutsche

Affinerie 1920–1949, Hamburg, edited approx. 1949–55, not published, p. 25. Manuscript in the Aurubis Company Archives, FGA, 12.8/19.

19_Uwe Bahnsen, Hanseaten unter dem Hakenkreuz, Die Handelskammer Hamburg und die Kaufmannschaft im Dritten Reich, Hamburg/Kiel, 2015, p. 10.

20_Ibid., p. 32.

21_Ibid., p. 28 f.

22_As stated previously in van Erckelens, Geschichte der Norddeutschen Affinerie Aktiengesellschaft in Hamburg, p. 244.

23_The tone of the language, e. g. in reports by the Executive Board, was neutral, both in 1933/34 and during the second neuralgic period around the beginning of the war in 1939/40. Cf. various reports in: FGA 6/17-2 and 6/17-3. However, the language used by the "Gefolgschaftsvertretungen", i. e. the Nazi organizations representing labor at company level, was more aggressive and loyal to the regime: ibid.

24_On the development of DAF, Changes of the internal constitutions and elimination of labour union: Hans-Ulrich Thamer, Der Nationalsozialismus, p. 248 ff., Stuttgart, 2002.

25_Figures vary in records available depending on type of product and selected time frame. The tendencies according to the summaries in tables in van Erckelens, Geschichte der Norddeutschen Affinerie, pp. 155, 210 f., 261 f. were the following: increase of electrolytic copper almost sixfold (1918: 17,200 t; 1939: 97,691 t); increase in lead nearly ninefold (1920: 1,936 t; 1939: 17,017 t); gold increased more than threefold with great variations (1921: 574 t; 1939: 1,916 t).

26_Ibid., p. 269.

27_Status: 7/31/1939. Report "Vergleichende Angaben über den Personalstand im Frieden und im Krieg, ebenso über die Produktion und die Umstellung auf Kriegsproduktion", January 1941, FGA, 3.24.

28_Report on the operation in fiscal year 1938/39, FGA, 6.17-2.

29_Report "Vergleichende Angaben über den Personalstand im Frieden und im Krieg, ebenso über die Produktion und die Umstellung auf Kriegsproduktion", January 1941, loc. cit.

30_In particular, NA was under the control of the Sonderring Schwermetall-Vorstoff und Erzeugung and here of its subdivision Arbeitsring Kupfer (Working Syndicate Copper). This was dominated across the Reich by people from Hamburg and from 1942 onward was headed by Dr. Felix Warlimont. In 1944, Director Kurt Heide became district officer especially for Hamburg. This form of organization was under the direct control of Albert Speer, the Reichsminister für Rüstung und Kriegsproduktion. Cf.: Rundschreiben Leiter Sonderring Schwermetall- Vorstoff- und Erzeugung, 7/11/1942; Rundschreiben Leiter Sonderring Schwermetall- Vorstoff und Erzeugung, 7/11/1942; Rundschreiben Hauptring Metalle, 10/17/1944, status: "Secret", FGA, 3.8/20.

31_Report "Vergleichende Angaben über den Personalstand im Frieden und im Krieg, ebenso über die Produktion und die Umstellung auf Kriegsproduktion", January 1941, loc. cit.

32_Memo "Strictly confidential", Hamburg, 2/9/1942, signed by Kurt Heide, FGA, 3/17.

33_Memo, Hamburg, 2/17/1942; Brill an Verwaltung Alsterterrasse, 9/6/1942, FGA, 3.17.

34_Felix Warlimont to Degussa and Metallgesellschaft, 5/12/1941, FGA, 12.8/23-II. Similar information can be found in Bericht über den Betrieb im Geschäftsjahr 1940/41, Hamburg, 10/20/1941, FGA, 6/17-2; Questionnaire from the Hamburg Chamber of Commerce, 7/10/1945, FGA, 3/24. According to this, however, there were already two people injured during the first attack on the plant. Ibid., ff.

35_Ibid.

36_Regarding the changes in the composition of the Supervisory Board, see FGA, 6/17-2 and /3.

37_Listed in Erich Stockhorst, 5000 Köpfe. Wer war was im Dritten Reich, Kiel, 2000.

38_The alignment of Degussa toward Nazi economic policy also happened under Hermann Schlosser's watch, see Peter Hayes, Die Degussa im Dritten Reich. Von der Zusammenarbeit zur Mittäterschaft, Munich, 2004.

39_The relevant bills of cost are filed with the Aurubis Company Archives, although without signature.

40_Ernst La Pierre (NA) to Robert Hirtes (Degussa). Memo "Judengold – Ablieferung!", 2/13/1940, FGA, 6.5/15.

41_This instruction was headed "Leihhausgold", NA to Degussa, 2/17/1940, FGA, 6.5/15.

42_Ibid.

43_Memo "Leihhausgold aus jüdischem Besitz, Besprechung im Büro der Verwaltung für Wirtschaftliche Unternehmen und für Verkehrsangelegenheiten in Hamburg", 2/16/1940, FGA, 6.5/15.

44_Sundry correspondence with Degussa, with pawnshops in various towns, with competing refineries, FGA, 6.5/15, 6.5/16.

45_Ralf Banken, Edelmetallmangel und Großraubwirtschaft. Die Entwicklung des deutschen Edelmetallsektors im "Dritten Reich" 1933–1945, Berlin, 2009, p. 337.
46_NA to Zentralamt für Vermögensverwaltung (Central Office for Asset Administration), 10/8/1948, FGA, 19/15-14.
47_Jahresbericht der Gefolgschaftsabteilung für das Geschäftsjahr 1943/44, 10/26/1944, FGA, 6/17-3. ff.
48_Bericht über den Betrieb im Geschäftsjahr 1941/42, 11/3/1942, FGA, 6/17-3.
49_Jahresbericht der Gefolgschaftsabteilung für das Geschäftsjahr 1943/44, 10/26/1944, FGA, loc. cit. ff.
50_Ibid.: Betreuung der in den Baracken Untergebrachten, 8/10/1943, FGA, 10.1.8/63.
51_Informationspapier zum Schluss des Geschäftsjahres 1944/45, 10/22/1945, FGA, 10.1.8/63.
52_Jahresbericht der Gefolgschaftsabteilung für das Geschäftsjahr 1943/44, 26/10/1944, FGA, loc. cit.
53_Bericht des Vorstandes [...] 1942/43, status: "Confidential", November 1943, FGA, 6/17-3.
54_Report on operations during fiscal year 1943/44, 11/11/1944, FGA, 6./17-3. ff.
55_Bericht des Vorstandes [...] 1943/44, status: "Secret", November 1944, FGA, 6/17-3.
56_Jahresbericht der Gefolgschaftsabteilung für das Geschäftsjahr 1943/44, 10/26/1944, loc. cit. The type of punishment was not specified in the records at FGA.
57_Circular letter by District Labor Deployment Officer in Mil. District X, 3/27/1944, FGA, 10.1.8/56.
58_Brill to District Labor Deployment Officer in Mil. District X, 3/31/1944, FGA, 10.1.8/56.
59_The difficulties were discussed among the Supervisory Board. Cf. minutes of the 430th meeting of the Supervisory Board [...]. April 10, 1945, FGA, 6/17-3. See also Questionnaire from the Hamburg Chamber of Commerce, 7/10/1945, loc. cit.
60_Notes about the development at the NA plant from the end of WWII until 1961 by Karl Prior, December 1961, FGA, 12.8/23-II.
61_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 72.
62_Law no. 52 "Sperre und Beaufsichtigung von Vermögen". NA received their "Notice Of Custody" on 4/15/1946, FGA, 1.6/19.
63_Memo, Hamburg, 9/5/1950, FGA, 1.6/19.
64_NA to Hamburg Chamber of Commerce, 7/6/1945, draft; on the status of the remaining labor force on June 1 (646) and on July 1 (409), see Questionnaire of Hamburg Chamber of Commerce, 7/10/1945, Annex 1. Both documents in FGA, 3/24.
65_NA to Hamburg Chamber of Commerce, 7/6/1945, draft, loc. cit.
66_Cf. e. g.: [...] Application for production approval, Annex 1, 1/29/1946, FGA, 1.6/18. NA to Military Government Econ 15, Hamburg, 1/16/1946, FGA, 1.6/19.
67_Table, 6/19/1946, English, in FGA, 1.6.18. Authorizations granted on 11/28/1945 and 12/6/1945, valid for one year; for wirebars, six months. Power consumption and labor requirements were usually approved at the same time but were as a rule insufficient and had to be renegotiated.
68_Memo "Besprechung mit Mr. Mathias", 6/19/1946, FGA, 1.6/24.
69_La Pierre memo "Unterhaltung mit Herrn Mathias", 5/7/1946, FGA, 1.6/19.
70_Memo without title, Hamburg, 10/21/1946, FGA, 1.6.24.
71_Note CORC/P(46)241, Allied Control Authority, 7/23/1946, copy in FGA, 1.6/24.

Notes on infoboxes

1_Draft of a circular letter to the "Gauleiters", 1940, undated, copy: FGA 19.3/73.
2_Literally: Appeal for "a donation by the German people on the occasion of the Führer's birthday", dated 3/27/1940. Newspapers all over the country promoted the campaign.
3_Dr. Brill and Warlimont to Head Office Alsterterrasse, 6/25/1940: FGA 19/15-12. Also: statement or summary "Metallspende des Deutschen Volkes", 1960s, undated, signed by Dr. Karl Prior: FGA, 12.8/23-II.
4_Ibid. Below.
5_Statement or summary "Denkmäler", 1960s, undated, signed by Dr. Karl Prior: FGA 12.8/23-II. Interpreted as "a kind of diversion tactic": NA intern no. 45, 1982.
6_NA's initiative shows: Dr. Prior to the administration Alsterterasse., 11/18, 1948: FGA 19.7/15a. The sculptures weighing 368 kg and 387 kg were returned by truck on September 30: NA to Goslar State Building Office, 9/17/1949; freight document no. 345 Norddeutsche Affinerie, 9/30, 1949, both: FGA 19.7/15a.
7_A detailed description of the objects, the history of their preservation and their return: Norddeutsche Affinerie AG (publ.), Zwölf Bronzen – Eine Odyssee, Hamburg, 2007. A first attempt at returning them had been rejected by the Federal

Construction Authority in 1966 and the sculptures had been cleared for melting down. Cf.: Federal Construction Authority to NA, 9/19, 1966: FGA 19.7./15a. In this case NA deliberately stored the bronze figures.

8_Categorization was carried out before arrival at the smelting shops, and many bells outlived the war due to this procedure. The Reich's Office mentioned before stipulated that B and C category bells should be treated with care to start with, and NA adhered to this meticulously: NA to Hamburg District Court, 11/26, 1953: FGA 19.7/15a.

9_All figures calculated from various documents preserved: FGA 12.8/23-II, 19.3/73, 19.7/15a, 19/15-12. Also: Summary "Kirchenglocken", 1960s, undated: 19/15-9. Greatly differing figures in: Friemuth, Die geraubte Kunst. He talks about 75,000 church bells having been melted down at the Hamburg port.

10_The operation was described in detail by Hans-Dieter Henning, who did research on the confiscation of bells. Henning to NA, 11/22, 2004: FGA 19.7/15a. Below.

11_Memo for record, Hamburg, 2/22/1945, signed by Dr. Karl Prior: FGA 19.7/15a.

12_Ulrich Herbert, introduction, in: Id. (publ.), Europa und der "Reichseinsatz". Ausländische Zivilarbeiter, Kriegsgefangene und KZ-Häftlinge in Deutschland 1938–1945, Essen, 1991, p. 7.

13_An overview is provided by N.N., Sowjetische Kriegsgefangene und Ostarbeiter, online resource: https://www.bundesarchiv.de/zwangsarbeit/geschichte/auslaendisch/russlandfeldzug/index.html.

14_Josef Eitel to Eugen van Erckelens, 6/13, 1962, in: FGA, 10.1.8/114.

15_Ursula Ratz, "Merton, Richard", in: Historische Kommission bei der Bayerischen Akademie der Wissenschaften (publ.), Neue Deutsche Biographie, vol. 17, Berlin, 1994, pp. 187–188.

16_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 59.

17_Cf. Susanne Lohmeyer, "Sophie Wohlwill", online resource: http://stolpersteine-hamburg.de/index.php?MAIN_ID=7&BIO_ID=37.

18_The death notice for Dr. Heinrich Wohlwill, Theresienstadt ghetto, dated 1/1/1943 notes a heart defect. The document is pictured in online resource: http://www2.holocaust.cz/de/document/DOCUMENT.ITI.15446.

19_van Erckelens, Geschichte der Norddeutschen Affinerie, p. 224.

20_Peter Hayes, Die Degussa im Dritten Reich. Von der Zusammenarbeit zur Mittäterschaft, Munich, 2004, pp. 65, 345, note 9.

We are international

1_Interview with Dr. Werner Marnette, 2015.

2_"Die Alimentation der NA", speech by Paul Hofmeister, member of the Executive Board, 463rd meeting of the management board on October 19, 1960, Firmengeschichtliches Archiv 6.2.1/17-07.

3_According to Paul Hofmeister, this already applied in 1960, "even foregoing short-term cyclical profits". Ibid. Also: interview with Dr. Werner Marnette, 2015. Today, about 90 % of Aurubis' raw material contracts are of a long-term nature.

4_Interview with Erwin Faust, 2015.

5_Interview with Dr. Werner Marnette, 2015.

6_"Even forgoing short-term cyclical profits", Paul Hofmeister, ibid.

7_Cf., for example, the early summary: Eugen van Erckelens, Geschichte der Norddeutschen Affinerie Aktiengesellschaft in Hamburg, p. 306 ff., Hamburg, 1955, unpublished. Below.

8_"Die Wiederinbetriebnahme der NA", circa June 1946, FGA, 1.6/24. ff.

9_Werner Abelshauser, Deutsche Wirtschaftsgeschichte. Von 1945 bis zur Gegenwart, Bonn, 2011, p. 127.

10_Cf. "Notizen über die Entwicklung im Werk der N. A. vom Ende des Zweiten Weltkrieges bis zum Jahr 1961", Karl Prior, December 1961, FGA, 12.8/23-II. ff.

11_van Erckelens, Geschichte der Norddeutschen Affinerie, p. 306 ff.

12_Survey of N.A. sourcing N. A. from 1914 (until 1953), in: FGA, 2.1.5/21 ff.

13_El Volcan coppermine in Chile, FGA, 15.1.2/275. ff.

14_Ibid. The quantities supplied, however, were far lower than those of external supply partners.

15_Major supplies to N. A. after World War II until 1965, FGA, 2.1.5/21. ff. The colonial Otavi Minen- und Eisenbahn-Gesellschaft in South-West Africa had been seized during the war but had resumed production as Tsumeb Corporation under American control in 1947.

16_Survey of NA sourcing from 1914 (until 1953), in: FGA, 2.1.5/21.

17_Main sourcing of N.A. after World War II until 1965, loc. cit. Listing in order of yearly tonnage.

18_"Die Alimentation der NA", speech by Paul Hofmeister, member of the Executive Board, 463rd meeting of the Supervisory Board on October 19, 1960, loc. cit.
19_Interview with Dr. Werner Marnette, 2015.
20_Ibid.
21_Minutes of 463rd meeting of the Supervisory Board […], October 19, 1960, FGA, 6.2.1/17-07. "Die Alimentation der NA", speech by Paul Hofmeister, member of the Executive Board, 463rd meeting of the Supervisory Board on October 19, 1960, loc. cit. Both ff.
22_Survey of N.A. sourcing from 1914 (until 1953), loc. cit. ff.
23_A few years later, Walter Gleich, future chairman of the Executive Board specifically referred to the "African copper belt's vulnerability to crisis". "The significance of South America […] for the sourcing of Norddeutsche Affinerie […]", speech by Walter A. Gleich, member of the Executive Board, 483rd meeting of the Supervisory Board on July 21, 1967, FGA, 6.2.1/17-12.
24_The issuer of the invitation to tender was the state-owned Chilean mining company Empresa. The bid was a cooperation with Lurgi GmbH in Frankfurt, a subsidiary of Metallgesellschaft, cf. correspondence and notes FGA, 3.4/98, Hüttenprojekt Chile. Below.
25_Also in cooperation with Lurgi, cf. correspondence and notes, FGA, 3.4/51-2, Hüttenprojekt Norwegen. Regarding the abandonment of the plan, cf. Memo for record, 3/10/1969, FGA, 3.4/51-2; Memo, 16.07.1971, ibid.
26_The 30 % acquired in 1962 increased to 50 % in 1969. 15.1.2/9 A/S Vigsnes Kobberverk, FGA, 15.1.2/319.
27_15.1.2/14 Palabora Mining Company Ltd., Johannesburg, FGA, 15.1.2/319. ff. The first production area was Palabora/Palabwora in the Transvaal in North-Eastern South Africa.
28_15.1.2/21 Otavi Mining Company (Proprietary) Ltd. (OMC), FGA, 15.1.2/319. Regarding the history of the stake in Otavi-Minen AG, see 15.1.2/21 Otavi-Minen AG (OMAG), FGA, 15.1.2/319.
29_15.1.2/27 Transvaal Alloys (Pty.) Ltd., Middelburg (TA), FGA, 15.1.2/319; Norddeutsche Affinerie AG, Annual Report 1979/80, p. 12; Comment Transvaal Alloys (Pty.) Ltd., 12/19/1996, FGA, 15.1.2/313; also regarding this subsidiary, interview with Klaus Prior, 2015. Klaus Prior was the project manager for many years.
30_Ertsberg […], Bougainville Copper Pty. Ltd. […], FGA, 16.1/23.
31_15.1.2/23 Freeport Indonesia Inc. New York/Djakarta (F. I.), FGA, 15.1.2/319. ff. During the 1970s and 1980s, the in-house magazine NA intern reported on the relations with New Guinea in detail several times.
32_First published in Donella Meadows, Dennis Meadows, et al., The Limits to Growth, New York, 1972.
33_Paul Hofmeister informed employees early on; see "Zum Jahr 1972", foreword by Paul Hofmeister, FGA, SB1, Sammelmappe Soziales.
34_As reported by the in-house magazine "Keine Entlassungen – keine Kurzarbeit", NA intern 28/1977, p. 4.
35_Interview with Dr. Werner Marnette, 2015.
36_15.1.2/25/2 Deutsche Giessdraht GmbH (DG), FGA, 15.1.2/319. ff. The original HK stake fell to NA as well after its acquisition of HK in 1999/2000; in 1983, Codelco from Santiago, Chile transferred its stake to subsidiary Codelco Kupferhandel GmbH, today headquartered in Düsseldorf.
37_Hüttenwerke Kayser, Rückgewinnung von Kupfer […] seit eineinhalb Jahrhunderten. Eine wirtschaftspolitische Entwicklung, FGA, 15.1.2-320-1. ff.
38_Interview with Dr. Werner Marnette, 2015.
39_Ibid. Similarly: interview with Erwin Faust, 2015. Below.
40_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre Norddeutsche Affinerie Aktiengesellschaft, Hamburg, 1991, p. 110. The latter was already announced at the beginning of the decade. "Wir haben das Vertrauen in die Zukunft nicht verloren", NA intern 40/1981, p. 6.
41_Interview with Dr. Werner Marnette, 2015.
42_Ibid. Also: Interview with Erwin Faust, 2015. Below.
43_Interview with Dr. Werner Marnette, 2015.
44_"Die Norddeutsche Affinerie fühlt sich gut gerüstet", Frankfurter Allgemeine Zeitung, 3/13/1996.
45_Interview with Dr. Werner Marnette, 2015. Below; "Niedrige Kupferpreise belasten Norddeutsche Affinerie", Hamburger Abendblatt, 1/31/2003.
46_"Norddeutsche Affinerie am 7. Juli im Handel", Frankfurter Allgemeine Zeitung, 6/18/1998.
47_"Aurubis AG – Information regarding first listing". Deutsche Börse AG (publ.), http//deutsche-boerse.com. A "greenshoe", i. e. an over-allotment option, for 3.2 m shares was not exercised in the end.
48_Press conferences on IPO, FGA, 23.1/35 and 23.1/36.
49_Stockholder structure during the fiscal year 1998/99: Degussa-Hüls 10 %; Possehl 10 %; Dresdner Bank 10 %;

institutional investors 29 % and private investors 41 %. Cf. Norddeutsche Affinerie AG, Annual Report 1998/99, p. 25.
50_Interview with Dr. Werner Marnette, 2015.
51_For strategy and overall key data, see Norddeutsche Affinerie AG, Annual Report 2001/02.
52_For an example, see Norddeutsche Affinerie AG, Annual Report 2004/05, p. 61; Annual Report 2006/07, p. 49.
53_Interview with Dr. Werner Marnette, 2015.
54_"Norddeutsche Affinerie plant Übernahme der Hüttenwerke Kayser – Gemeinsam die Nr. 4 der Welt", NA intern 99/1999, p. 4.
55_Words to that effect: interview with Dr. Werner Marnette, 2015; similar: interview with Erwin Faust, 2015.
56_The location is presented on the Aurubis AG website (publ.), online resource: https://www.aurubis.com/de/de/shared/standorte/lunen.
57_"NA übernimmt Prymetall", NA intern 4/2001, p. 7.
58_The location is presented on the Aurubis AG website (publ.), online resource: https://www.aurubis.com/de/de/shared/standorte/stolberg.
59_For a brief chronology of the acquisition, see "Zusammenschluss von NA und Cumerio erreicht", NA intern 1/2008, p. 10 f.
60_For these and specific key data of the acquisition, see Norddeutsche Affinerie AG, Annual Report 2007/08, pp. 48, 76, 118 ff.; Dr. Björn Frenzel, interview with the Executive Board and Legal Department, 2015.
61_Dr. Bernd Drouven, chairman of the Executive Board, in press interview, "Das Cumerio-Angebot wird nicht erhöht", Hamburger Abendblatt, 2/1/2008.
62_For an example see "Österreicher zwingt Norddeutsche Affinerie an Verhandlungstisch", Handelsblatt, 6/29/2007.
63 _Information from Legal Department at Aurubis AG, 2015.
64_The NA Executive Board had to make the first concessions. There were no plans to call off the project, however, as stated by then-chairman Dr. Werner Marnette. "Norddeutsche Affinerie im offenen Clinch mit Großaktionär", Die Welt, 6/30/2007.
65_Information from Legal Department at Aurubis AG, 2015.
66_For an example, see "Kupferkrieg geht in die nächste Runde", Der Standard (Austria), 9/20/2007.
67_Dr. Bernd Drouven, Dr. Björn Frenzel, interview with the Executive Board and Legal Department, 2015. The EU Commission approved the merger on 1/28/2008.
68_There were similar statements from Dr. Bernd Drouven and Dr. Björn Frenze, ibid.
69_The city of Hamburg and HSH Nordbank each owned 5 %. Norddeutsche Affinerie AG, Annual Report 2007/08, p. 43. Regarding the background, see "Agenda Hanseschreck Hamburg", Financial Times Germany, 2/19/2008.
70_The increase in capital of November 8 included just under 10 % of stocks or € 100 million. Norddeutsche Affinerie AG, Annual Report 2007/08, p. 26 ff.; interview with the Executive Board and Legal Department, 2015.
71_"Cumerio verlässt die Börse", Manager Magazin, 4/15/2008. About 200 ideas for individual projects were lined up in advance. Norddeutsche Affinerie AG, Annual Report 2007/08, p. 52.
72_For an example, see Norddeutsche Affinerie AG, Annual Report 2007/08, p. 10.
73_Dr. Bernd Drouven, Dr. Stefan Boel and Dr. Bernd Langner, interview with the Executive Board and Legal Department, 2015.
74_Dr. Bernd Drouven, Dr. Stefan Boel: interview with Executive Board and Legal Department, 2015.
75_Norddeutsche Affinerie AG, Annual Report 2007/08, pp. 5, 48.
76_On the opening of the 80 million investment, see "Unter Strom", CU 4/2008, p. 10.
77_Norddeutsche Affinerie AG, Annual Report 2007/08, p. 70.
78_Ibid., cover.
79_"General Meeting 2009, Letzte Hauptversammlung der Norddeutschen Affinerie AG", CU 1/2009, p. 10 f.
80_Interview with Dr. Werner Marnette, 2015.
81_Aurubis AG, Annual Report 2007/08, letter to stockholders, p. 23 f.; Aurubis AG, Annual Report 2008/09, p. 55.
82_Dr. Bernd Drouven, interview with the Executive Board and Legal Department, 2015.
83_"Als das Geheimnis gelüftet wurde …", CU 1/2009, p. 12.
84_Luvata, "Zahlen und Fakten", CU 2/2011, p. 9.
85_Aurubis AG, Annual Report 2010/11, p. 81.
86_Aurubis AG, Annual Report 2010/11, p. 7 ff.
87_"Aurubis will Werk in Schweden schließen", Handelsblatt, 11/25/2011; "Wir sind sehr zufrieden!", Interview with Stefan Boel and Ari Ingman, CU 3/2012, p. 14 f.
88_Ibid.
89_Aurubis AG, Annual Report 2010/11, p. 8; interview with the Executive Board and Legal Department, 2015.
90_Aurubis AG, Annual Report 2010/11, p. 58.

91_Interview with the Executive Board and Legal Department, 2015 ff.

Notes on infoboxes

1_Survey of NA sourcing from 1914 (until 1953), in: FGA, 2.1.5/21. Below.
2_Anke Schwarzer, Wo der Kaiser seine Schutztruppen verabschieden ließ, Zeit online, 7/8, 2015, online resource: http://www.zeit.de/hamburg/politik-wirtschaft/2015-07/hamburg-kolonialzeit-deutsch-suedwest-baakenhafen.
3_Heiko Möhle, "Pardon wird nicht gegeben". Von aufständischen Afrikanern und hanseatischen Kriegsgewinnlern, in: Id. (publ.): Branntwein, Bibeln und Bananen. Der deutsche Kolonialismus in Afrika. Eine Spurensuche, Berlin/Hamburg, 2011, p. 64 ff.
4_Anke Schwarzer, Kupfererz aus Südamerika und der Otavi-Mine. Der rötliche Glanz hanseatischer Kolonialkriegsgewinnler Hamburg, 2013, online resource: https://www.hamburg-global.de/v1.0/placemarks/78.
5_German Bundestag, 10th legislative period, printed matter 10/2642, 12/14, 1984. Written questions with replies by the Federal Government submitted during the week starting on December 10, 1984, p. 20, online resource: http://suche.bundestag.de; Claudius Wenzel, Südafrika-Politik der Bundesrepublik Deutschland 1982–1992. Politik gegen Apartheid?, Wiesbaden, 1994, p. 166.
6_Here from: Themenroute, Sole, Dampf und Kohle. Hüttenwerke Kayser, online resource: http://www.route-industriekultur.de/themenrouten/10-sole-dampf-und-kohle/huettenwerke-kayser.html.
7_Norddeutsche Affinerie to Executive Board of Metallgesellschaft AG, 1/18, 1941, in: FGA, 15.1.2/320-2.
8_Cf. Article in Handelsblatt from 2007, Erst die Firma, dann die Familie, in: FGA, 15.1.2/320-1. Below.

We are loyal

1_Aurubis AG (publ.), Nachhaltigkeitsbericht (Sustainability Report) 2013, Hamburg, 2014.
2_"Betr.: Arbeitskreis in der Betriebsverwaltung", Hamburg, 8/19/1971; Draft "Gründung eines Arbeitskreises,", Hamburg, 8/18/1971; Memo "Überlegungen zur […] Arbeitsplatzgestaltung", Hamburg, 1/14/1966. All in Firmengeschichtliches Archiv, 10.1.3/92.
3_"Europäischer Betriebsrat gegründet", CU 4/2009, p. 17. Interview with Renate Hold, Hans-Jürgen Grundmann, 2015.
4_Presented in: CU 3/2009 to 3/2010. Workshops: "Gemeinsam die Konzernwerte finden", CU 4/2008, p. 13.
5_See, for example, additional workshops organized at management level at all locations in "Offene und konstruktive Werte-Workshops im Konzern", CU 4/2010, p. 14 f.
6_Introduction of Greek labor to NA, 6/28/1960; memo "Travel Report Yugoslavia", 10/22/1970. Both in FGA, 10.1.3/51.
7_Memo "Betriebszugehörigkeit von Kontraktausländern", 8/19/1970, FGA, 10.1.3/51. In the case of Spain, a company representative was to carry out a "stricter selection in accordance with our needs" locally from 1971 onward. The difficulty here was that the Franco regime was unwilling to allow skilled workers to leave. Note "Anwerbung von spanischen Gastarbeitern", 9/29/1971, FGA, 10.1.3/51.
8_Memo "Kräftebeschaffung aus der Türkei", 10/6/1969, FGA, 10.1.3/51.
9_Employees were informed prior to the arrival of foreign labor, like in 1972 when "another 30 Spaniards with craftsman skills" were expected at the end of May. "Neue Mitarbeiter", NA intern 6/1972, p. 2.
10_Goy to Hofmeister, Probleme Gastarbeiter, 5/25/1965, FGA, 10.1.3/51.
11_"Spanier in Deutschland", El Correo Catalan, 1/5/1961, translated in FGA, 10.1.3/51.
12_"Betriebsrat besichtigte Gastarbeiterheime", NA intern 6/1972, p. 2.
13_Probleme Gastarbeiter, 5/25/1965, FGA, 10.1.3/51. Below.
14_Memo "Ausbildung der Gastarbeiter", 12/23/1969, FGA, 10.1.3/51. "Unterricht über Sicherheit für die ausländischen Mitarbeiter", NA intern 6/1972, p. 5. ff.
15_Memo "Information und Betreuung der Gastarbeiter", 10/14/1971, FGA, 10.1.3/51.
16_"Ausländische Mitarbeiter 25 Jahre bei der NA", NA intern 57/1985, p. 30.
17_Günter Kroll, longtime head of training at NA, in a contemporary interview. See "Die Chancen sichern!", NA intern 35/1979, p. 15.
18_"Hilfe für ausländische Jugendliche," NA intern 40/1981, p. 17.
19_Cf. relevant October issues of CU between 2010 and 2014. Some locations stand out, like Stolberg, with an apprenticeship ratio of 9 %, "far in excess of North Rhine-Westphalian

standard level" and a 90 % retention rate on completion. "Wir bilden für uns aus", CU 3/2014, p. 3.

20_Interview with Wolfgang Gross, 2015.

21_Behörde für Soziales, Famile, Gesundheit und Verbraucherschutz (publ.), Vielfalt als Chance für Unternehmen – Trends, Themen und Handlungsfelder von Diversity Management, Hamburg, 2008, p. 11 f. The award is given to innovative vocational training projects by Beratungs- und Qualifizierungsstelle zur beruflichen Qualifizierung von jungen Migrantinnen und Migranten (BQM) and UV Nord, Vereinigung der Unternehmensverbände in Hamburg und Schleswig-Holstein e. V. (Association of Federations of Industry and Commerce in Hamburg and Schleswig-Holstein).

22_Aurubis AG (publ.), press release "Ausbildungsbeginn bei Aurubis", 9/5/2014; online resource: https://www.aurubis.com. Also "Top-Noten für Ex-Praktikanten", CU 2/2009, p. 2.

23_"Drei Merkure in einem Jahr", CU 1/2009, p. 3; "Auszeichnung mit Responsible Care Preis", CU 3/2010, p. 3.

24_"Austausch zwischen Industrie und Schulen", CU 2/2013, p. 15.

25_"Für mehr weiblichen Nachwuchs in Naturwissenschaft und Technik", CU 3/2014, p. 11.

26_"Perspektivkonsens, Berufsorientierung macht Schule", Ruhr Nachrichten, 11/10/2010.

27_Interview with Wolfgang Gross, 2015.

28_"Töchtertag", NA intern 2/2001, p. 10.

29_"Vom Girls' Day 2011 an drei Standorten", CU 2/2011, p. 6.

30_Aurubis AG (publ.), Press release "Lünen/Hamburg", 7/1/2014; "Argentinien, USA, Australien, Neuseeland & Co.: Lüner Schüler in aller Welt", CU 3/2010, p. 10 f.

31_"Deine Zukunft startet bei Aurubis!", CU 3/2012, p. 12.

32_"Aurubis auf Studententag in Aachen", CU 4/2010, p. 7; "Im Gespräch mit dem Nachwuchs", CU 3/2012, p. 14.

33_Aurubis AG, Geschäftsbericht 2011/2012, EXPLORE!, p. 28 f.

34_Aurubis AG, Annual Report 2013/2014, p. 70.

35_Aurubis AG, Annual Report 2011/12, p. 100.

36_Aurubis AG, Annual Report 2013/14, p. 71. Annual ratios: 11.6 % in 2014, 11.8 % in 2013, 11.5 % in 2012.

37_FGA, Inquiry to archives no. 1573 regarding ratio of women in management positions, 7/8/2015.

38_Interview with Renate Hold, Hans-Jürgen Grundmann, 2015. Below.

39_Aurubis AG, Nachhaltigkeitsbericht (Sustainability Report) 2013, Hamburg, 2014, p. 52; "Mehr Familie und mehr Frauen", CU 4/2012, p. 3.

40_However, absolute numbers remain low. Interview with Renate Hold, Hans-Jürgen Grundmann, 2015.

41_Interview with Renate Hold, Hans-Jürgen Grundmann, 2015.

42_Aurubis AG, Nachhaltigkeitsbericht (Sustainability Report) 2013, Hamburg, 2014, p. 52 f.

43_"Ausgezeichnet für Familien", CU 3/2012, p. 16 f.; interview with Renate Hold, Hans-Jürgen Grundmann, 2015.

44_Interview with Dr. Thomas Schultek, 2015.

45_Cf. the so-called "December issue", Norddeutsche Affinerie AG (publ.), NA, 1951, p. 31.

46_Cf. the so-called "December issue", Norddeutsche Affinerie AG (publ.), NA, 1952, p. 18.

47_"Wenig beachtet und viel genutzt: die Waschkauen". NA intern 68/1988, p. 20 f.

48_Cf. the so-called "December issue", Norddeutsche Affinerie AG (publ.), NA, 1952, p. 18.

49_"Spatenstich bei Aurubis Hamburg, Startschuss für den Neubau der Waschkaue, des Gesundheitszentrums und der Arbeitssicherheitswerkstatt in einem Gebäude", CU 3/2014, p. 16.

50_He was reimbursed with three marks per year for each NA employee who was a member of the Statutory Health Insurance Fund. 100 Jahre Betriebskrankenkasse der Norddeutschen Affinerie, Hamburg, 8/8/1984, FGA, SB12, Sammelmappe Soziales.

51_Cf. the so-called "December issue", Norddeutsche Affinerie AG (publ.), NA, 1952, p. 16. ff.

52_For an example, see "Rauchen oder Gesundheit?", NA intern 32/1979, p. 11.

53_"Früherkennungsuntersuchungen nutzen!", NA intern 6/1972, p. 11.

54_Interview with Dr. Thomas Schultek, 2015; "Gesundheitsschutz bei Aurubis", CU 3/2012, p. 18.

55_Interview with Dr. Thomas Schultek, 2015. Below.

56_The early history of the security team was summarized in compact form on the occasion of its anniversary for the benefit of its employees. See "50 Jahre Werkschutz der NA", NA intern 21/1975, p. 19 ff. Below.

57_Reported by the Hamburger Abendblatt on 3/13/1971; "Rufnummer 277", NA intern, 5/1972, p. 12.

58_Reformed again on 5/23/1986, HmbGVBl., 1986, p. 137.

Last revised in 2013: HmbGVBl., 2013, p. 487.
59_Quote by Martin Hauschild, head of plant Fire Department since 2012, in "Bereit für jeden Einsatz", CU 3/2013, p. 12.
60_"Arbeitssicherheit als unternehmerische Aufgabe," FGA, 6.2.1/17–10. In 1959/60, there were 674 accidents; in 1962/63, 451 accidents. FGA, SB12, Sammelmappe Soziales.
61_There were 674 accidents in 1959/60 and 451 accidents in 1962/63. Ibid.
62_"Neulinge besonders gefährdet", NA intern 27/1977, p. 17.
63_"Works meeting 1/29/1981", NA intern 40/1987, p. 8.
64_"Geschichte und Erfolge des NA-Betriebssports", NA intern 23/1976, p. 15. Below.
65_Cf. the so-called "December issue", Norddeutsche Affinerie AG (publ.), NA, 1952, p. 29. Below.
66_As told by a founding member still active at the time of the 40th anniversary of the corporate sports community. "Entspannung, Fitness und Kontakte", NA intern 79/1992, p. 12.
67_Cf. the so-called "December issue", Norddeutsche Affinerie AG (Hg.), NA, 1952, p. 29.
68_"Luv und Lee", NA intern 1/2007, p. 54 f.
69_"Geschichte und Erfolge des NA-Betriebssports", NA intern 23/1976, p. 15; "Entspannung, Fitness und Kontakte", NA intern 79/1992, p. 13.

Notes on infoboxes

1_An overview with statistics is provided by Wolfgang Seifert, Geschichte der Zuwanderung nach Deutschland nach 1950, 5/31/2012, online resource: http://www.bpb.de/politik/grundfragen/deutsche-verhaeltnisse-eine-sozialkunde/138012/geschichte-der-zuwanderung-nach-deutschland-nach-1950?p=all.
2_N. N., Erstes "Gastarbeiter-Abkommen" vor 55 Jahren, 12/20, 2010, online resource: http://www.bpb.de/themen/IEX7W3,0,Erstes_GastarbeiterAbkommen_vor_55_Jahren.html.
3_Seifert, Geschichte der Zuwanderung nach Deutschland nach 1950, loc. cit.
4_75 Jahre Schule Slomanstieg 1932–2007, Hamburg, 2007, p. 27, in: FGA, 12.6/66.
5_Ibid., p. 3 f.
6_Förderverein der Schule Slomanstieg, NA-Intern 1/2007, p. 57.
7_Integration. NA präsentiert ihr Modell in Berlin, CU 4/2008, p. 15.
8_Cf. the objectives and tasks of SCHULEWIRTSCHAFT, online resource: http://www.schulewirtschaft.de/www/schulewirtschaft.nsf/id/PageZiele-und-Aufgaben_DE?open.
9_Cf. online resource: http://www.mintpink.de/infos.html.
10_Aurubis AG (publ.), press release, Aurubis Recyclingzentrum Lünen fördert weitere Schüler-Auslandsaufenthalte zum Ausbau von Fremdsprachenkenntnissen, 7/1/2014, online resource: www.aurubis.com.
11_100 Jahre Betriebskrankenkasse der NA, NA-Intern, 54/1984, p. 12.
12_Deutsche Sozialversicherung, Krankenversicherung, Geschichte, online resource: http://www.deutsche-sozialversicherung.de/de/krankenversicherung/geschichte.html.
13_100 Jahre Betriebskrankenkasse der NA, NA-Intern, 54/1984, p. 12. Below.
14_Deutsche Sozialversicherung, Krankenversicherung, Geschichte, online resource: http://www.deutsche-sozialversicherung.de/de/krankenversicherung/geschichte.html.
15_Aus der letzten Betriebsversammlung, Jeder ist selbst verantwortlich, NA-Intern 34/1979, p. 8 f.

We are innovative

1_Interview with Michael Landau, 2015; Interview with Peter Kartenbeck, 2015.
2_"Neue Anodenschlammverarbeitung", CU 1/2013, p. 20 f.; Aurubis AG, Annual Report 2012/13, pp. 14, 75, 86 ff.
3_Emil Wohlwill to Dr. Adolf Frank, 10/11/1900, loc. cit., quoted in 125 Jahre Norddeutsche Affinerie Aktiengesellschaft, p. 29.
4_Robert Müller, Allgemeine und technische Elektrometallurgie, Vienna, 1932, p. 338; Norddeutsche Affinerie (publ.), 100 Jahre Norddeutsche Affinerie, Hamburg, 1966, p. 28.
5_"75 Jahre elektrolytische Kupferraffination auf der Norddeutschen Affinerie Hamburg", in: Zeitschrift für Erzbergbau und Metallhüttenwesen, vol. IV, issue no. 7, offprint, Stuttgart, 1951, p. 247. Below.
6_Norddeutsche Affinerie (publ.), 100 Jahre Norddeutsche Affinerie, Hamburg, 1966, p. 28 ff.
7_"75 Jahre elektrolytische Kupferraffination", loc. cit., p. 247.
8_Emil Wohlwill to Dr. Adolf Frank, 10/11/1900, loc. cit., p. 29. Space utilization at the old plant is portrayed in similar fashion in "75 Jahre elektrolytische Kupferraffination", loc. cit., p. 248.
9_Eugen van Erckelens, Geschichte der Norddeutschen Affinerie Aktiengesellschaft in Hamburg, Hamburg, 1955, unpublished, p. 75. ff.; "75 Jahre elektrolytische Kupferraffination", loc. cit., p. 247.
10_Ibid., p. 247 f.

11_van Erckelens, Geschichte der Norddeutschen Affinerie, p. 76. Similar information in Heinrich Wohlwill, 25 Jahre Elektrotechnischer Verein in Hamburg 1904–1929, transcript, originally in the anniversary publication Der Elektrotechnische Verein in Hamburg 1904–1929, Hamburg, 1929, p. 152 ff.

12_DR-Patent No. 90276 Kl. 40, 4/16/1896; DR-Patent No. 90511 Kl. 40, 6/9/1896.

13_Patenting of the process with asymmetrical alternating current: DR-Patent Nr. 207555 Kl. 40C/7, 9/22/1908. Various documents regarding licensing have been preserved in the FGA, 2.4/38.

14_Report on the new primary smelter, 12/11/1972, FGA, 8.1/34. Below.

15_"Neue Rohhütte", Speech by Dr. Peter Kartenbeck, 4/5-6/1973, FGA, "NA – Daten", no signature. Below.

16_Similar: Interview with Michael Kopke, 2015.

17_New supply contracts for concentrates concluded in the early 1970s: with Bougainville in Papua New Guinea for 200,000 t per year for 15 years; with Freeport in West Irian (Indonesia) for 78,000 t per year for 13 years; with Prieska in South Africa for 75,000 t per year for 10 years. "Rohhütte Werk Ost", speech by Dr. Peter Kartenbeck, no date, possibly January 1974, FGA, "NA – Daten, Produktionsschema [...]", no signature. Similar: interview with Peter Kartenbeck, 2015.

18_"Neue Rohhütte", speech by Dr. Peter Kartenbeck, 4/5-6/1973, FGA, "NA – Daten", no signature. Below.

19_Memo, dated 11/20/1961, FGA, 8.1/34.

20_A compact yet detailed description of the Outokumpu flash smelting process can be found in "30-page report on the production of anode copper from primary and secondary raw materials", undated, FGA, 8.5.1/26.

21_"Quantensprung in die Zukunft", CU 1/2012, p. 12 f. Below.

22_Introduced at the AIME Annual Meeting in Chicago. Abstract [...] "Optimierung des neuen CONTIMELT –Verfahrens [...]", undated, FGA, "NA – Daten," no signature.

23_Detailed description of process in "'Contimelt' – Ein neues kontinuierliches Verfahren zum Schmelzen und Raffinieren von Kupfer", METALL 35/5, May 1981, p. 417 ff.

24_The former site manager at RWO, in an interview, 2015; similar: interview with Dr. Peter Kartenbeck, 2015.

25_"Anodenjubiläum in der RWO", NA intern 97/1999, p. 17.

26_"RWO 00 und RWO 2000", NA intern 3/2000, p. 16 f. Also, interview with Michael Kopke, 2015.

27_Aurubis AG, Annual Report 2008/09, pp. 30, 56; Annual Report 2012/13, pp. 72, 88.

28_"Eine Erfolgsgeschichte sondergleichen", CU 3/2009, p. 10 f. In July 1989, the first tankhouse cells were started up and by September they was almost running at full capacity. The plant was inaugurated on October 6. "Lob vom Umweltsenator – Einweihung der neuen Kupferelektrolyse", NA intern 71/1989, p. 18 ff.

29_Report by Dr. Peter Kartenbeck, "Neubau Elektrolyse Werk Ost", ca. 1985, undated, FGA, 8.5.1/53. According to this, the anodes and cathodes were only about 50 % of the usual weight when compared to modern systems, and the size of the cell was only 60 %.

30_Various documents in 8.5.1/50, FGA, such as Memo, "EWO – Terminlicher Ablauf der Planungs- und Bauarbeiten, Hüttenbaugesellschaft Peute m.b.H.", 2/1/1972; Memo, "Investitionskosten neue Elektrolyse", 9/22/1972. In 1987, however, explorations were still being made as to whether the Werk Ost would actually become the site of the plant since the town of Brunsbüttel in Schleswig-Holstein, for example, was also bidding for this industrial project as part of its structural development efforts. In the end, the decision for a solution on site had similar logistical reasons as in the case of the RWO. Memo, "Standortbetrachtungen/Neue Elektrolyse, Gespräch mit der Wirtschaftsförderungsgesellschaft Schleswig-Holstein [...]", 6/11/1987, FGA, 8.5.1/53.

31_Memo, "Neuplanung einer CU-Elektrolyse", 1/6/1971, FGA, 8.5.1/50; Memo, "Kathodenpresse –Phelps Dodge", 2/24/1972, FGA, 8.5.1/53.

32_Various documents in 8.5.1/53, Firmengeschichtliches Archiv: draft of an agreement (in English) with MIM regarding the ISA process, 4/3/1984; "Feasibility-Studie Kupferelektrolyse Werk Ost", 10/23/1984; Memo, "Wirtschaftlichkeitsvergleich", 11/2/1984.

33_Memo with diagram project organization, 8/24/1987, FGA, 8.5.1/53.

34_Gerhardt Berndt, chairman of the Executive Board, to members of the Supervisory Board, 2/3/1988, FGA, 8.5.1/53.

35_Interview with Dr. Michael Landau, 2015.

36_"Feasibility Studie Kupferelektrolyse Werk Ost", 10/23/1984, FGA, 8.5.1/53. In reality, production during the first year of operation already reached 157,000 t. See CU 3/2009, p. 11.

37_Memo, "Erweiterung Kupferelektrolyse Werk Ost", 9/24/1990, FGA, 8.5.1/53.

38_Various documents on the test series and description in FGA, 8.5.1/42. For a compact account of the pioneering work at the time, see 30 Jahre Strangguss, 9/24/1980, FGA, 12.5/2.
39_"Die wirtschaftliche Lösung einer anwendungsspezifischen Automatisierungsaufgabe", FGA, "NA – Daten", no signature.
40_"Vorteile kontinuierliches Stranggiessen gegenüber diskontinuierlichem Giessen", undated, FGA, 8.5.1/38; "Beendigung der Drahtbarrenproduktion", 1979, FGA, 7.2/26.
41_Report in NA intern, "Dora Eins Punkt Eins bis Eins Punkt Vier", 4/2004, p. 20.
42_Various documents on the planning and implementation in FGA, 8.5.1/39 and /40.
43_A compact survey of the technical principles in "Eine lange Erfolgsgeschichte, ROD-Produktion bei Aurubis", CU 4/2010, p. 20 f.
44_Product brochure TOP ROD, Norddeutsche Affinerie AG, 2001. Report on the introduction in NA intern, "TOP CAST und TOP ROD, Zwei neue Namen die man sich merken muss", 97/1999, p. 20 f.
45_Dr. Bernd Drouven at the opening of KRS-Plus. "Ein weiteres Plus für Lünen", CU 3/2011, p. 18.
46_Aurubis AG, Recycling, 2013; Recycling, NA intern, special edition, May 2005. Below.
47_Norddeutsche Affinerie AG, Annual Report 2001/2002, pp. 19 f., 35, 47 f. Below. KRS already had the pending implementation of the European Waste Electric and Electronic Equipment Directive from 2006 onward in mind, which gave rise to expectations of increasing quantities of secondary raw materials.
48_"Der Vorstand im Dialog", Norddeutsche Affinerie AG, Annual Report 2001/02, p. 3.
49_CU reported: "KRS-Plus in Lünen, Der Bau hat begonnen", CU 4/2010, p. 7; "Ein weiteres Plus für Lünen", CU 3/2011, p. 18 f.
50_This was due to a bull market in precious metals in 1979/80. See Memo, "NA-Aktivitäten im Hinblick auf verbesserte Edelmetall-Versorgung", 3/11/1982, FGA, 8.5.1/35. On sourcing from IBM see Memo, "Elektronikschrott aus USA", 1/15/1982, FGA, 8.5.1/35.
51_For correspondence regarding individual companies see FGA, 8.5.1/35, file segment "Marktsituation".
52_Extracts from reports "Bureau of Mines Report of Investigations (R I)", 2/4, 1982, FGA, 8.5.1/35.
53_As already described in the brochure; see Norddeutsche Affinerie AG, Computerschrott-Recycling, undated.
54_In 2013, the share was approx. 17 %. See Aurubis AG, "Der führende integrierte Kupferproduzent", company presentation, November 2014.
55_CU reported on the start. See "Innovationen sind der Schlüssel zum Erfolg", CU 3/2009, p. 10.
56_"Innovationsmanagement, Hilfestellung und Ideenfindung", CU 4/2011, p. 10 f. Regarding the pending application for a patent on the improvement of both the process and the facility for processing iron silicate stone, see Aurubis AG, Legal Dept., attorney's file AUR 2014-03.
57_Aurubis AG, list of patents, status February 2014, Legal Dept. Patents applied for included ones which referred to the oxygen content in copper melts in 2001 and 2002; to the forming of anodes in 2006 and 2012; to the process of producing an electrolysis electrode in 2010 and 2011; to repairing electrolysis cathodes in 2011; and to processes and installations for processing flue dust in 2011 and 2011.
58_Norddeutsche Affinerie AG, list of patents, status 7/28/2015, Legal Department.
59_Norddeutsche Affinerie AG, Annual Report 1999/00, p. 31. Below.
60_Norddeutsche Affinerie AG, Annual Report 2000/01, pp. 31, 51, 98. CIS Solartechnik GmbH was a 50/50 joint venture with Cordes & Graefe KG in Bremen.
61_"Solarzellen auf Kupferbasis bei der NA", NA intern 4/2000, p. 22.
62_Aurubis AG, Annual Report 2010/11, p. 99.
63_Aurubis AG, Heat Exchanger Material 2013, p. 5.
64_Interview with Dr. Mario Löbbus, R&D manager, 2015. Below.
65_Aurubis AG, Annual Report 2013/14, p. 6.
66_Interview with Dr. Mario Löbbus, 2015.
67_Ibid. Below.

Notes on infoboxes

1_Various documents on individual sales of licenses, in: FGA, 2.4/38.
2_Xstrata Technology (publ.), presentation "ISA Process, Cathode Stripping Machine", Brisbane, 2012, here from online resource: http://www.mesco.co.jp/english/images/ISAPCathe2012.pdf; interview with Dr. Michael Landau, 2015. Below.

We are sustainable

1_Aurubis AG (publ.), Sustainability Report 2013, Hamburg, 2014.

2_The Aurubis Sustainability Management is part of the Corporate Communications & External Affairs Department. Interview with Sustainability Manager Kirsten Kuck, 2015; diagram on Sustainability Strategy at Aurubis AG (publ.), Sustainability Report 2013, Hamburg, 2014, p. 28. Below.

3_This practice began in fiscal year 2008/09. The reports are based on the guidelines issued by the Global Reporting Initiative (GRI), an independent organization in Amsterdam which supports companies in their open communication of sustainability issues.

4_Hamburg State Archives, Gesundheitsrat 1, vol. 5, p. 331 f. For similar descriptions, see Arne Andersen, "Industriepolitik und Umwelt – Die Norddeutsche Affinerie in Hamburg", in: 1999. Zeitschrift für Sozialgeschichte des 20. und 21. Jahrhunderts, 3 (1988), issue 1, pp. 8–43.

5_Andersen, "Industriepolitik und Umwelt", p. 10 f.

6_Appropriate application by Elbkupferwerk dated "November 2, 1853", cited in ibid., p. 11.

7_Ibid., p. 12.

8_It is now an established fact that the policy of "tall smokestacks" which was common until the 1960s only resulted in the harmful substances being distributed within a larger radius. Cf. Franz-Josef Brüggemeier, Tschernobyl, April 26, 1986. Die ökologische Herausforderung, Munich, 1998, pp. 67–83.

9_This type of reasoning was typical of the time. The actual environmental media (air, soil, water) were not protected by legislation, but the right of ownership of third parties in the environment of emission-heavy production facilities kicked in. Any strains on the environment – which might result in a reduction of the property value – were only admissible within the limits of what was common for the area. Otherwise, property owners had the right to sue the party responsible for damages.

10_Andersen, "Industriepolitik und Umwelt", p. 15 f.

11_Ibid., pp. 21–24.

12_Ibid., p. 24.

13_Cf. Silke Ruth Laskowski, Das Menschenrecht auf Wasser. Die rechtlichen Vorgaben zur Sicherung der Grundversorgung mit Wasser und Sanitärleistungen im Rahmen einer ökologisch nachhaltigen Wasserwirtschaftsordnung (Recht der nachhaltigen Entwicklung 7), Tübingen, 2010, p. 473.

14_Andersen, "Industriepolitik und Umwelt", p. 24.

15_Ibid., p. 25 f.

16_Copy of an excerpt from the notice of approval issued by the Building Inspection Department on June 6, 1908 regarding the construction of a metallurgical plant on the Peute: NA intern, Special Ecology Issue, Hamburg, 1985, p. 4. Below.

17_Andersen, "Industriepolitik und Umwelt", p. 27.

18_Hamburg environmental authorities and Hanseatic City of Hamburg (publ.), Sanierung der Norddeutschen Affinerie, Hamburg, 1985, p. 4.

19_Interview with Dr. Hans-Joachim Velten and Dr. Karin Hinrichs-Petersen, 2015.

20_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 120.

21_Interview with Dr. Hans-Joachim Velten and Dr. Karin Hinrichs-Petersen, 2015.

22_Yet there were still sizeable amounts of sulfur dioxide which left the plant unfiltered, as well as smaller amounts of arsenic, lead and cadmium. Cf. online resource www.umwelt-atlas-hamburg.de/4kapitel/portrait_affi_de.htm.

23_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 120.

24_Andersen, "Industriepolitik und Umwelt", pp. 28–37. Below.

25_Ibid., p. 28 f., e. g. in Hamburger Nachrichten, 1/25/1928 and Hamburger Fremdenblatt, 1/3/1928.

26_Cf. research overview by Jeannette Cornelie Riedel-Lorjé/ Thomas Gaumert,"100 Jahre Elbe-Forschung. Hydrobiologische Situation und Fischbestand 1842–1943 unter dem Einfluss von Stromverbau und Sieleinleitungen", in: Archiv für Hydrobiologie, supplement 61, Stuttgart, 1982, pp. 317–376. p. 330 ff.

27_Cf. Andersen, "Industriepolitik und Umwelt", pp. 29, 31. The KPD had detected 29.6 g of copper, 15.75 g of arsenic, 48 g of free sulfuric acid and 56 g of sulfate per liter of water. The State Institute of Hygiene established 33.9 g of copper, 19.7 g of arsenic, 76 g of free and 70.7 g of combined sulfuric acid.

28_Ibid., p. 33 f.

29_Ibid., p. 36.

30_Ibid., p. 39.

31_Cf. ibid., p. 40; also see "Sinkende Blase", Der Spiegel, 10/9/1972, pp. 94–96.

32_Cf. for a detailed account Joachim Radkau, Die Ära der

Ökologie. Eine Weltgeschichte, Munich, 2011, pp. 124–164.
33_Cf. Hans-Peter Vierhaus, Umweltbewusstsein von oben. Zum Verfassungsgebot demokratischer Willensbildung (Schriften zum Umweltrecht 48), Berlin, 1994, pp. 110–114; Federal Environmental Agency (publ.), 40 Jahre Umweltbundesamt 1974–2014, Dessau, 2014, pp. 15–30.
34_For details on the course of events, see FGA, 22.6/9, SO_2-Emission 3.10.1972 and preliminary proceedings.
35_"Sinkende Blase", Der Spiegel, 10/9/1972, pp. 94–96.
36_Ibid., p. 96.
37_It was not until 1972, when the Federal Constitutional Law was amended and the principle of competing legislation was extended to air pollution control, that the requirements for a national pollution control act were created. The German Federal Emission Control Act came into force in 1974. A separate Hamburg authority for environmental policy was not created until December 1978.
38_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 92.
39_Die Meilensteine der NA-Umweltaktivitäten, 1920–2003, p. 3 in FGA, 22.1/14.
40_Umweltbehörde der Freien und Hansestadt Hamburg (publ.), Sanierung der Norddeutschen Affinerie, Hamburg, 1985, p. 6.
41_The group exists to this day; online resource: www.friedensblitz.de/geos/.
42_Umweltschutzgruppe Physik-Geowissenschaften, Wasser in Hamburg – Giftig Salzig Dreckig Stinkig, Hamburg, 1981; id., Wasser in Hamburg 2, Hamburg, 1983; id., Glänzende Geschäfte, Umwelt hin – Geld her, Hamburg, 1985; id., Wasser in Hamburg 3, Hamburg, 1988.
43_Cf. www.umweltatlas-hamburg.de/4kapitel/portrait_affi_de.htm.
44_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 103.
45_Interview with Dr. Hans-Joachim Velten and Dr. Karin Hinrichs-Petersen, 2015.
46_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 103.
47_Ibid., p. 116. Below.
48_"Tödliche Gefahr durch Kupferhütte", in: Die Tageszeitung (taz), 2/5/1985; "Tarnen und Täuschen", Der Spiegel, 7/1985, pp. 100–103, cited here from p. 100.
49_Ibid.
50_See for example "Tumult in der Hamburger Bürgerschaft", Die Welt, 2/15/1985; "Proletarische Eierwerfer gegen Hamburger Grüne", Die Tageszeitung (Taz), 2/15/1985.
51_"Unter Umständen Sanierungskosten mittragen. Zur Arsenverseuchung in Hamburgs Osten: Die Kupferhütte bestreitet eine Alleinschuld", Harburger Anzeigen und Nachrichten, 2/9/1985.
52_For details of the program, see Umweltbehörde der Freien und Hansestadt Hamburg (publ.), Sanierung der Norddeutschen Affinerie, Hamburg, 1985, pp. 24–31.
53_Norddeutsche Affinerie Aktiengesellschaft (publ.), 125 Jahre, p. 116 f.
54_Emission Declarations 1970 and 1991, Norddeutsche Affinerie AG; "Weniger Arsen aus Affi", Die Tageszeitung (taz), 10/30/1992.
55_Die Meilensteine der NA-Umweltaktivitäten 1920–2003, p. 14 in FGA, 22.1/14.
56_Ibid., p. 15.
57_Ibid., p. 16.
58_Aurubis AG, Aktualisierte Umwelterklärung 2014 (Updated Environmental Statement), Hamburg and Lünen, Hamburg, 2014, p. 16 ff.
59_Interview with Dr. Karin Hinrichs-Petersen, 2015.
60_Ibid.
61_Interview with Ulf Gehrckens, 2015.
62_Ibid.
63_Ibid. Below.
64_Ibid. Below. Regarding power plant planning, see for example Norddeutsche Affinerie AG, Annual Report 2004/05, p. 18.
65_For example, interview with Peter Willbrandt, 2015.
66_Interview with Ulf Gehrckens, 2015. Below.
67_Ibid.
68_Aurubis AG (publ.), press release, "Aurubis als bester Neuteilnehmer Deutschlands von Carbon Disclosure Project geehrt", 11/5/2015.
69_Cf. dena's online resource http://www.dena.de/presse-medien/pressemitteilungen/dena-vergibt-best-practice-labelfuer-energieeffizienz.html.
70_Interview with Ulf Gehrckens, 2015.
71_Interview with Peter Willbrandt, 2015.
72_Aurubis AG (publ.), Aurubis Business Partner Screening, Zusammenfassung für Stakeholder, August 2015. Below.
73_Bischöfliches Hilfswerk Misereor e. V., Diakonisches Werk der Evangelischen Kirche in Deutschland e. V. für die Aktion

"Brot für die Welt", Global Policy Forum Europe (publ.), Vom Erz zum Auto, Aachen, Bonn, Stuttgart, September 2012; Bischöfliches Hilfswerk Misereor e. V. (publ.), Menschenrechtliche Probleme im peruanischen Rohstoffsektor und die deutsche Mitverantwortung, Aachen, 2013.

74_Dachverband Kritische Aktionäre (publ.), "Lückenhafte Unternehmensverantwortung bei Aurubis", press release no. 3/2014, Hamburg/Cologne, 2/25/2014.

75_Interview with Sustainability Manager Kirsten Kück, 2015. Individual supply partnerships with Peruvian mining companies are subject to contract clauses which rule out disclosing their names.

76_For a detailed overview of the Peruvian mining sector, see Germany Trade and Invest Gesellschaft für Außenwirtschaft und Standortmarketing mbh (publ.), Peru, Herausforderungen und Chancen für eine nachhaltige Entwicklung im Rohstoffsektor, Berlin, 2014.

77_Misereor e. V. (publ.), Menschenrechtliche Probleme im peruanischen Rohstoffsektor, p. 6.

78_Misereor e. V. et al. (publ.), Vom Erz zum Auto, pp. 23, 33.

79_Kritische Aktionäre (publ.), Hintergründe zur NA Hauptversammlung 2002, cited here from the online resource www.criticalshareholders.de/Archiv/Konzernkritik/Norddeutsche_Affinerie/NA2002/NA2002-b/na2002-b.html, 2002. In 2000, the organization Rettet die Elbe (Save the Elbe River) had asked similar questions with regard to the Ok Tedi mine in Papua New Guinea during the annual general meeting. Rettet die Elbe (publ.), Gegenanträge zur ordentlichen Hauptversammlung on April 4, 2000 in Hamburg, cited here from the online resource www.umweltatlas-hamburg.de/inhalt_heavy_metal.php.

80_Reports in the employee magazine "Wertvoller Dialog", CU 4/2014, p. 19. In 2014 alone, seven meetings with NGOs had taken place since spring, namely with Deutsche Umwelthilfe, WWF, Rettet die Elbe, Germanwatch, Sudwind, Transparency International, and Misereor.

81_Interview with Chief Compliance Officer Henning Michaelsen, 2015; interview with Sustainability Manager Kirsten Kück, 2015.

82_Aurubis AG (publ.), Aurubis Business Partner Screening, Zusammenfassung für Stakeholder, August 2015.

83_Interview with Sustainability Manager Kirsten Kuck, 2015.

84_Organization for Economic Cooperation and Development (OECD) in Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas, Paris, 2011; for the accession to the Global Compact, initiated by the United Nations (UN) in 2000, which includes 10 corporate principles for a social and ecological shaping of globalization: see Aurubis AG to Ban Ki-Moon, General Secretary of the United Nations, 12/22/2014. Online resource: https://www.unglobalcompact.org/what-is-gc/participants/ 49491.

85_Aurubis AG (publ.), press release "Aurubis ist erfolgreich gemäß LBMA für konfliktfreies Gold auditiert worden" ("Aurubis successfully audited for conflict-free gold in accordance with LBMA"), 1/30/2014.

Notes on infoboxes

1_Interview with Benno Oldach, 2015.

2_An overview of the history and the problems from 1984 onward, is provided by Roland Seib, Blickpunkt: Die Ok Tedi-Mine in Papua-Neuguinea. Eine Umweltkatastrophe, online resource: http://www.pazifik-infostelle.org/publikationen/blickpunkte/30612.html.

3_Interview with the head of Primary Raw Material Purchasing Nicholas Albrecht, 2015.

4_For example, by the interest group Förderkreis Rettet die Elbe e. V. (Save the Elbe River), with comprehensive information material, online resource: http://www.rettet-die-elbe.de/oktedi/. Below.

5_NA unterstützt den Bau eines Schulungscenters in Papua Neuguinea, NA intern 1/2002, p. 13; Unterwegs in sozialer Mission. Eine Reise ans andere Ende der Welt, NA intern 1/2008, p. 25 ff.; interview with Dr. Thomas Schultek, 2015.

We are future-oriented

1_Marlies Uken, Ohne Kupfer keine Energiewende, Die Zeit, 9/1/2011.

2_Interview with Executive Board 2, 2015.

3_Deutsches Kupferinstitut (Hg.), Kupfer – Werkstoff der Menschheit, Düsseldorf 2006, p. 16 ff.

4_Interview with Erwin Faust, 2015.

5_Dr. Bernd Drouven: interview with Executive Board 2, 2015.

6_Ibid.

7_Similar: Dr. Stefan Boel: interview with Executive Board 2, 2015.

8_Dr. Stefan Boel: interview with Executive Board 2, 2015.

9_Ibid.

10_Interview with Erwin Faust, 2015.

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Nicholas Albrecht, Dr. Stefan Boel, Dr. Bernd Drouven, Dr. Erwin Faust, Dr. Björn Frenzel, Ulf Gehrckens, Wolfgang Gross, Hans-Jürgen Grundmann, Dr. Karin Hinrichs-Petersen, Renate Hold-Yilmaz, Dr. Peter Kartenbeck, Michael Kopke, Kirsten Kück, Dr. Michael Landau, Dr. Bernd Langner, Dr. Mario Löbbus, Dr. Werner Marnette, Henning Michaelsen, Benno Oldach, Klaus Prior, Irene Scherner, Dr. Thomas Schultek, Birol Senol, Prof. Dr. Fritz Vahrenholt, Dr. Hans-Joachim Velten, Peter Willbrandt

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Key personalities
Page 141: Photo Richard Merton: Hans Achinger, Richard Merton. Biography, Frankfurt, 1970.

Glossary

Affination
Process of eliminating silver from its alloys.

Alloys
Metallic materials consisting of at least two metals. Alloys are mainly produced by combining the base metal with alloying additions, either by melting and casting them together, by pressing or diffusing them into the base metal or, less frequently, by chemical decomposition of metal compounds.

Alimentation
The supply of copper ores from home and abroad.

Anode furnace
Facility used to produce anode copper by purifying the copper (combined purging and reduction process) plus lowering the oxygen content.

Anode slime
Product of copper electrolysis. The anode slime is deposited on the bottom of the electrolytic cell during dissolution of the copper anodes. Precious metals, e. g. gold and silver, as well as selenium and lead accumulate in the slime.

Anodes
End product of pyrometallurgical copper production; electrodes of an electrolytic cell with positive polarity; copper content approx. 99.5 %.

Blister copper or blown copper
Unrefined copper which in its liquid state has a greater dissolving capacity for gases than solid metal. When the copper solidifies, the gases are precipitated as small blisters.

CDP
The Carbon Disclosure Project (CDP) is a non-profit organization which aims to encourage both companies and local authorities to publish their environmental data.

Cementation
Precipitation of a metal from a saline solution through a baser metal. The baser metal comes before the metal to be precipitated in the electrochemical series and is dissolved instead of the more precious metal.

Complex raw materials
Both primary and secondary raw materials are becoming more complex to the effect that copper contents are dwindling while the concentrations of by-elements and impurities are increasing.

Connector strip
Primary product for connector applications used for separating and connecting wires. Used in numerous electrical or energy-driven industrial and consumer products such as cell phones, laptops, tablets, casings, medical appliances, etc.

Continuous casting method
Casting method in which a moving saw cuts off individual bars of variable lengths. The resulting continuous casting products are then processed to obtain sheet metal, foil, sections and tubes by either rolling or extrusion.

Converter
Facility mainly used for refining processes.

Copper anodes
At Aurubis, the end product of the primary smelter with a copper content of around 99.5 %.

Copper cathodes
Quality product of copper electrolysis with a copper content of 99.99 %.

Copper concentrates
Product gained from the processing and enrichment of copper ores. Copper ores are almost always found as chemical compounds and only contain low concentrations of copper (between 0.5 and 4 % copper content). After extraction, they are enriched into concentrates at processing plants (copper content between 25 and 40 %).

(Copper) Electrolysis
Electrochemical process used for copper production in which anode and cathode are suspended in a sulfuric