

Happy birthday, ERCOSPLAN

The ERCOSPLAN Group of companies celebrated its 50th birthday in some style in its home city of Erfurt, Germany. As well as being a renowned university city, Erfurt is close to Germany's potash heartland – the field in which ERCOSPLAN and its predecessors gained a core expertise as a mining consulting and engineering group. As described here, the celebrations attracted participants from far afield.

The university city of Erfurt is the capital of Thuringia – the Green Heart of Germany, and a region famed for thinkers and poets down the centuries. It is also the headquarters of the ERCOSPLAN Group of companies, which celebrated its 50th anniversary in some style of 9 September 2005 in an Honour Symposium that was attended by 120 guests from nine countries.

Thuringia and the adjacent states of Hesse and Saxony-Anhalt have access to a wide range of mineral ores and salts, and the region became a centre of mining in Germany in medieval times. At one time, the number of mines exceeded 3,000. Only a handful remain today, but they are of world-ranking significance, as they comprise the network of potash mines and processing plants operated by K+S Kali GmbH (K+S).

Potash is at the heart of the ERCOSPLAN business portfolio. As the successor to the former Kali-Ingenieurbüro Erfurt, ERCOSPLAN is a specialist consulting and engineering group whose core activities include project management in all aspects of the extraction and processing of industrial potash and mineral salts. ERCOSPLAN enjoys unique expertise in the following fields:

- ◆ **Exploration and evaluation** of mineral salts and natural brine deposits.
- ◆ **Conventional and solution mining** of

mineral salt deposits and natural brines.

- ◆ **Processing** of mineral salts and natural brines.
- ◆ **Environmental sustainability** in modern mines and processing plants.

The ERCOSPLAN Group consists of six associated companies. As inheritors of the tradition set by Kali-Ingenieurbüro, they offer consulting and planning services for the exploration, mining and processing of potash and other mineral salts, including environmental conservation and rehabilitation, as well as ensuring the effective utilisation of resources. Now a limited liability company whose shares are owned by the management, employees and other



The mining and processing of potash is at the heart of the ERCOSPLAN business portfolio.

long-term partners, ERCOSPLAN is entirely independent from other mineral salt producers and equipment suppliers. In this, its Golden Jubilee year, ERCOSPLAN today employs around 125 specialist staff, 75 of them in Erfurt, with others in branch offices in Leipzig and Sondershausen. As a reflection of the Group's confidence in its future, it also employs around nine apprentices.

All associated with the Group are proud of ERCOSPLAN's achievements and look forward to a very bright future, especially as the Group continues to accumulate its expertise when providing the following services:

- ◆ Pre-feasibility studies, feasibility studies, bankable feasibility studies and due diligence studies for complete potash and mineral salt projects.
- ◆ Exploration concept studies, estimations of geological resources and mineable reserves.
- ◆ Basic engineering and detail engineering for complete potash and mineral salt projects, from mineral extraction to final product shipping.
- ◆ Process design and technology.
- ◆ Investment studies, capital cost assessment studies and operating cost analyses.
- ◆ Environmental impact assessment studies.
- ◆ Market studies.
- ◆ Project management and control.

- ◆ Supervision of installation, commissioning and start-up.
- ◆ Mine abandonment and closure, plant demolition engineering.

Exploiting the White Gold

Central Germany is the cradle of the modern international potash industry, exploiting the famous "White Gold". Almost 150 years ago, the first potash production began in Stassfurt, in the North Harz region. During drilling exploration for rock salt, carnallite brines were discovered in 1851, below which thick rock salt layers were found. Ten years later, the carnallite began to be processed, using a cold leaching technology that was developed locally. By the end of the 19th century, more than 50 mines and plants had been set up in the Stassfurt area alone. Hot leaching technology was first harnessed in 1898 at Sondershausen, South Harz. These were the roots of the body of knowledge that forms the core of ERCOSPLAN Group today.

When Germany was divided between the Federal Republic and German Democratic Republic (GDR), the latter became the third largest producer of potash worldwide and under state control, Kali-Ingenieurbüro became responsible for planning projects. A significant landmark was the opening of the Zielitz plant in 1972, north of Magdeburg, to exploit the sylvinite deposit. Zielitz became part of K+S Kali GmbH in the early 1990s, and a comprehensive modernisation programme established Zielitz as the most modern potash facility in Europe, producing more than 40,000t/d ore. Production is expected to break all records in 2005, exceeding 1.5 million tonnes K₂O.

ERCOSPLAN has done remarkably well to cope with the political, economic and social upheavals that followed German reunification in 1990. Many formerly state-owned enterprises have fallen by the wayside during the subsequent period, unable to cope with the new market environment. By contrast, ERCOSPLAN had the vision to draw on its expertise and traditions and regenerate itself as a leading supplier of engineering and advisory services to the German

From Kali-Ingenieurbüro to ERCOSPLAN: the major milestones

1948-1955: The beginnings

This was a period of reconstruction after the devastation of World War II. Damaged and abandoned potash mines and processing plants were repaired and recommissioned, under the administration of the Soviet Union.

1955-1969: The Kali-Ingenieurbüro era is launched

A specialist group of engineers was brought together and a dedicated office built in Erfurt, employing up to 230 staff. Potash mining and processing was vested with the state-owned Vereinigung Volkseigener Betriebe Kali, within which Kali-Ingenieurbüro (KIB) operated independently. Extensive investments were made during this period in the Southern Harz facilities of Bernburg and Zielitz.

1970-1990: The Kombinat Kali era

The government's reorganisation of the Thuringian and South Harz potash industry resulted in the formation of the Kombinat Kali, which exercised more centralised control. KIB lost its autonomy as a consequence. One outstanding achievement during this period was the planning, development and commissioning of the potash plant at Zielitz, together with major investments at the Merkers, Sondershausen, Teutschenthal and Bleicherode plants.

1990-1992: German reunification and KIB Plan GmbH

German reunification in October 1990 was accompanied by massive political, economic and social changes in the former GDR states, which impacted on the potash industry. The first two years were a period of transition as Kali-Ingenieurbüro was reorganised as KIB Plan GmbH and its parent company adapted to the new market-based economy and prepared for privatisation.

1992-1995: Enter ERCOSPLAN GmbH

ERCOSPLAN GmbH was formed in July 1992 when 11 partners from KIB joined forces to exercise a management buy-out (MBO). The official name of the new company indicated its intended line of business: ERCOSPLAN Erfurter Consulting und Planungsbüro GmbH. The new team quickly gained an impressive portfolio of clients in Thuringia, Saxony-Anhalt and Hesse. Further expansion followed with the acquisitions of Institut für Gebirgsmechanik GmbH (IfG), Leipzig in 1992, and Glückauf Vermessung GmbH, Sondershausen in the following year. However, an economic downturn in 1995 put ERCOSPLAN GmbH under considerable financial pressure, and the company undertook a major review of its activities and structure, which led to a fundamental reorganisation.

1996-2005: The ERCOSPLAN Group of Companies

To secure the long-term future for the group, individual business areas were gradually transformed into four new single private limited liability companies under one holding, supplemented by the Institut für Gebirgsmechanik (IfG) and Glückauf Vermessung subsidiaries, which have retained their identity. The ERCOSPLAN Umwelt Consulting GmbH subsidiary was the first to emerge, in 1996, followed by ERCOSPLAN Ingenieurgesellschaft Geotechnik und Bergbau mbH and ERCOSPLAN Ingenieurbüro Anlagentechnik GmbH in 1998, and ERCOSPLAN Hoch- und Tiefplanung GmbH in 2001.

ERCOSPLAN Ingenieurgesellschaft Geotechnik und Bergbau GmbH and ERCOSPLAN Ingenieurbüro Anlagentechnik GmbH continue the KIB traditions in the field of mineral salt mining. The client portfolio is now a global one. Despite being the youngest of the four subsidiaries, ERCOSPLAN Hoch- und Tiefbauplanung GmbH has enjoyed considerable success to earn the highest share of the group's turnover, which totalled around €10 million in 2004.



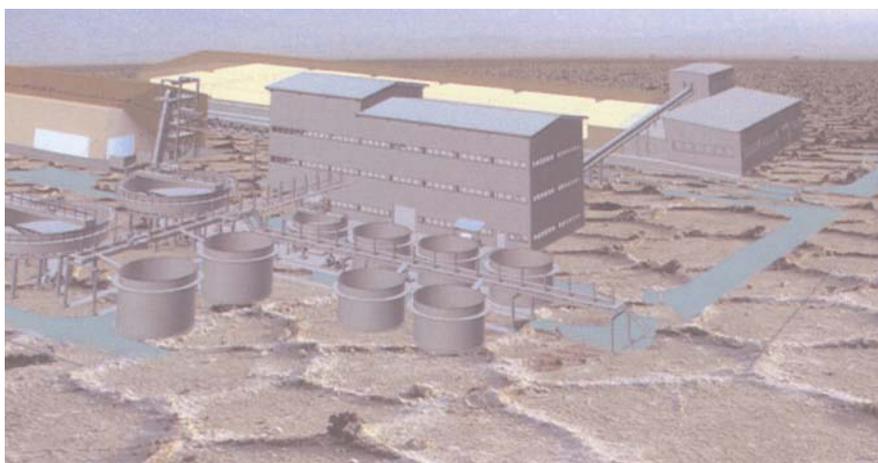
Headquarters of the ERCOSPLAN Group of companies in Erfurt.

potash industry and increasingly to a global list of clients.

ERCOSPLAN recognises that the exploration and evaluation of mineral salt resources are multi-stage processes. The valuable salt may be contained in an underground deposit or as natural brine in the pore volume of rocks, or in lakes on the earth's surface. With each step, knowledge of the deposit increases, but the exploration costs increase even further. A decision therefore has to be made at each stage whether or not there is a reasonable chance that the raw material can be exploited and processed economically. This requires firstly an interpretation of the available exploration data by experienced geoscientists. It furthermore needs an understanding of the extraction and processing technology from the outset.

At this stage in the project, ERCOSPLAN geologists, mining and drilling engineers will liaise with the Group's process designers and processing engineers to carry out a realistic assessment of the geological resources and the mineable reserves. The service will typically begin with a critical examination of all available data about the deposit, which are then used to develop a geologic 3D model of the deposit as a basis for exploring concepts. Geological fieldwork, core logging, sampling and drilling supervision are included in the scope of the study.

The next stage in the project is to evaluate the rock mechanics. Mineral extraction from an underground deposit will create mine openings whose safety and stability must be guaranteed during the whole mine life and furthermore after the closure



A 3-D model of the proposed IMPASCO potash plant near Khor, Iran.

date. Rock mechanical studies are thus an important aspect of mine design and extraction schedules, as well as for environmentally safe mine closure procedures.

The Institute für Gebirgsmechanik GmbH subsidiary specialises in mechanical studies, offering:

- ◆ Rock mechanical laboratory test work
- ◆ Rock mechanical in situ test work
- ◆ Rock mechanical modelling.

The Institut für Gebirgsmechanik GmbH employs state-of-the-art technology to provide computational modelling of rock mechanical behaviour. The programs developed by the Institut für Gebirgsmechanik include:

- ◆ An elasto-plastic material model to describe the softening and brittle fracture of carnallite.
- ◆ A visco-elastoplastic material model with softening, dilatancy and primary, secondary and tertiary creep to describe the time-dependent softening behaviour of salt rocks preceding creep fracture.
- ◆ A combined material model for describing the creep of salt rocks, including inverse transient creep.

The MKEN and SENK programs for computing time-dependent stress-strain processes in underground mining systems and for predicting the surface effects resulting from mine subsidence.

By harnessing these tools, all issues arising from underground mineral extractions and/or disposal and storage in underground openings can be evaluated.

All aspects of mining

Since every mineral deposit is unique, it requires a particular mine layout and adaptation of proven exploitation methods as well as the careful selection of subsurface infrastructure systems before starting a mining project. Inclination, spatial distribution of areas with different thicknesses and grades influence the efficiency of conventional mining, and thus an optimised mine layout is a key element in overall efficiency when extracting the ore.

The ERCOSPLAN Group provides consulting and planning services to support the client at all stages of the mining project:

- ◆ Beginning with the first concepts for the new operation.

- ◆ Followed by design and method studies for debottlenecking and/or extending running operations.
- ◆ Up to the mine closure and site reclamation.

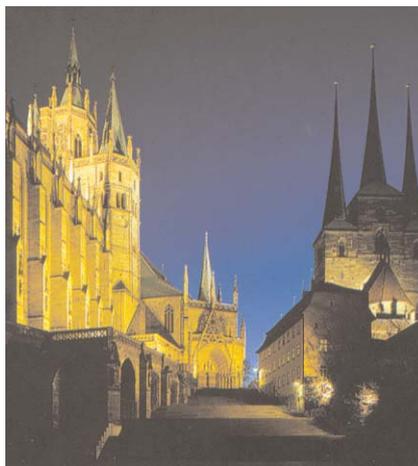
Starting with the mine layout and mining method engineering, both tailored to take account of the deposit's particular geology as well as the hydrogeological and rock mechanical limitations of underground extraction, ERCOSPLAN's consultants will design a mine that is optimised for maximum production capacity and minimal operating costs.

ERCOSPLAN pays particular attention to mine safety concepts, based on a rigorous assessment of potential risks and the preparation of preventative strategies.

Solution mining is an alternative to conventional mining. The solubility of most mineral salt in water is excellent. This property provides an opportunity to exploit these mineral resources by dissolving the mineralised brine underground and pumping it to the surface for further processing. The application of solution mining technology requires specific geological conditions and a tailor-made cavern system, as well as favourable economic conditions compared with conventional mining. ERCOSPLAN uses planning software such as *Mine Sight* and *AutoCad*, and has devised its own programs for drilling and pumping equipment selection.

Mines and caverns require surveying for several reasons: scheduled underground extraction, drift and infrastructural development on conventional mines are managed on the basis of accurate mining plans resulting from the mine survey. Controlling the underground dissolution progress in caverns and old flooded mines and shafts requires particular surveying techniques, which ERCOSPLAN can provide. Its surveying service subsidiary, Glückauf-Vermessung GmbH, undertakes:

- ◆ A complete mine survey service for underground mines
- ◆ Extraction schedule monitoring
- ◆ Underground deformation/convergence monitoring
- ◆ Shaft bob plumbing and shaft diameter monitoring
- ◆ Surface levelling
- ◆ Surveying for flooded potash and salt mines.



The twin churches of Erfurt, the Mariendom and Severikirche, are symbolised in the ERCOSPLAN Group logo.

Designing the processes

Process design is the start point for every processing plant project, whether it is for a new project, a capacity increase or a modernisation project. Over the past 50 years, the ERCOSPLAN Group and its predecessors have been responsible for more than 500 projects for the processing of more than 40 products. The services comprise, among others:

- ◆ Process design
- ◆ Process optimisation
- ◆ Mass and heat balances
- ◆ Dimensioning of equipment
- ◆ Laboratory and pilot plant tests
- ◆ Supervision of start-up.

Using modern software tools as well as drawing on its accumulated expertise, ERCOSPLAN designs programs for the processing of ore, bittern and brine from solution mining and natural lakes using the following process steps:

- ◆ Mechanical treatment (dry and wet milling, screen settling, steam settling, flotation, mechanical debrining, compaction).
- ◆ Thermal treatment (hot and cold leaching, evaporation and crystallisation, drying).
- ◆ Chemical treatment (decomposition reactions, precipitation reactions, bromine and iodine extraction, gas/liquid reactions for carbonisation, exchange of salts).

Based on the results of the process design, the ERCOSPLAN Group uses

modern software tools to engineer the plant, optimising investment costs, running costs and ease of maintenance.

Handling the product

To design conveying, storage and bagging facilities requires considerable competence in logistics, the relevant process technology, as a comprehensive understanding of the products' characteristics. This ensures that the optimum machinery and equipment is selected. ERCOSPLAN engineers have designed more than 100 plants, handling over 20 different products, using:

- ◆ Belt conveyors, drag chain conveyors, bucket elevators, screw conveyors, pipelines
- ◆ Tanks, hoppers, silos
- ◆ Storage units for raw and intermediate products (such as wet salt) and final products
- ◆ Dedusting equipment
- ◆ Bag and big bag fillers
- ◆ Palletisers
- ◆ Loading units for transport facilities by rail, road or ship.

Sustainable mineral salt extraction

Considerable attention is now focused on the environmental aspects of mining and processing operations. The ERCOSPLAN Group can support both the project owner in planning the necessary protection measures for the mine and processing sites and the governmental authorities in permission procedures. Over the past half-century, the Group has been involved in more than 100 environmental projects, in five continents. The Group's expertise in this field enables ERCOSPLAN to provide:

- ◆ Initial environmental assessment studies
- ◆ Site monitoring before the project starts, the design of monitoring procedures during site preparation, start-up and production
- ◆ The design of closing procedures and post-operational monitoring measures
- ◆ Independent advice in discussions and disputes with non-governmental organisations.

The potash and mineral salts industry

has specific environmental issues, and very specific protection measures are required to ensure safe operations over the long term, particularly with respect to water-soluble mineral deposits and large brine streams handling salt in processing plants. During the production phase, optimisation of waste management and water balance will help to reduce operating costs. Last but not least, after mine operations cease, ERCOSPLAN can design and supervise an environmentally-safe mine and processing site reclamation programme, as well as the demolition of the plant.

Since the Global Mining Initiative was formulated in 2002, all mine operators have to consider not only the extraction and underground infrastructure, but also the closure procedures – *The Time*

After. ERCOSPLAN provides a specific service for this period, focusing on:

- ◆ A comprehensive risk assessment for the post-operational phase, including the recommendation for required closure measures.
- ◆ The design and supervision of post-operational backfill of abandoned mine fields, whether backfilling of processing residues or re-using mine openings for industrial waste disposal.
- ◆ The design and supervision for drift sealing and/or shaft filling and sealing.
- ◆ The design and supervision of plant demolition and waste disposal.
- ◆ The design and of tailings pile recultivation.
- ◆ The design and supervision of site reclamation.

- ◆ The design and realisation of the post-operational monitoring programme.

Innovation requires Research & Development, and ERCOSPLAN enjoys close partnerships with academic researchers and specialised laboratories to exchange ideas over key issues and transform academic concepts into applied industrial practice. This has led to many patents and scientific publications. ERCOSPLAN also maintains the closest of relationships with leading manufacturers of plant and equipment, ensuring that the most modern and efficient mining and processing operations can be undertaken.

These principles have remained constant throughout ERCOSPLAN's fifty-year history, and have ensured a truly blue-chip client base today.

Celebration and insights

ERCOSPLAN's birthday party in Erfurt drew over 120 people from nine countries, representing senior executives among the Group's customers, as well as senior representatives from the state governments of Thuringia, Hesse, Saxony-Anhalt, Lower Saxony and Saxony. All received the warmest of welcomes from Dr. Henry Rauche, Managing Director and CEO of ERCOSPLAN Ingenieurgesellschaft Geotechnik und Bergbau mbH and ERCOSPLAN Ingenieurbüro Anlagentechnik GmbH his colleagues. The celebrations also provided a very valuable snapshot of several major potash projects around the world.

As Patron of the ERCOSPLAN Honour Symposium, Dr. Volker Sklenar, Minister for Agriculture, Natural Conservation and Environment in the Thuringian State Government, expressed his appreciation of the achievements of ERCOSPLAN at home and further afield. "Mining reflects the evolution of society, but it requires special measures to protect the wellbeing of the population and the welfare of miners," he said. ERCOSPLAN had accepted the social, economic, envi-

**“Liasing with
companies such
as ERCOSPLAN
ensures the
project's success”**

ronmental and technological challenges that followed the reunification of Germany, which gave the company further expertise to carry out similar work overseas. ERCOSPLAN has a very bright future, Dr. Sklenar said, and all concerned can be proud of its achievements.

Kurt Bartke, offered congratulations in his capacity as Head of the Hesse Mining Administration. He appreciated the work ERCOSPLAN undertook in the Safety Assessment of Mining Activities by the Werra River – a project which brought together the States of Hesse and

Thuringia. What makes ERCOSPLAN unique, he asked? Bartke identified qualities of reliable expertise, comprehensive knowledge, and the ability to co-operate and communicate. "And they're fun to work with too," he added.

The successful transformation of Kali-Ingenieurbüro to the ERCOSPLAN Group can be attributed above all to the vision of Dr. Heinz Bartl. He outlined the Projects, Persons, and Milestones in the Group's illustrious history. Above all, ERCOSPLAN had confounded the pessimists, who did not foresee a future for the company within the unified German potash mining industry. Dr. Bartl and his fellow managers felt that such hard-gained engineering and technical expertise should not be squandered and so led the MBO to avoid liquidation, discovering new business opportunities at home and abroad after 1995. One important factor in ensuring the lasting success of overseas projects is a readiness to engage in job sharing with the local partners. "Never underestimate local knowledge," Dr. Bartl said.

Gerd Grimmig, a board member of K+S AG, paid tribute to ERCOSPLAN's

role in ensuring the competitiveness of the German potash industry in international markets. K+S is the second largest producer of fertilizers in Europe and the *esco* division is Europe's largest salt producer, generating a turnover of €2.6 billion in 2004 and profits of €141 million, as well as employing a workforce of 11,000. The number of potash mines in Germany has shrunk from 24 in 1972 to 17 in 1988, and to just six today, but efficiency is much enhanced, boosted by investments of €58 million at the Zielnitz facility, €58 million at the Bernburg salt plant, and €26 million at Sigmundshall, and the sylvinitic transport project linking operations between Hesse and Thuringia. Production at Zielitz rose progressively from 830,000 tonnes K₂O in 1988, 1.385 million tonnes K₂O in 1998, and a forecast record of 1.492 million tonnes K₂O this year. K+S extracts 39.4 million t/a of potash raw salts and 8 million t/a of magnesium products, giving the group a 13% share of the global potash production of 53.0 million tonnes. K+S ranks fourth in the world, with an output in 2004 of 6.7 million tonnes K₂O.

Stuart Middleton of AMEC, Saskatoon, paid tribute to the engineering partnership with ERCOSPLAN and reviewed *Recent Developments in the Canadian Potash Industry*. He observed that the international potash industry has gone through two decades of contraction and a consequent consolidation of producers. During this period, investment in the Canadian potash industry has been limited mainly to secondary processing projects, which allowed a shift to the increased production of granular product to accommodate market changes. Technical innovation suf-

fered because of low investment. This situation was suddenly transformed when a relaxation of the tax regime in Saskatchewan province prompted the three leading Canadian potash producers to announce plans for a 2.6 million t/a expansion in production.

Buoyant sales and higher prices have spurred numerous debottlenecking and expansion projects. It is very expensive to expand the diameter of a mineshaft, so most of the work will focus on expanding skip capacity, and upgrading hoists and cycle time control systems. Middleton described the trends in the expansion, renewal and modernisation of potash processing plants, outlining:

- ◆ New approaches in the modelling of the mine/mill interface and mill throughput.
- ◆ Expansion of the throughput capacity of the mills to the maximum mining and hoisting capacity of the existing mines.
- ◆ Upgrading the quality specification of the product, in particular with increased compaction capacity.
- ◆ Reducing the operating costs in the plants by replacing old multiple equipment circuits with modern high capacity process units.
- ◆ Improving environmental conditions in the plants and meeting stricter environmental requirements efficiently.

A two-horse race in Thailand

Prof. Dr. Chuta Kulabusaya, President of TEPARAK International and a Director of ASEAN Potash Mining Co. (APMC), described progress with this long-mooted project, in which TEPARAK is the largest

Thai shareholder. APMC is liaising with ERCOSPLAN and several other German partners to exploit the deposits in north east Thailand that were originally discovered in the 1950s. Two such projects are currently being developed: in addition to the APMC project at Bamnet Narong, Asia Pacific Potash Corp. (APPC) plans to bring on stream a mine at Udon, further north.

Prof. Kulabusaya described the history of the project and developments to date. The Thai potash deposits form part of the 700 m thick evaporate sequence in the Mahra-Sarakham formation of the Khorat basin. In the southern area of the basin, close to Bamnet Narong, in depths of between 180-250 m, a 50 m layer of carnallite was found, with other layers of sylvinitic of a few metres in thickness. Seismic drillings were undertaken in the concession area of 110km², supported by underground trial mining. These tests revealed measured resources of 405 million tonnes with an average KCl content of 15.2%, plus indicated resources of 850 million tonnes with an average KCl content of 17.1%. These resources provide the basis for the ASEAN Potash Mining Co. project.

Further north, in the Sakhon Nakhon basin area of Udon Thani province (close to the border with Laos), sylvinitic deposits have been investigated since 1993. The thickness of the drilled sylvinitic in depths between 300 and 350 m varies from between a few decimetres to 15 m. Up to 118 million tonnes of raw salts were determined as proven and probable reserves, with an average K₂O content of 23.4%. These provide the basis of the APPC Udon South project.

APMC will mine the 250 m carnallite deposit using bulk mining technology. Once mining has been completed, back-filling with slurry will be employed to fill the stopes, in line with procedures applied in Germany. Comprehensive testing at the exploratory mine in Bamnet Narong show that the mining method is mechanically feasible and above all very efficient. The project promises very low mining costs, extracting between 6.2-7.5 million t/a of potash ore and 1.1 million t/a of final product, plus 2.4 million t/a of salt and magnesium by-products. The carnallite

Table 1: Canadian potash capacity increases 2005
Million t/a of KCl product

Company	Current capacity	New and restored capacity in design and construction	Planned additional capacity increase	Total projected
PotashCorp	9.90	1.90	0.40	12.20
Mosaic	8.00	0.36	1.40	9.76
Agrium	1.70	0.31	0.24	2.25
Total	19.60	2.57	2.04	24.21
Cost (\$ million)		550	436	

ore will be processed, using hot leaching technology.

By contrast, the APPC project will mine the sylvinite raw salts in a long-wall system. APPC will reduce surface subsidence by using processing residues as backfilling material, in-placed by slurry backfill technology. The sylvinite ore will be upgraded to potassium chloride in a flotation process, with a planned production of 1 million t/a of final product.

Both projects seek to harness the booming Asian potash market, especially China, where a demand of 12 million t/a KCl is forecast by 2010. Currently, overseas suppliers meet 96% of Asia's demand for potash: the two Thai potash projects seek to increase the region's self-sufficiency. The APPC site is 650km from the nearest seaport from the Udon site, and would be linked by rail, but APMC is much closer. Transporting the finished project will require a few kilometres of transport overland, after which the product will be transhipped on to river barges and moved a distance of 350 km to the modern seaport of Map Ta Phut in the Gulf of Thailand.

Prof. Kulabusaya said that both projects are in a favourable planning stage and are focusing on the required approval procedures, which are a precondition of final project implementation. APMC has made the first steps towards full-scale production. The company has already excavated a 1% decline drift and trial mine, and has applied for a final mining licence from the Thai government. The project financing has been guaranteed by the ASEAN government partners and a private investor, while negotiations are under way with qualified contractors. Prof. Kulabusaya expected that implementation of the project would begin in 2006, at a budgeted cost of \$ 500 million. Current estimates schedule the first potash production to begin before 2010, paving the way for Thailand to rank among the top five potash producers in the world.

ERCOSPLAN has contributed to each of the Thai potash projects, proving consulting and engineering services. Prof. Kulabusaya paid tribute to ERCOSPLAN's contribution from what he described as "The Motherland of the Potash Industry," especially in devising efficient

**The ERCOSPLAN Group of companies.
Who does what?**

ERCOSPLAN Erfurter Consulting und Planungsbüro GmbH

- ◆ Commercial services for the Group
- ◆ Accounting and financial services for the Group
- ◆ Personnel management
- ◆ Administration.

Eng. Gerhald Rockmann is Group Managing Director.

ERCOSPLAN Hoch- und Tiefbauplanung GmbH

- ◆ Architectural services
- ◆ Industrial and urban development
- ◆ Infrastructure planning
- ◆ Reconstruction of industrial buildings.

The senior management team is headed by Eng. Rolf Hellbach, Dr-Eng. Dietmar Marohn and Eng. Gerhald Rockmann.

ERCOSPLAN Ingenieurbüro Anlagentechnik GmbH

- ◆ Mineral salt processing and treatment technology
- ◆ Technology and processing of backfill plants and waste reprocessing plants
- ◆ Brine management
- ◆ Control and regulation technology.

The division is headed by Dr. Henry Rauche and Eng. Jochen Freund.

ERCOSPLAN Ingenieurgesellschaft Geotechnik und Bergbau GmbH

- ◆ Mining geology and hydrology
- ◆ Mining technology
- ◆ Mine damage analysis
- ◆ Risk assessment.

Dr. Henry Rauche heads the division.

ERCOSPLAN Umwelt Consulting GmbH

- ◆ Exploration and reclamation of dangerous waste
- ◆ Restoring old land
- ◆ Environmental acceptability.

Eng. Günter Böse heads the division.

Glückauf VERMESSUNG GmbH

- ◆ Mine surveying
- ◆ Engineering geodesy
- ◆ Mine damage analysis.

Headed by Eng. Ulf Nuschke and Eng. Bernd Scholte

Institut für Gebirgsmechanik GmbH (IfG)

- ◆ Rock mechanics
- ◆ Modelling of rock mass
- ◆ In situ measurements and rock mechanical monitoring.

Headed by Dr. Wolfgang Minkley and Eng. Wolfgang Schreiner



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2



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3

- 1 A full house in Erfurt.
- 2 Stuart Middleton offered insights on the Canadian potash industry.
- 3 All aboard the party tram.
- 4 Warm greetings from Dr. Henry Rauche, Managing Director and CEO of ERCOSPLAN Anlagentechnik GmbH.
- 5 The celebrations culminated with a meal in one of Erfurt's finest restaurants.
- 6 Dr. Volker Sklenar: "Mining reflects the evolution of society."
- 7 Kurt Bartke: "And they're fun to work with too."



Table 2: Khor Brines, Iran – average ion content

Li ⁺	Cl ⁻	SO ₄ ²⁻	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺
56	238,244	124	75,808	15,028	5,496	34,952

mining and processing methods for the carnallite ore, as well as the rock mechanical studies to ensure both safe mining and the high standards of environmental protection required by the Thai government.

A contractor’s perspective

Jochen Greinacher, of Deilmann-Haniel GmbH, described *The Significance of Consulting Companies from the Mining Contractor’s Perspective*. He represents a company that specialises in the underground construction, assembly and repair of mines, and other work that cannot be undertaken by the mine operators. This work includes the sinking of shafts and the construction of complete shaft facilities, as well as the development and assembly of underground plants and facilities.

Liaising with consulting companies such as ERCOSPLAN is essential to ensure the success of the project, especially if the planning work is outside the core competence of the contracting company. The development of a new shaft will typically involve geotechnical pre-examinations, rock mechanical calculations, planning and static calculations of construction components such as buildings and ventilation systems. Deilmann-Haniel undertakes a full range of mining projects, ranging from design/build projects, turnkey projects, and contract mining (Build-Operate-Transfer, or BOT), but in all cases has good cause to liaise with experienced planning and consultancy companies such as ERCOSPLAN.

Carnallite solution mining

Norbert Grüşchow, of ngConsulting, described the pioneering technology employed by DEUSA International in his presentation on *Carnallite Solution Mining at the Bleicherode Site*. Extensive resources and innovative solution mining technology

provides favourable conditions for producing potash and magnesium products in North Thuringia. This carnallite deposit near Stassfurt has an extension of approximately 20km² and is situated in a depth of 350-400 m. It consists of potassium chloride and magnesium chloride in the form of carnallite (KCl.MgCl₂.6H₂O), plus halite (NaCl) and kieserite (MgSO₄.H₂O). A further extension is planned to raise production to 105,000 t/a, while a secondary project involves the production of magnesium chloride. Current output is around 45,000 t/a.

DEUSA is evaluating the increased exploitation of the brines for various purposes, including the production of special brine for flooding abandoned mines in the area. The NaCl produced at the site is currently crystallised and mainly fed back into the mine cavern with the solvent, but opportunities exist to promote some of the output as high quality salt paste as a niche product. The development of additions to the product range is contemplated, not only using the existing resources, but also from recycling the waste salts and waste solutions. DEUSA International foresees how escalating gas prices will help enhance efficiency at the Bleicherode site, and it has received approval to produce its own supplies of gas (thermolyse) and store gas in future in the brine field at Kehmstedt.

A new project in Iran

Mehran Azimi, Mining Engineer and Chief Execution Officer of IMPASCO (Iran Mines and Mining Industries Development and Renovation Organisation) outlined the project to exploit the brines in the Khor region to produce K60 potash. The Khor deposits cover an area of 2,000 km², some 600 km east of Teheran. IMPASCO has retained ERCOSPLAN with the goal of producing 50,000 t/a KCl, 300,000 t/a NaCl and 30,000 t/a Mg(OH)₂. An exploratory study was undertaken in 1998. Taking the porosity

of the salt crust into account, the volume of the brine reserve is an estimated 450 million m³. The brines contain Na, K, Mg, Ca and small amounts of SO₄ ions, but no I or Br has been detected. Table 2 shows the average ion content.

The production of 50,000 t/a KCl requires the provision of about 13 km² of solar ponds, one third of the area being carnallite ponds and the remaining two-thirds salt ponds. To extract the brines, channels have been developed, supplemented by two pumping stations using vertical and centrifugal pumps. Two pipelines of 70 cm in diameter have been constructed to transfer the brines to the solar ponds at a rate of 4,000 m³/hour. Precipitation of salt and carnallite in the solar ponds will be done in separate phases and controlled by increasing the density from the evaporation process. The final brine will be returned from the carnallite ponds back to the playa brine field, while the salt and carnallite that have settled in the ponds will be transferred to the processing plant after harvesting.

To prevent seepage, the base and the walls of the ponds are lined with ground clay. The region is arid, remote from major population centres and is characterised by extremely high temperatures. IMPASCO hopes that the operation will eventually employ around 400 people directly and another 1,000 people indirectly, transforming the economy of the Khor and Biabanak regions. At present, there is no grid to supply electricity, but power is generated by a diesel unit. The evaporation ponds have been completed, while the processing plants are currently under construction. IMPASCO hopes that the facility will come on stream in 2006.

Keynote projects

Christine Schilling and Jochen Freund, of ERCOSPLAN, described some of the Group’s most significant developments which have drawn on its long-established core expertise in carnallite, rock salt and KCl. An important milestone in the Group’s history was the construction in 1976 of the potash plant at Zielitz, which today forms a key part of the K+S AG operation. Another milestone was the 1,600 t/h underground salt processing

plant planned for Südwestdeutsche Salzwerke AG. The project addressed the challenge of providing modern technology that generates less dust and produces higher volumes in a cramped underground environment.

ERCOSPLAN is currently working with GEA Messo GmbH on a carnallite brine solution mining project in the Congo, processing the brine to produce KCl and magnesium based on evaporation and crystallisation. The Canadian engineering company Genivar has commissioned planning documents for the plant, in conjunction with the preparation of a bankable feasibility study on behalf of the Canadian investor promoting the project, MagIndustries.

Further recent highlights include contracts from the Russian potash producers JSC Uralkali and JSC Silvinit. The latter company commissioned a compaction plant designed by ERCOSPLAN in August 2005. ERCOSPLAN is currently working on the design of a 250,000 t/a

granular KCl facility for Silvinit and a 750,000 t/a compaction plant for Uralkali. Also being undertaken for Uralkali is the design of a 1,000 t/h silvinit hot leaching plant.

Dr. Peter Marggraf, formerly of the Thuringian Mining Authority described *Recent Aspects of Potash Mining in the Werra District*, focusing on mine site reclamation. Extensive potash mining in the region has led to three particular aspects of concern:

- ◆ The danger of rock bursts and subsidence.
- ◆ A risk of CO₂ emissions from heavy gas/salt eruptions.
- ◆ Hydrologic dangers from inflows from the upper zone foot wall.

ERCOSPLAN has carried a safety assessment on behalf of the Mining Authorities of Thuringia and Hesse, and an extensive backfilling programme has helped to ensure the integrity of old mine workings and mitigated the risks described above.

Dr. Peter Bayer of the Landesanstalt für Altlastenfreistellung Saxony-Anhalt concluded the presentations by discussing the *Redevelopment, Abandonment and Reclamation of Potash and Rock Salt Mines in Thuringia and Saxony-Anhalt*. Since the early 1990s, GVV mbH has taken over responsibility for redeveloping redundant mine sites, employing backfilling, flooding, dam construction and shaft reclamation and filling techniques, taking account of local geological conditions. The work has given ERCOSPLAN a valuable body of knowledge that can be applied to mines elsewhere in the world.

After the formal proceedings, ERCOSPLAN continued the celebrations with a lively social evening. This involved chartering a vintage tram to give guests a tour around the historic city, a chance to sample the renowned Thuringian bratwurst sausage and a beer or two, and a meal in one of the city's finest restaurants. It was a wonderful party and the perfect conclusion for a memorable day. PK