THE WORLD THAT MOVES US
THE WORLD THAT MOVES US

... lies up to 1,500 metres below the Earth’s surface. We mine raw materials which came into being million years ago. We process, refine and market the nutrients and minerals extracted from them all over the world.

**We are really on the way:** We can produce well over 20 million tonnes of salt and more than seven million tonnes of potash and magnesium products each year – with sites in Europe, South and North America.

**Our tasks are great:** Our products ensure rich harvests, increase safety on winter roads, promote health and boost the quality of life – they form an important basis for our modern industrial society.

**Ours is a long tradition:** For 125 years, customers have put their trust in our products; our employees have frequently been involved with mining for generations. More than 14,000 employees today contribute to the success of the K+S GROUP. Eight of them talk about their world above and below ground: from extraction to the finished product. Be fascinated by the world that moves us.
THE WORLD THAT MOVES US

SECURING RAW MATERIALS
BASIR BAHRAMI

EXTRACTING RAW MATERIALS
ANDREAS RICHTER

MINING RAW MATERIALS
DENNIS WILTNER

REFINING RAW MATERIALS
JENS HOLLENBACH
SELLING RAW MATERIALS
LEONARDO ROSAS

DISTRIBUTING RAW MATERIALS
SUSANNE NEIRO

APPLYING RAW MATERIALS
OLIVIER GOUJARD

VALUING RAW MATERIALS
LENA MICHEL
Securing raw material S

"WE ARE WORKING TOGETHER TO MEET THE CHALLENGES RELATED TO THE CONSTRUCTION OF OUR POTASH PLANT IN CANADA AND ARE PLEASED WITH THE DAILY PROGRESS".
In the southern part of the Canadian province of Saskatchewan, flat grassland stretches to the horizon. “We Canadians say: If anyone wants to run away here, you can still see him running the day after tomorrow”, is how Basir Bahrami describes the extent of the province, which is twice as big as Germany. Widely visible, red and white steel frameworks rise up into the blue winter sky. The rigs markedly indicate that the prairie’s treasure lies below ground. At a depth of 1,500 metres, great potash deposits are waiting to be exploited. Bahrami works as a process engineer on the site of the Legacy Project about 50 kilometres north of the small city of Moose Jaw. Since the ground-breaking ceremony in summer 2012, K+S has been preparing the extraction of the crude salt for the new potash plant.

**NEW POTASH PLANT ON A GREENFIELD**

Basir Bahrami has been on the site since December 2012: “It’s the first greenfield project in Saskatchewan in nearly 40 years. It is the most important current capital project of the K+S GROUP. You only get the opportunity to be part of something so big once in a lifetime”.

Approximately 1,700 people will work on the construction site during the peak stage and 1,200 of those workers will live at the site. That is why, apart from rigs, pipes and wires, a complete construction camp is arising.

At the Legacy site, potassium chloride is not mined by means of drilling and blasting, as is customary in German mines. Instead, it is extracted through developing underground openings, so-called caverns. A first test cavern is already connected.

There will be a total of 36 caverns when the site is commissioned, which is forecast for the summer of 2016. The basic principle is simple: Fresh water will be pumped into the deposit, the salt rock dissolves, roughly 250 metres
wide and up to 60 metres high caverns are created, and the potassium brine solution is pumped back up and processed further.

**SIMULATION FOR OPERATIONAL READINESS**
This is where Basir Bahrami’s work starts: He is a member of the technical authority team which plans the surface facilities for the evaporation, clarification and crystallization of the brine. “Already at the construction stage, we work on process modelling of the facilities. This also enables us to identify possible ‘bottlenecks’ and to modify the planned production process accordingly”, Bahrami explains. With his experience, he will also give input to a training simulator for the facility operators and provide assistance in preparing the operating manuals.

Bahrami likes the familiar atmosphere and the balanced cultural mix in the German-Canadian project team: “A mood full of anticipation dominates our employee update meetings. We are working together to meet the challenges ahead and are pleased with the daily construction progress”.

**POTASH FOR THE GROWING MARKETS OF ASIA AND AMERICA**
Why are we building a new plant? K+S is expecting the global potash demand to grow by three to five per cent each year. It makes sense to increase our production. The new plant in Canada gives us the possibility of increasing our annual production capacity in the long term by at least 2.86 million tonnes. The new site is to be the starting point for sales to the growing markets of Asia and South America as well as in North America.
EXTRACTING RAW MATERIALS

“THE GERMAN POTASH DEPOSITS CONTAIN NOT ONLY POTASSIUM BUT ALSO MAGNESIUM AND SULPHUR – THIS IS GLOBALLY UNIQUE”.
ANDREAS RICHTER, AGE 35
SURVEYOR
IN A THREE-SHIFT ENTERPRISE, THE CREW SEEKS TO IT THAT THE EXTRACTION IS DONE.

Nine hundred metres underground, Major District 3 of the Hattorf/Wintershall mine. Surveyor Andreas Richter stands in the middle of an intersection, the headlights of his off-road vehicle lighting up the underground labyrinth. The compacted salt stacks and the reddish-brown marbled potash streaks appear in the beams of light. In the mine, the temperature is a pleasant 28 degrees Centigrade, and humidity is 20 per cent.

Richter is focusing on his measuring instrument. A tachymeter is his essential companion, with this tool he measures the deposit’s position and height and gives the direction for further extraction with a red laser beam. He then fires bolts into the ridge, the roof of the mine, as markers.

“We miners call it ‘hanging up hours’. The mates in the drilling vehicle now know exactly in what direction they must make the holes in the rock, so that the crude salt can be extracted. The roadways are prepared predominantly at right angles”, Richter explains.

In potash mining, the mining is done according to the “room and pillar method”. The road width and pillar geometry are chosen for every mining section in such a way that the stability of the excavation work is ensured even at a depth of 1,200 metres. The pillars are dimensioned in such a manner that they can carry three times the weight actually resting on them.

THE MEMORY OF THE MINING OPERATIONS

Andreas Richter is an employee of the mine-survey at the Werra plant. Apart from practical surveying, his tasks also include evaluating and documenting the insights. All data flow together in the mine plans, the memory of the mining operations. These drawings document all shafts, roadways and excavations. They constitute relevant documentation also for the mining authority.
Potash extraction in the Werra valley – this is a tradition going back over 100 years. The Werra Verbund plant, one of the world’s biggest potash mines, came into being in 1997 out of the formerly independent plants of Hattorf, Wintershall, Unterbreizbach and Merkers. The district underground has grown to an area of significantly more than 300 square kilometres, which corresponds to the size of a large city like Munich.

A PART OF THE WHOLE
Richter is one of more than 4,400 employees of the Werra plant. In the three-shift enterprise, the crew sees to it that the extraction is done. Richter has been working in Major District 3 since 2010. Before then, he had spent four years doing surveying work above ground. “Then finally the opportunity presented itself to switch to underground. I like being part of the great picture”.

UNIQUE PRODUCT RANGE
The extraction and processing of crude salts containing potash is in part more demanding in Germany than in other countries, due to geological conditions. However, at the same time the yield is of particular value: Because the raw materials in the German potash deposits contain not only potassium but also magnesium and sulphur. This globally unique condition enables K+S to produce, apart from potassium chloride, a number of high-quality speciality products for agriculture and industry. A diversity not offered by any other potash producer in the world.

Extracting raw materials

Up to 20 tonnes of crude salt fit into the shovel of loaders which transport the rock that has been blasted to crushing plants. From there, the crushed salt is brought to the extraction shaft along conveyor belts to be subsequently processed in the factory.
MINING RAW MATERIALS

“OUR FAMILY HAS BEEN INVOLVED WITH MINING FOR GENERATIONS. MY SONS ARE CONTINUING THE TRADITION”.

our family has been involved with mining for generations. my sons are continuing the tradition.
DENNIS WILTNER, AGE 49
MINING BLASTER
Dennis Wiltner is a calm, considerate man. But when the mining blaster presses the red button, things go bang. Up to 5,000 tonnes of white gold breaks from the wall in one go. Until then, it had been securely embedded deep below the surface of the Earth for millions of years.

“That moment is something special for me each time”, says the 49-year-old – even after 26 years below ground. The underground blasting is precisely pulsed; individual blasting takes place at intervals of 50 milliseconds – which is shorter than the blink of an eye.

Wiltner’s task is to fill the holes with explosives and to fix the detonator. His colleagues in the bench drilling jumbo had previously drilled the holes 30 metres deep into the rock. Later, when he is at a safer distance in the fresh-air stream, he can trigger the blasting. After that, Wiltner leaves the mine, his work done.

Workers on the next shift transport the rock that has been blasted to the crusher. The crushed chunks are then transported to the shaft by conveyor belts that wind along the roadways for miles. Above ground, they pass through a series of grinding and screening stages. At the end the grains of salt are up to a fifth of a millimetre small – just right for more than a thousand applications for which salt is needed.

MODERN TECHNOLOGY MAKES THE WORK EASIER
The mining district of the Bernburg salt plant extends to the size of a city. Dennis Wiltner has to travel up to nine kilometres underground by off-road vehicle to get to his workplace.

The miner’s work is characterised by the use of modern large-scale machines. Wiltner has experienced the constant development at his own workplace too: “In the
past, we used to shove explosives cartridges into the drill holes by hand. Since the beginning of the ‘90s, we have been blowing the explosives through a hose by compressed air into the drill holes – it makes the work tremendously easier”.

**LIKE FATHER, LIKE SONS**

The history of mining in Bernburg started in 1884; it shaped the region in the heart of Saxony-Anhalt. Dennis Wiltner’s family too has been associated with mining for generations. “My father sank the shaft in the Zielitz potash plant”, Wiltner recalls. His sons are continuing the tradition: One of them works above ground in Bernburg, while the other underwent training as a mining technologist – and acquired the right to carry out blasting.

**IN BERNBURG THE SALT IS PARTICULARLY PURE**

About three million tonnes of salt are processed annually in Bernburg. Apart from the salt that is mined, which has a particularly high purity of 99 per cent, evaporated salt is also produced. Two thirds of the production reach the streets of Europe as de-icing salt. One third is used as food grade salt and for industrial applications, such as water softening.
REFINING RAW MATERIALS

“OUR RAW MATERIAL IS NOT ONLY USED FOR PLANT NUTRITION; IT IS ALSO AN ESSENTIAL MINERAL FOR THE HUMAN BODY”.

“our raw material is not only used for plant nutrition; it is also an essential mineral for the human body”.
After 30 years of professional life, experiencing an atmosphere of departure once more and performing pioneering work: Jens Hollenbach knows how good it feels to enter new territory. He was at the forefront when the Zielitz plant in 2009 produced a high-purity product for the food industry for the first time.

The qualified electrician and master craftsman had been gathering experience at various posts in the plant over the years. He then received an offer to educate himself further in a two-year course of studies, in order to undertake a task in the new production unit: “I agreed immediately”.

Previously, Germany’s newest potash plant had specialised in fertilizers and products for diverse industrial applications. But the raw material from the Zielitz deposit is not only used for plant nutrition; potash is also an important mineral for the human body. With the production of high-purity potassium chloride, the Zielitz plant gained a further pillar. The food thus produced is internationally sought after.

INVESTMENT IN CLEANROOMS
The potassium chloride is refined in so-called cleanrooms. Cleanliness is the greatest imperative in the shining stainless steel facility. No foreign particle is allowed to stray onto the saline solution, which is purified, subsequently dried and finely sifted for the grain size desired. “The properties of the mineral are not changed in this process”, Hollenbach emphasises. Those at Zielitz are proud of the fact that their product is called “natural”.

A fully-automatic system, which mixes and packs the product, is the domain of Jens Hollenbach. He works in close cooperation with production planning, materials management and logistics and knows how the individual wheels lock together.
KaliSel® is the name of the product from high-purity potassium chloride which has challenged the Zielitz employees. For the food industry expects additives to be produced in accordance with recognised processes. For that reason, K+S imposed quality management on the entire process chain and confirmed this through certifications in accordance with internationally recognised standards.

“That was something totally new for us”, Hollenbach recalls. “Together we rose to the challenge, learnt something new, and are now proud to be able to meet all standards”.

KaliSel® enriches food
The strength of KaliSel® particularly consists in the fact that it enriches food with an important mineral. It is used in bread and pastry products, meat and sausage products, convenience foods and snacks, dairy produce, baby food and drinks. KaliSel® is particularly attractive for the American market, because numerous food manufacturers offer low-sodium products there. But there is also a growing demand from South America and Asia.
SELLING RAW MATERIALS

“OUR SALT HAS A DEGREE OF PURITY OF 99 PER CENT. YOU COULD SPRinkle IT ON YOUR BREAKFAST EGG STRAIGHTAWAY”.
What a workplace! When sales manager Leonardo Rosas develops strategies, analyses key figures or welcomes customers in his office in Santiago de Chile, he can look out from the 6th floor of the glass office block as far as the Andes. “I enjoy this view every day”, Rosas says.

His office is in Las Condes, Chile’s largest banking district. The locals, with some pride, call the skyscrapers “Sanhattan” – after the world-famous Manhattan. At a distance of 1,800 kilometres further north, K+S CHILE extracts raw materials in the Tarapacá region – a totally different world.

**SALT AS FAR AS THE EYE CAN SEE**

Tarapacá – that is salt as far as the eye can see. Five hundred square kilometres between the Andes and the Pacific. “The world’s biggest open-cast salt mine”, Rosas enthuses. These gigantic deposits were created as a result of the evaporisation of saline waters. In this desert region, where it almost never rains, K+S extracts up to eight million tonnes of salt every year. “The salt has a degree of purity of 99 per cent. You could sprinkle it on your breakfast egg straight from the ground”, says Rosas.

The salt is transported from the mine to the Company-owned port of Puerto Patillos just under 30 kilometres away. From there, it goes by ship either through the Panama Canal to the east coast of the United States or to Brazil and to four processing and packing sites that stretch along the Chilean coast as far as Puerto Montt deep into the south – just to mention a few examples.

Rosas has been working for K+S CHILE for ten years. The industrial engineer had spent his professional life so far placing consumer goods on the market. In the case of the tradition-steeped company established in 1905, he was attracted by the challenge of positioning a product...
Selling raw materials

Trucks transport the salt extracted in open-cast mining from the Chilean mine to the K+S port of Puerto Patillos just under 30 kilometres away. Freighters are loaded here with up to 100,000 tonnes of salt.

Leading brands of food grade salt

“And we succeeded particularly well”, considers Rosas. And the facts prove him right: The Sal Lobos and Biosoal food grade salt brands are leaders on the Chilean market. The Sal Lobos premium brand’s offer includes gourmet salts with unusual spice additions; Biosoal is the market leader with regard to low-sodium products. In addition, K+S Chile supplies industrial salt, for instance for water softening and feed, as well as salt for chemical use, and exports de-icing salt to North America.

Rosas is sure: “We are on the right track to further expand our sales markets in South America”.

K+S is the world’s largest salt producer

With an annual production capacity of about 30 million tonnes of salt, K+S is the world’s largest supplier of salt products. K+S produces on three continents like no other competitor and is therefore able to meet the increasing demand for the countless areas of application in every quality.
DISTRIBUTING RAW MATERIALS

“Even a bulk commodity business such as ours can successfully be handled by containers”.
EVERY YEAR, K+S SENDS ABOUT 60,000 CONTAINERS ON THEIR WAY, FOR THE MOST PART FILLED WITH POTASH PRODUCTS.

Only the seagulls in the port of Hamburg soar higher. Gigantic steel boxes move there as if drawn by an unseen hand. When the containers weighing tonnes are lowered onto the deck, the whole ship vibrates. Susanne Neiro observes how one container after another finds its place on the freighter. It will depart today, reaching the port in Shanghai about 40 days later. Also on board: Potash and magnesium fertilizers from K+S.

"Simply fascinating", says Susanne Neiro as she watches the criss-cross traffic of the megaboxes. At the back of what looks like a child’s game lies a complex control system. Neiro heads the Containerservices department of K+S Transport. The 31-year-old’s main tasks are to purchase shipping space and to organise the ship freighting. Every year, K+S sends about 60,000 containers on their way, for the most part filled with potash products, but to a small extent also filled with salt. Most of the containers go to Asia.

PIONEER IN THE USE OF CONTAINERS

Nowadays, 90 per cent of the general cargo in international trade is transported by container ships up to 400 metres long. “I consider it remarkable that a bulk commodity business such as ours can so successfully be handled by containers”, says Neiro. “We started using containers when prices for shipping bulk goods exploded in 2003”. About 20 per cent of the potash products reach their destination at the customer by container.

On the way from Asia to Europe, the containers which K+S sends to the Far East contained television sets, toys or clothing. “Without our products, the containers would probably have to set out empty on their return journey”, says Neiro. This also explains why containers have proved to be cost-effective. A further advantage: Customers can order smaller quantities straight to their front door. This frequently applies to fertilizer specialties in particular.
In containers bound for the Far East, K+S has been using this route for several years to supply the Asian markets. Previously, the containers came to Europe with toys, clothing or electronic goods. On arrival at their destination, the goods go straight to our customers’ door in a “well portioned” manner.

**AROUND THE WORLD BY RAIL AND SHIP**

In 2002, Susanne Neiro embarked on a dual course of study at K+S and passed through various logistics departments. Her experience: “The longer the journey that the goods have to travel, and the more services have to be agreed, the more complex the processes become. The point is to select the carrier best suited and most cost-effective for a particular stage of a journey”. It’s called combined transport in logistics jargon.

Neiro’s department also supervises the run-up journey from the plants to the port. A smaller part of the fertilizers is already loaded into containers at the production site and transported to Hamburg by inland waterway and rail. The major part arrives in bulk at the Company’s own “Kalikai” (“potash quay”) and is loaded there. Neiro’s job does not end when the goods reach Shanghai: If need be, onward transport must also be organised into the interior of the country with smaller ships, so-called “feeders”.

**GLOBAL LOGISTICS NETWORK**

In 2013, the K+S GROUP transported a total of more than 54 million tonnes of goods. The global logistics network includes not only the Company’s own Kalikai in the port of Hamburg, but also the Chilean port of Puerto Patillos, through which K+S CHILE ships its salt products.
APPLYING RAW MATERIALS

“FOR ROBUST CROP GROWTH, EVERY NUTRIENT MUST BE PRESENT IN THE NECESSARY AMOUNT AT THE RIGHT TIME”.
THE FINDINGS GAINED FROM RESEARCH AND FIELD TESTS HELP TO CONTINUOUSLY IMPROVE PRODUCTS AND TO INCREASE KNOWLEDGE.

Olivier Goujard has a love for agriculture in his blood. Already as a small boy on his family’s own farm in the Champagne of France, he learnt that plants need not only water and sunlight for healthy growth, but also nutrients.

Later, Olivier Goujard turned his passion into a profession. He works as an application consultant for K+S. The agronomist graduate advises farmers in France and on the Iberian Peninsula. He is sometimes out and about in the enormous golden yellow grain fields in the Paris basin or might be meeting vegetable farmers in sun-soaked Andalusia.

The 42-year-old appreciates the many-sided aspects of his work. “It’s great to experience how landscapes, colours and fragrances change from one cultivation region to another”.

**FERTILIZING ADAPTED TO CROP AND LOCATION**

Goujard informs his customers about the economically optimal use of fertilizers and new scientific knowledge. Often enough, it is small adjustments which improve the quality and yield of the harvests.

The type and amount of nutrients needed vary, depending on the crop, cultivation system and location. “Citrus fruits, wine and also vegetables react, for example, sensitively to saline fertilizers, which can have a negative effect on the crop yield. Farmers therefore play it safe with our fertilizer speciality potassium sulphate, which contains little chloride”, says Goujard knowingly.

**LIQUID FERTILIZERS FOR DRY SOIL**

For robust growth in a short time, crops need a great amount of nutrition. “Every nutrient must be present in the necessary amount at the right time, to aid crop growth optimally”, says Goujard. But if the soil has dried out, the crops can hardly absorb the nutrients in it. The
consequence: declining yields despite needs-based fertilized soil.

For intensive agriculture in the dry regions of southern Europe, Goujard therefore recommends the use of liquid fertilizers. Because if nutrients and water are combined – the professional speaks of fertigation – the crops can absorb the minerals better and more uniformly. In previous years, K+S has expanded its offer of liquid fertilizers. Goujard is certain: "In view of climate change and longer periods of drought, the importance of liquid fertilization will continue to increase. From 1980 to 2010 alone, the areas so treated increased by a factor of twenty to about 10 million hectares globally – a trend that is continuing to rise!"

**Research in the Field**

The optimal use of fertilizers depends on many factors. The findings gained from research and field tests help to continuously improve products and to increase knowledge about needs-based caring for crops under different climate and soil conditions. On this basis, K+S prepares individual fertilizing recommendations for customers from all over the world. For more growth and yields.
“AT THE LATEST WHEN LOOKING OVER THE PLANT, I KNEW THAT THIS WAS NOT A JOB LIKE ANY OTHER.”
LENA MICHEL, AGE 27
ENVIRONMENTAL MANAGER
Even before Lena Michel had signed her employment contract at K+S, her future boss sent her on her first "business trip". She was to take a close look at potash production, in order to get an impression directly on site of what she would be dealing with.

She drove into the Hesse-Thuringian potash district and in the Hattorf factory viewed what was at first sight an impenetrable steel tangle of pipes, boilers and drums. She was then brought by a piste caterpillar onto the far-off visible, glistening white tailing pile. An awe-inspiring experience. "At the latest when looking over the plant, I knew that this was not a job like any other."

Just under two years later, Lena Michel is a welcome face at the plants. The environmental manager works in the sustainability team of K+S Kali GmbH. Her self-diagnosis: "I am incurably inquisitive". That is a very useful quality in her job, because she takes care of environmental data management and is a specialist in standards and regulations in the area of sustainability. Michel is well connected at national and European level. It is important for K+S to attend to developments in the environmental field at an early stage, in order to be able to adjust to them quickly later. "We know that we are only economically successful long-term when we have more in mind than just ourselves", says Michel.

K+S extracts raw materials from the Earth and processes them above ground. This is associated with encroachments on the environment. "We apply modern extraction and processing methods, use energy, water, factory supplies and auxiliary materials as sparingly as possible and avoid waste wherever possible."

In the environmental field, K+S is already today collecting a large amount of data. And more will be added in
the future. Lena Michel tracks the path of the crude salt up to the finished product. How much water is needed, how much energy used and what emissions arise? She is still at the very beginning of the so-called “life cycle assessment” and collects enormous amounts of information. “The results will help us to control our production processes even better and to inform our customers even more transparently”.

**PACKAGE OF MEASURES ON WATER PROTECTION**

K+S is working continuously to reduce the use of water in the production plants and to lower the saline wastewater volumes even further. The best example of this is the “package of measures on water protection” in the Werra plant. In 2011, its implementation commenced. All production sites of the Verbund plant – Hattorf and Wintershall in Hesse as well as Unterbreizbach in Thuringia – are included with construction measures, further process improvements and plant expansions. By the end of 2015, we will thus halve the volume of saline wastewater compared to 2006.
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This brochure is also available in German. In the event of any doubt, the German version of the text will prevail.

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