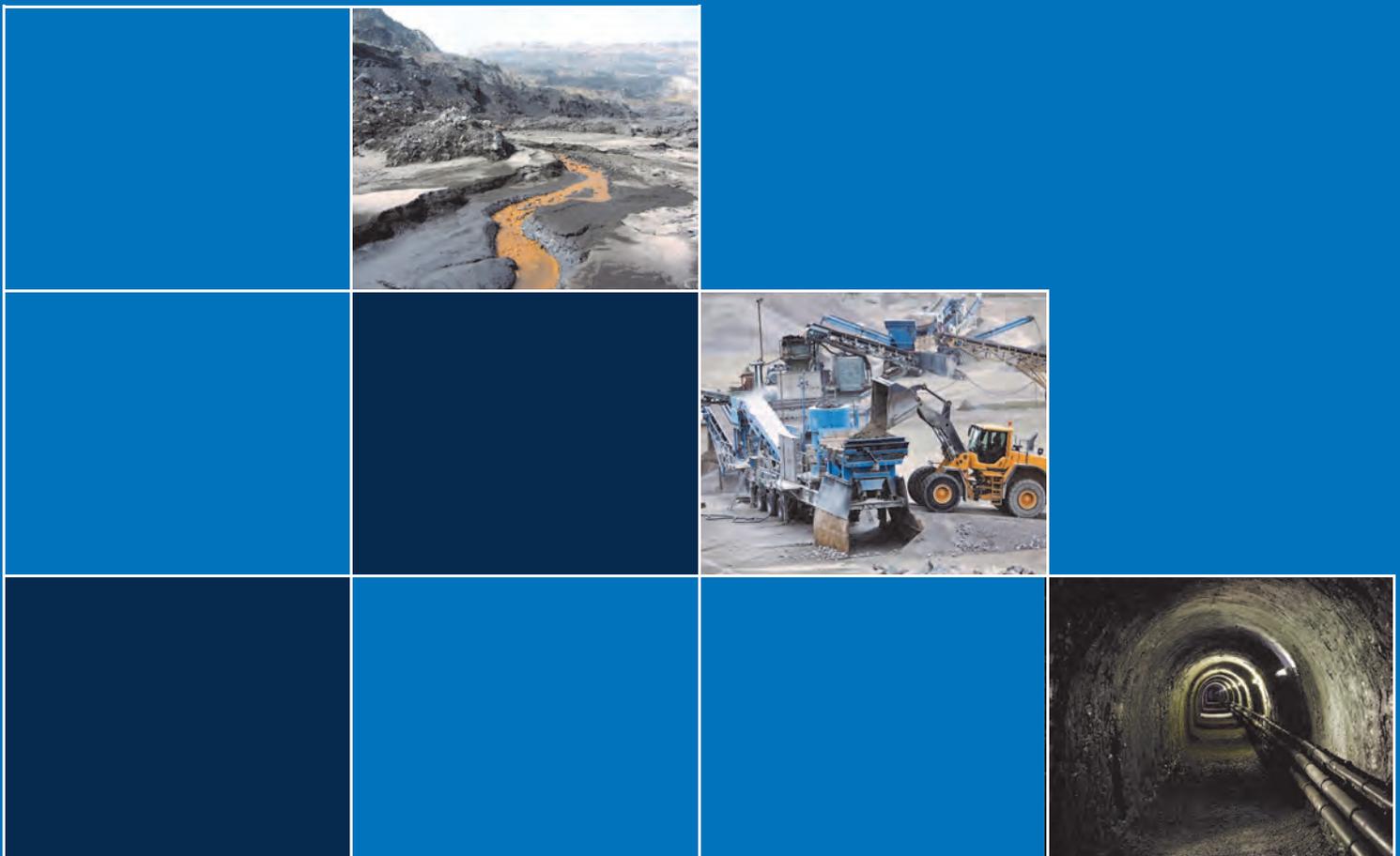




**Brenk  
Systemplanung**

Consulting Engineers & Scientists

# Consultancy in Mining and Environment



**INDEPENDENT – RELIABLE – INNOVATIVE**

Made in Germany



# Mining and Environmental Management

When developing new deposits, optimising existing mines or rehabilitating former sites, investors, operators and authorities are faced with the conflicting demands of economic and technical optimisation of raw material extraction and sufficient precautions in the field of environmental protection.

Based on our many years of experience in mining and environmental management, we offer independent, reliable and innovative services throughout the entire mineral raw materials life cycle for

## Investors:

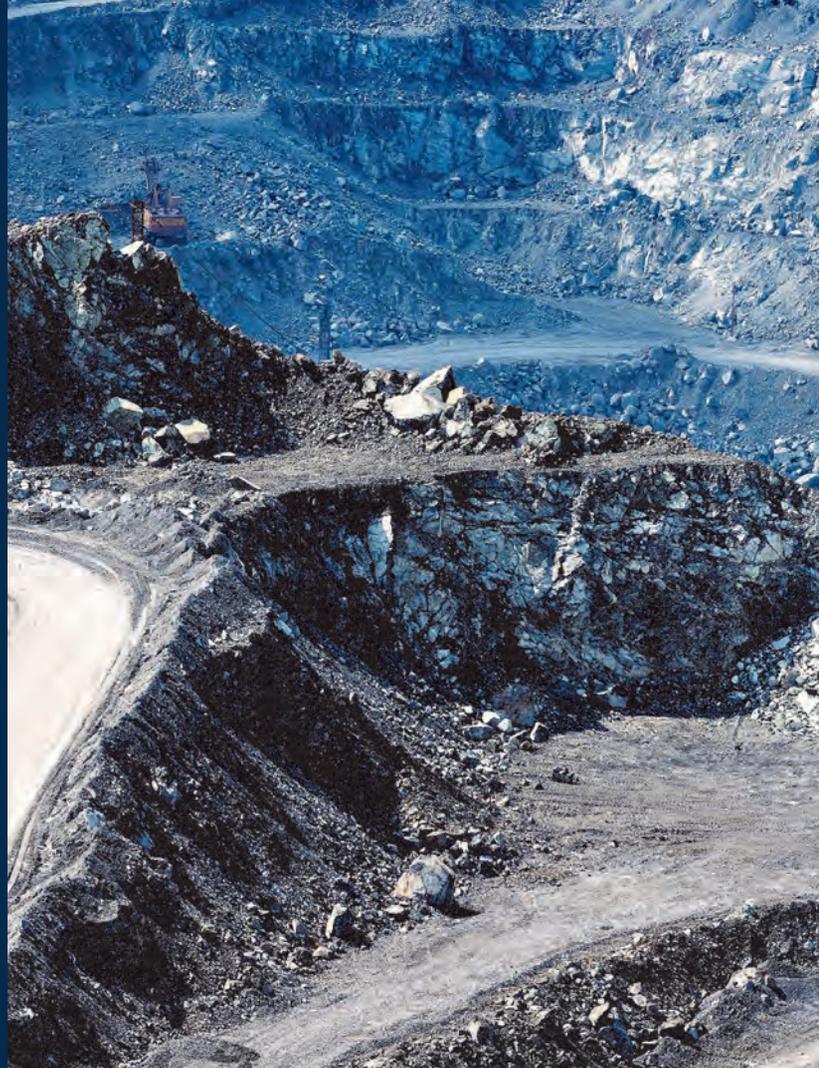
- ◆ market studies
- ◆ risk assessments
- ◆ due diligence reviews
- ◆ (pre-)feasibility studies

## Operators:

- ◆ mine planning
- ◆ licensing and approval procedures
- ◆ management of mining legacy sites
- ◆ environmental impact assessments

## Regulatory Authorities:

- ◆ strategic consultancy
- ◆ technical expert support
- ◆ revision of mining legislation
- ◆ improving administrative processes



**Market Studies**

We analyse the raw material development potentials and conduct market studies to keep both investors and economies on track.



**Planning and Optimisation**

We offer an anticipatory, environmentally compatible planning for sustainable mining operations right from the start of your mining project.

# Our Services



## Legislation and Approval

We support the examination and optimisation of approval and administrative procedures under mining law both for supervising authorities and applying companies.



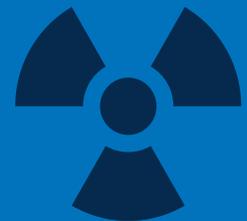
## Environmental Protection

We develop innovative concepts to minimise and reduce the effects of mining on water, soil and air in order to protect our environment.



## Safety and Rescue

We support you in implementing work safety measures, preparing emergency plans or reviewing your concepts - both technical and organisational.



## NORM

We provide extensive knowledge and experience in radiation protection which enable us to develop suitable concepts for handling naturally occurring radioactive material.

# Mine Development Potential

Development

Strategic Consultant  
Project Manager Consultant  
Owner's Engineer

Market studies  
(Pre-)Feasibility studies  
Due Dilligence  
Mine planning  
Licensing procedures

Optimisation  
Logistics  
Occupational safety  
Environmental protection

Mine Operation



Our consulting covers economic, legal or strategic challenges in the development of the mining sector, not only in conventional mining but also in the oil and gas and geothermal industries.

By reviewing the business risk and conducting market studies taking into account supply chains and customer demand, our experts assess the economic feasibility of a project and its financial risk, providing our clients a professional and independent support.

**Our services in mine development comprise:**

- ◆ market studies for mining companies, investors and the supplying industry,
- ◆ reliable risk assessments,
- ◆ the analysis of raw material development potentials,
- ◆ specification of ways how to increase the added value of raw materials prior to sale or export,
- ◆ preparation of tender documents and project management for mine development programmes.

# Planning and Optimisation

Waste management  
Remediation strategies  
Monitoring

Closure and  
Rehabilitation



Mine planning and optimisation require a variety of individual techniques to solve specific challenges at different stages of the mining value chain.

Thorough planning and prudent mining operations limit the liability and minimise the expenditure on insurances. We provide our clients with high quality, cost-effective solutions which completely meet the requirements and entirely comply with the relevant codes of practice. By means of mathematical modelling and optimisation, we support our clients to cope with shortages in their processes or resources superiorly. We distinguish ourselves from competitors by developing independent and individual solutions which enable us to consider any technical specifications needed.

**Our services in planning and legislation comprise:**

- ◆ mine and infrastructure planning,
- ◆ due diligence, scoping, (pre-)feasibility studies,
- ◆ optimisation of logistics and supply chain management,
- ◆ mine closure and waste management,
- ◆ revision and development of mining legislation,
- ◆ examination and optimisation of approval and administrative procedures under mining law,
- ◆ development of organisational structures for mining authorities,
- ◆ controlling and expert opinions for quality assurance.



If both engineering and legal or economic issues need to be examined, we offer our clients a broad expertise in the fields of macroeconomics and mining legislation.

Our experts are highly skilled in advising ministries and authorities on the further development of the mining sector by revising the mining legislation and developing an organisational structure to improve administrative processes under mining law.

# Numerical Simulations



The long-term effects of mining on the environment are best to be estimated with the help of numerical models. By using both standard and proprietary software tools we calculate the dispersion of contaminants in soil, water and air. On this basis, we carry out environmental impact studies and risk analyses and develop site-specific mitigation, remediation and reuse concepts for mining (legacy) sites.

We are a one-stop-shop capable of providing consultancy, development and implementation of appropriate software solutions. Our environmental modelling portfolio includes the following aspects:

## Water Balance

Quantification of water balance variables under given climatic conditions.

## Groundwater Flow

Calculation of the dispersion of pollutants in the saturated and unsaturated zone.

## Geochemical Reactions

Coupled reactive mass transport and equilibrium modelling.

## Wind Erosion

Calculation of aerosol releases due to wind erosion of uncovered surfaces.

## Dust Mitigation

Forecast of emissions and evaluation of effective counter-measures.



**Environmental impacts of mining:**  
A hard coal mining area in Vietnam.

# Environmental Protection



Sustainable remediation comprises the rehabilitation and reutilisation of tailings, dumps and landfills as well as ensuring the permanent elimination of pollutant discharges into air, soil and groundwater. Facing those demands we consider

- ◆ environmental impacts such as acid mine drainage, seepage water and dust emissions,
- ◆ capacity and logistics problems as well as,
- ◆ operational and remediation planning.

Forward-looking environmentally compatible planning from the outset of a project avoids subsequent costly remediation measures and helps our clients to mine sustainably.

## **Our services comprise:**

- ◆ environmental impact assessments, including planning, execution or coordination of trades and accompanying technical discussions with authorities and the public,
- ◆ the numerical modelling and evaluation of the pollutant discharge in water, soil and air for both chemo-toxic and radio-toxic contaminants,
- ◆ developing monitoring concepts, designing suitable countermeasures and sustainable remediation measures for mining legacy sites,
- ◆ the optimisation of capacities and transport processes for actively operated tailings, dumps and landfills also with regard to environmentally relevant requirements.

# Radiation Protection



The accumulation of naturally occurring radioactive material (NORM) as a result of mining or technical processes is a particular issue of facilities handling substances containing radionuclides of the uranium and thorium decay chain.

Mined ores with a high mineralisation of uranium- or thorium-containing constituents may contain increased specific activities in the mining residues (e. g. heap material, tailings, slags) leading to a significant radiation exposure of workers, the general public and the environment.

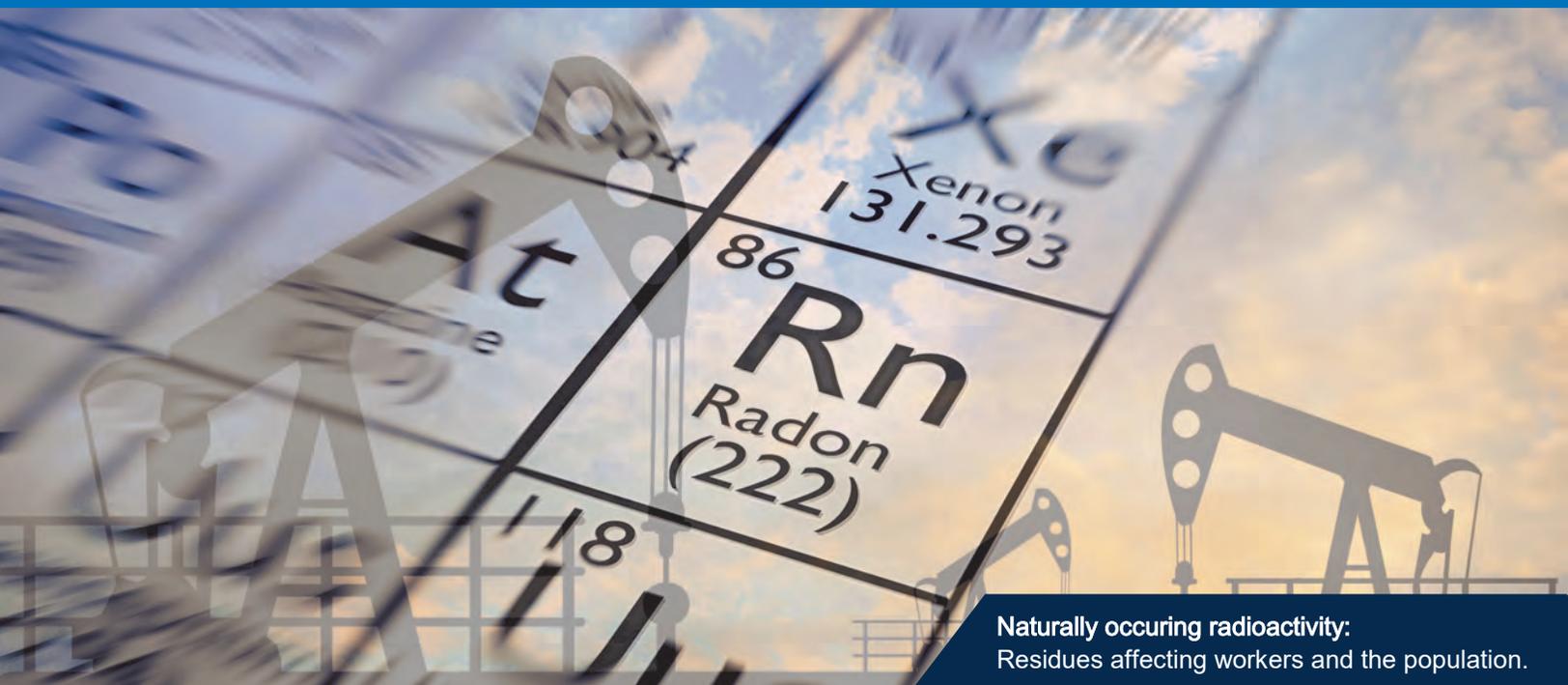
Such residues need to be considered from the radiation protection point of view. Of particular importance for the radiological exposure of the general public is that residues from mining and ore processing may be used for landfill and road construction as well as for house construction materials.

By means of process analyses and modelling of activity balances on a high scientific basis we develop the best solutions for our clients to deal with NORM residues from mining or industrial processes.

We carry out on-site measurements for radiological assessments using our own measurement technology and develop suitable concepts for dealing with NORM, reducing radiation exposure and for identifying possible disposal options.

## Our client base comprises:

- ◆ national regulators and international organisations
- ◆ hard coal mining companies
- ◆ NORM industries
- ◆ oil and gas companies
- ◆ geothermal facilities
- ◆ radioactive waste management organisations



**Naturally occurring radioactivity:**  
Residues affecting workers and the population.



# Safety and Rescue Concepts

**Occupational safety and escape routes:**  
High standards create safe working conditions.



Mining may imply working in hazardous atmospheres and environments, such as the underground.

We support our clients in mine management with regard to occupational health and safety, the preparation of emergency plans and environmental and radiation protection measures.

Here, we consider the respective legal situation as well as logistic, technical, geologic and economic constraints.

We approach planned or existing underground facilities in innovative and specialised manners, taking into account both occupational safety and legal compliance. In doing so, we consider the premises of economic efficiency and examine the use of innovative solutions for our clients.

This results in synergetic optimisation approaches with regard to mine development or transport processes and technologies.

Our holistic and interdisciplinary approach, which is independent of the operator's and supplier's point of view, also allows us to provide expert evidence for regulatory purposes.

**Our services in safety and rescue comprise:**

- ◆ planning, checking or revising escape route concepts for underground mining and disposal facilities, e. g. regarding the length of escape routes, the duration of self-rescue or the use of technical aids,
- ◆ review of emergency management concepts,
- ◆ consultancy in technical and organisational mitigation and prevention strategies.

## Worldwide Mining Expertise

### Germany

*Headquarter and business premises*

- ◆ Strategic consultant for mining authorities
- ◆ Revision of mining legislation
- ◆ Environmental modelling
- ◆ Risk assessments
- ◆ NORM

### United States

- ◆ Due Diligence in mining projects

### Libya

- ◆ Environmental impact assessments
- ◆ Environmental modelling
- ◆ NORM

### Chile

- ◆ Environmental impact assessments
- ◆ Environmental modelling

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### Namibia

- ◆ Project Progress Monitoring
- ◆ Consultant for mine sector development

# Our Project Examples

## Kosovo

- ◆ Consultant for the development of the mining authority
- ◆ Environmental modelling
- ◆ Risk assessments for lead and zinc mines
- ◆ Quality assurance in data management

## Tajikistan

- ◆ Project Progress Monitoring
- ◆ Consultant for mine sector development

## Vietnam

- ◆ Environmental modelling in a hard coal mining area
- ◆ Remediation concepts for waste heaps

## Sultanate of Oman

- ◆ Consultant for mine sector development
- ◆ Market studies
- ◆ Revision of mining legislation
- ◆ Strategic consultant for ministries



Since 1979 Brenk Systemplanung GmbH has been dedicated to the demanding tasks of mining, radiation and environmental protection as a politically and economically independent expert company.

As an interdisciplinary team with a large know-how and expertise, we offer our customers innovative and reliable all-round services.

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