



UK Trade
& Investment

UK – Delivering Global Mining Solutions



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“BHP Billiton has operations in over twenty-five different countries and always aims to procure as much as possible from local suppliers. However, British expertise also plays an integral role in BHP Billiton’s operations; from engineering consultancy, financial and legal advisory services to the specialist geological expertise and construction equipment we need. British universities produce some of the best geoscience and engineering graduates and can help a company like ours innovate and find more efficient and ecological ways of extracting the resources needed for future global growth.”

Andrew Mackenzie
CEO, BHP Billiton

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UK mining capabilities: an introduction



The UK delivers world class capabilities to the global mining sector, with four of the top five leading globally diversified mining companies listed in London. In 2012, UK-listed mining companies had a total market capitalisation of \$425bn, more than any other financial market in the world.

The UK is the preeminent source of mining finance, providing liquidity for all sizes of projects and operations. Supporting this access to capital, the UK is host to a huge concentration of professional service providers delivering legal, financial due diligence and technical expertise to miners, owner, nation states and investors. Leading global mining companies continue to choose the UK's legal and regulatory systems for their stability and clarity to help attract investment for mining developments.

It is no coincidence that many world-renowned institutions supporting the development and implementation of leading international standards and frameworks for mines and mining are UK-based. These bodies underpin the efforts of miners to manage their businesses effectively, and nation states to ensure the benefits of their natural wealth support their development goals.



UK consultancies and multinationals work closely with governments to support diverse and sustainable economic growth from mining sector investment. This recognises UK world leading expertise in master planning from the individual mine, to local, country and macroeconomic level. UK firms provide leading expertise in port operations and assessment of operational logistics. These include consultancy services for project, port and freight terminal integration ensuring economic distribution of the mined product. UK companies deliver these services across the globe.



Underpinning this expertise is world class capability of UK companies in the assessment of social and environmental impacts, through stakeholder analysis. These lead to the development of strategies that maximise local content and create long term economic prosperity while protecting biodiversity, ecosystems and the environment.

The growing global demand for metals and minerals is driving miners to look at ever decreasing grades of ore found in increasingly remote locations. Rare resources such as energy and water are scarce, all of which increases risk and costs. For operating mines, fluctuating commodity prices and skills shortages have put pressure on mining companies to find operational efficiencies and savings to maintain economic viability. UK based consultancies, cost consultants and project managers deliver solutions to add value in the 'design, build and operate lifecycle'. UK professionals help mitigate risk, improve productivity and increase profitability whilst cementing stakeholder relationships.

Skills, learning and knowledge transfer to maximise local content for employment in communities and businesses are a core element of the UK offer. UK providers are pioneers at developing partnerships between education and business. UK firms offer corporate, executive, leadership and vocational training while providing the educational equipment, resources, technology and software to deliver solutions for all forms and stages of learning.

The UK is a global financial centre for the mining industry, underpinned by recognised regulatory and legal frameworks that help deliver mining finance and development.

The UK has over 170 universities and higher education institutes, with four of its universities ranked in the global top ten. Many boast world-class geoscience, minerals and materials and engineering research centres, who in conjunction with corporate research institutes conduct world-leading pure and applied research into every facet of the mining industry and its supply chain.

The UK is a global leading centre of delivering low carbon solutions, helping achieve significant design and operational efficiencies across the mining lifecycle that will help deliver sustainable twenty-first century mining.





Supporting development of a 21st Century Mongolia

A mine development delivers economic benefits beyond the mine alone

The South Gobi region of Mongolia has rich copper and gold reserves. UK-headquartered Rio Tinto's Oyu Tolgoi project in the South Gobi desert is creating a blueprint for partnerships and social collaboration between miners and host nations. It is designed to offer a sustainable legacy for generations of Mongolians far beyond the mine's predicted 50-year lifespan.

The largest employment training effort in Mongolian history will enable 90 per cent of the workforce to be drawn from the local population. An impressive infrastructure programme will advance living standards across the region. It includes a new airport, two new mining schools, a new 70km water pipeline, 100km of new roads, plus an enhanced electricity supply. Under Rio Tinto's 'Mongolia First' initiative, over \$1bn has been spent with local suppliers, and \$1.2m in microlending is supporting local businesses across South Gobi. In addition to maximising the economic legacy of the Oyu Tolgoi project, Rio Tinto aims to ensure the environmental impact of the mine will be minimal.

An environmental monitoring programme is being run in cooperation with local government, herders who inhabit the region and non-government organisations. Biodiversity experts are advising on wildlife protection strategies. The project is implementing water efficiency techniques that will ensure Oyu Tolgoi has one of the most stringent water-conservation practices of any mine worldwide. This work is complemented by substantial initiatives aimed at community health and protecting the country's rich cultural heritage.



Establishing a climate for mining

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Successful mining operations that deliver the outcomes set by their stakeholders operate in a supportive climate. Establishing that requires the right governance frameworks, appropriate financing, best practice standards, a strong human rights culture and advanced skills. UK companies and organisations have the expertise and experience to develop and create all the factors that promote a mutually constructive, welcoming and profitable climate for the development and management of mining operations – and beyond.



For a mine to flourish, it requires a host region or nation with a robust governance and policy framework that clearly articulates the responsibilities, and rights, of all stakeholders in the mine’s development and operation. Mines and the infrastructure that supports them are hugely capital intensive. Appropriate financial frameworks require a mechanism for fundraising, managing the funds and returning profits to shareholders and other stakeholders. This requires appropriate planning to provide environmental, social and biodiversity and ecosystem solutions to satisfy all stakeholders. UK companies meet the highest demands to consistently deliver solutions to these issues.

Mining operations should be aligned with international best practice and standards throughout their lifecycle. A key element of international standards is the development of a human rights culture that recognises all stakeholders, both within the mine’s operations and in the wider communities and society beyond the mine. Along with a strong policy and governance framework clear human rights policies are no longer a ‘nice to have’ option, rather they are an essential requirement of investors and capital markets and must be adhered to throughout the mining lifecycle. Underpinning a strong governance framework is the ability to manage stakeholder relations and provide effective communication of what a mine will deliver at the local, regional and national level in order that the ‘Social License to Operate’ can be maintained throughout the life of the mine and beyond.

Natural resources are finite and the lessons of history highlight that many formerly resource-rich regions suffer from the ‘resource curse’, where there is no long-term strategy in place for when post-mining tax revenues decline. Providing sustainable development planning to support the mine and diversification is key for long term economic prosperity as well as satisfying the requirements of investors and NGOs.

The UK has world leading expertise in all aspects of the mining lifecycle. This publication showcases a wide selection of capabilities and case studies from UK organisations, institutions, consultants, companies and experts. It demonstrates that UK companies have the depth, breadth and global reach to deliver expert, effective and profitable solutions throughout the mining lifecycle and beyond.



Developing and operating a successful mine requires access to significant levels of investment capital. Raising finance via international financial markets underpins the funding of the global mining industry. The UK is the preeminent source of mining finance, providing liquidity for all sizes of projects and operations.

The UK's financial sector offers both access to capital from a uniquely broad range of investment capital sources and the skills and expertise to successfully manage the fundraising process. Financial institutions in the UK, principally in London, offer project finance, Initial Public Offerings (IPOs), private equity, mezzanine and development finance. There is ample provision for trade finance and open currency markets for efficient trading of currencies. UK financial organisations are uniquely expert at developing creative structures for less mainstream opportunities.

To maintain the effectiveness and strength of the fundraising capability of financial institutions, the UK and London financial markets have developed the widest array of support services. These range from technical services for due diligence, engineering, feasibility studies and technical reporting to competitive insurance services for all aspects of investment risk. The full range of mining-centric professional services can be accessed, including accountancy, tax, audit and legal advice, project and risk management and investor communications.

Investors and organisations seeking finance can choose from the London Stock Exchange (LSE) and AIM (formerly the Alternative Investment Market), which feature a uniquely international and outward-looking perspective. The capital city is also home to highly regarded commodity markets – such as the London Metals exchange and London Bullion Markets.

London's financial markets are well regulated. They apply practical and pragmatic methodologies that have been tried and tested, and companies and investors are required to adopt the highest standards of corporate governance. The court systems are efficient, fair and independent of the highly stable UK government, with rapid arbitration and professional litigation services to protect mining companies and their investors.

Between 2008 and 2011, 51 mining and materials firms made Initial Public Offerings in London, accounting for over 30 per cent of capital raised on the London Stock Exchange.

Markets for Miners, PwC



Award-winning London-based global law firm successfully navigates \$170m loan through regulatory obstacles

Syndicated loan to finance the development of Kwale Mineral Sands Project, Kenya

In a challenging global financial market, involving a cross-section of financial institutions is a vital ingredient when successfully financing mining projects. State regulation is increasing globally, specifically across East Africa. Providing reassurance and securing the support of the Kenyan government was just one of the challenges London-based law firm Mayer Brown overcame whilst advising the mandated lead arranger when constructing a \$170m syndicated loan.

The loan was for Australian mining company Base Resources to finance its Kenyan titanium-mining project, Kwale Mineral Sands, set to be Kenya's first large-scale mine and a world class asset. The Kwale Project is 50km from Mombasa. Base Resources expects the project's annual production of titanium ore to include 330,000t of ilmenite, representing approximately 10 per cent of the world's supply and 80,000t of rutile, contributing nearly 14 per cent of global output.

The deal was particularly challenging as the loan syndicate involved a number of development funding banks that have highly specific lending criteria, requiring Mayer Brown's skills to get the deal to completion on time. The project won 'The Exploration and Development Funding' Deal of the Year Award at the Mining Journal Awards in December 2011.

London Stock Exchange: delivering uniquely flexible capital-raising capabilities to the world's mining sector

The London Stock Exchange (LSE) has many of the global mining giants, as well as smaller companies in pre-production stages. It facilitates the highest capital raisings in the mining sector, including the Glencore listing in 2011, which was the largest UK Initial Public Offering (IPO) ever. The exchange offers flexible listing options, covering finance to mining companies at pre- and post-exploration phases. Miners can access top valuations and a diverse investors base by choosing the LSE.

To put London's importance as a global financial centre into perspective, during the period between 2008 and 2011, a total of 51 mining and materials corporations made Initial Public Offerings (IPOs) in London.

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Creating a policy and governance framework



Clarity of the rule of law and corporate governance is a key issue to address when seeking to attract investment to support the development of a national mining industry. Leading global mining companies continue to choose the UK's legal and regulatory systems for their stability and clarity.

UK lawyers have directed and managed the regulatory framework in which mining occurs. This includes handling permitting enquiries, preparing legislative strategy for investors and probing local regulators and counsel on the precise content and nature of existing legal and fiscal frameworks.

There are further complex regulatory and reputational risks for those operating in the mining sector. The industry faces particular risks in relation to fraud and corruption, as identified by international transparency organisations. These include operations in high risk jurisdictions, where demands for facilitation payments are prevalent, raising challenges for due diligence, risk assessment and fraud prevention for companies and their supply chains.

UK professional services firms can advise on anti-corruption and fraud investigations, including international investigations and asset tracing, worldwide criminal corruption, money laundering allegations, and related regulatory investigations. These investigations may require global resolutions in multiple jurisdictions with numerous regulators.

The introduction of the UK Bribery Act, and similar legislation by other national governments, has also further extended the reach of UK law to overseas corruption.

Increasingly, companies are looking to enhance their compliance according to anti-corruption legislation. UK lawyers are ideally placed to help advise on the design and implementation of these programmes and ways to mitigate risks.

Creating practical and effective corporate anti-bribery and corruption frameworks to mitigate business risk

Anti-bribery and corruption are high on many stakeholders' agendas. The commercial realities of doing business in some regions can directly conflict with anti-corruption legislation. Professional services firm PricewaterhouseCoopers (PwC) has helped a number of miners successfully manage this conflict.

PwC worked with a major global miner to support its development of a succinct, accessible and clearly understood policy and guidance material on anti-corruption issues. The framework was designed to help the miner manage what works best in practice and PwC's knowledge of what is seen as being appropriate to the relevant legislative and regulatory authorities.

The policy and guidance material addressed the corruption risks faced by the business in their broader and more sophisticated forms, including the payment of bribes. Those individuals who are in a position to expose both themselves and the business to risk understand the situations that may face them and the manner in which they should conduct themselves. PwC supported the framework's implementation and helped with the development of anti-corruption training materials for relevant staff, including classroom and e-learning modules.

Creating a balanced economy



It is important to maximise the economic benefits from a strong natural resource endowment. UK consultancies and multinationals work closely with governments to ensure they achieve diverse and sustainable economic growth, resulting from investment in the mining sector.

The UK is a centre of excellence and innovation in sustainable development. UK firms help create national economic strategies which ensure that host nations can enjoy social, environmental and financial benefits, long after the closure of mining operations.

The objective of modern mining is one of sustainable development and, in the long term, national economic benefit – an objective that UK companies are expert at helping regional and national governments achieve. National economic strategies for sustainable development consider the basic questions around the resource itself and also set out developmental priorities for the investment of significant tax revenues and general economic growth. UK companies specialise in balancing such social and economic demand for development with the range of other issues that need to be tackled to ensure mining operations lead to a balanced economic output that can deliver a long term positive legacy.

UK professional services firms have the capabilities to deliver master planning to ensure sustainable growth. Provision of infrastructure both to enable mining and as part of wider economic development objectives is key.

The UK supply chain provides expertise in water and energy efficiency and management and provision of transport links incorporating road, rail and ports and communications as well as the necessary education and healthcare solutions. More broadly the UK's offering provides for low carbon sustainable cities, towns and villages planned to adapt to climate change. These incorporate solutions to environmental pollution, such as waste and contaminated land, resource depletion, water shortages and flooding, and preservation and enhancement of natural environment and heritage assets.

Delivering the framework that attracts investment can help create a successful natural resources sector that can be the starting block for achieving economic prosperity. A national mining strategy should also consider the national infrastructure for rail, road, ports and harbours, energy and water while developing education can help lead towards development of a diverse economic strategy.

With world leading expertise in sustainable development, UK companies deliver master plans which ensure that long term economic prosperity can be achieved following the initial recovery of natural resources.



Reversing population decline: multidisciplinary socio-economic planning to create a more liveable mining city region

Developing more desirable cities alongside an expanding mining operation

The Berezniki-Solikamsk-Usolye (BSU) Tri-City region is one of the major industrial centres of Russia. It not only delivers gas and oil, but also holds the world's second largest recoverable potash reserves as well as an integrated chain of related processing industries. Yet, despite the region's wealth in natural resources, the conurbation suffers from severe population decline. Exacerbated by low life expectancy and an ageing mine workforce, declining access to human resources is becoming business critical. Population outflow is largely due to quality of life and safety considerations, as the region is seen as unattractive relative to its nearest large city of Perm, which has a population of 1m and is able to offer a wider variety of job opportunities.

The mining and related industrial companies plan to grow by at least 10 to 20 per cent over the next decade. UK-based strategic consultants Happold Consulting lead the team appointed by Uralkali, the region's largest mining company and the regional government, to prepare a city regional master plan to develop a new strategy and direction. The aim is to transform the area into a place that is attractive to current and prospective employees and to secure the long term environment and infrastructure required for viable, low impact extraction. The multidisciplinary approach requires input from UK-based consulting engineer Buro Happold's infrastructure, ground engineering, environmental, building and socio-economic experts.

Ultimately to attract and retain the required workforce, the BSU Tri-City region needs to be more liveable – it must have better infrastructure, transport, housing and social facilities, plus an improved public realm. In addition, a major effort will be needed to up-skill the workforce. The plan developed by Happold Consulting with Uralkali will meet the challenge of creating a more liveable city region to support a continuing and expanding mining operation within the limits of regional governmental and company budgets.

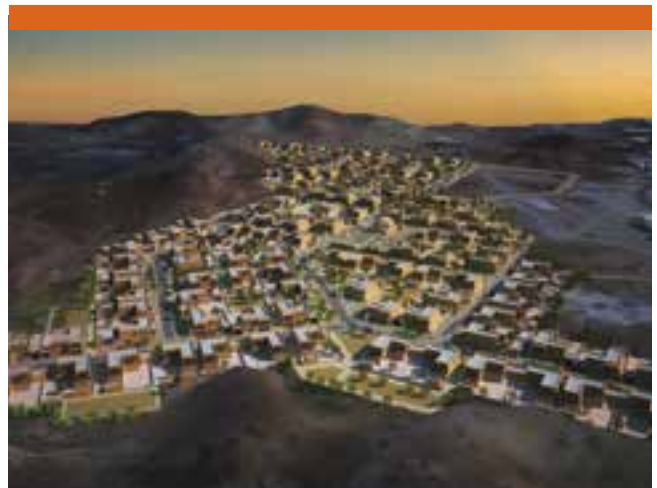
Nation building: urban and rural infrastructure and facilities improvement programme to 2030

Creating the United Arab Emirates Holistic Plan

To improve the quality of life of the population of and visitors to the North Emirates, the Ministry of Public Works for the United Arab Emirates (UAE) required a Holistic Plan to identify the region's development requirements to 2030. The UK-based, multidisciplinary professional services firm Atkins was commissioned to create a plan detailing the principal areas of change over the next two decades.

Developing the region is uniquely challenging, requiring the integration of urban, rural and natural resource extraction, alongside the aspirations of each of the seven Emirates. As part of the growth and change element of the Holistic Plan, Atkins was tasked with identifying and evaluating options to create a Vision and Spatial Development Framework. This included finding what public facilities were required to meet the needs of urban and rural areas, and defining the public buildings portfolio needed to house and deliver the services.

Particular attention was paid to understanding the needs and enhancing the quality of life of rural inhabitants, plus identifying improvements across infrastructure and transport, land use, public services, culture and heritage, plus safety and the environment.



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Social, economic and environmental assessment and planning



UK firms assist in satisfying the criteria required to obtain finance for mining operations, as well as in designing and implementing the human rights frameworks under which mine operators work worldwide.

Professional services delivered by UK companies ensure that the demands of the public for transparent and accountable human rights disclosures are met. They also guarantee that the human rights due diligence and impact assessments required under the Equator Principles and the World Bank Group's International Finance Corporation (IFC) Performance Standards – to help companies attract investment – are properly performed.

As developing markets open up, both private enterprise and sovereign investors have to comply with the requirements of international standards. Mining projects have major infrastructure implications, so from the earliest stages institutional investors and governments look to international human rights norms and requirements to ensure that they are lending or borrowing on a socially responsible basis. This is particularly important in developing economies, where guidance and assessment are crucial in terms of outward investment. UK firms are specialists in this field and offer comprehensive services ranging from assessing risk through to devising effective action plans.

The social license is no longer sought only at the stage when operations have commenced. The Equator Principles and IFC Performance standards demand that companies seeking investment demonstrate at the planning stage that they have assessed and considered the impact of any project upon the human rights of stakeholders and the relevant communities.

The shift toward ethical financing demands that companies, in practical terms, have to obtain that social licence prior to receiving funding and approvals.

The UK is a recognised leader in assisting mining companies to obtain the required assessments and in performing due diligence. UK firms also help create action plans to assist mining companies in making the changes required to obtain finance, ensuring that subsequent monitoring can be undertaken without difficulty and without surprises.

The UK's world-leading professional services firms design human rights strategies, draft policies, and prepare standard operating procedures. At the monitoring stage, service providers measure impacts and externally audit companies' human rights policies and controls.

The UK's world-leading professional services firms have considerable expertise in effectively supporting the aims of bodies that develop global standards and principles to which mining companies should adhere. These include the Equator Principles, the World Bank Group's International Finance Corporation (IFC) Performance Standards, and the Extractive Industries Transparency Initiative (EITI).



Investors in natural resources and extractive industries are increasingly seeking ethical business practices when making investment decisions.

Defining a master environmental and social management plan for Nigeria

Solid minerals sector assessment to derive solutions to mitigate social and environmental impact

With little modern exploration applied to date, the overall geologic framework of Nigeria is highly prospective, and there is high potential for future discoveries of gold, rare earth, and base metals. Recognising this, the Nigerian Ministry of Solid Minerals sought a socially and environmentally responsible route to potential mine developments.

On behalf of the World Bank, the Ministry commissioned UK-based Wardell Armstrong International (WAI) to conduct a Sectoral Environmental and Social Assessment (SESA) of the solid minerals sector. The objective was to assess the institutional capacity and capabilities of the ministry and to evaluate the impacts of increasing the solid minerals sector in Nigeria.

The output of the assessment, based on the diagnosis, included strategic priorities for future studies, mitigation works and recommendations for the definition of an environmental master plan and social management plan for the mining sector of Nigeria.

Supporting the development of a country's mining industry

Mining is just one of the sectors that have kept Zambia's economic growth positive through the global recession. To assist with implementing an optimised fiscal regime that will maximise reinvestment into infrastructure and public services, the Zambian Chamber of Mines commissioned PricewaterhouseCoopers (PwC) in the UK to look into the mining sector in Zambia. The study is designed to assess the economic impact of changes to the mineral fiscal regime and demonstrate the wider economic contribution of the mining sector.

A Computable General Equilibrium (CGE) model was constructed to estimate the impact of various taxation and investment scenarios on the mining sector and the wider economy, specifically the impact on Gross Domestic Product (GDP), exports, employment, and investment. This is the methodology used widely by the World Bank and IMF to evaluate similar issues.

The dynamic bespoke model developed includes a detailed representation of the Zambian fiscal system. It accounts for virtually all types of taxes currently levied, takes into account the economic interactions and dynamic behaviours of ten economic sectors, and projects potential impacts over 40 years.

The study also involved an analysis of the Zambian economy, the mining sector's contribution to the economy, as well as an assessment of government tax policy.



Stakeholder relations and management



UK communications consultancies and multinationals have the experience and capability to manage the wide range of issues operators face during the development, operation and closure of a mining project.

The UK has world-leading expertise in mapping out and delivering on stakeholders' needs, whether those stakeholders are civil society, governments, regulators, local communities, investors, employees, suppliers, customers, media, or non-governmental organisations. Each company or issue has a unique set of actors whose influence, knowledge or potential value must be considered and mapped to determine the right level of outreach and engagement.

UK consultants work with mining clients to map and develop the most appropriate stakeholder engagement and communication strategies. They are expert at imparting prudent, forward-looking advice on stakeholder positions, likely actions and other key issues. They are also leaders in developing opportunities and risk assessments to help mining companies understand, engage and successfully cooperate with particular constituencies and their interests.

UK communications firms further assist with addressing the needs of a business to access capital via public and/or private markets, by ensuring the investment case is well understood. They also focus on communicating the business's social licence to operate and the economic and social and impact benefits they have on developing economies.

Employees are crucial stakeholders: not only are they company ambassadors, but their development also has a direct benefit to local and national communities. Successfully communicating such benefits is often key in mining companies entering into profitable new markets and expanding in existing ones.

UK firms specialise in working with mining clients to articulate and communicate their 'social licence to operate' to key stakeholder groups.



The UK's expertise in stakeholder mapping and engagement provides essential strategic planning tools. It is the necessary first step in proactive stakeholder relations that not only help win the support of stakeholders, but also ensure business and societal goals are successfully met.

Integrated stakeholder communications underpins successful Initial Public Offering on the London Stock Exchange

Engaging with stakeholders around the world ensures understanding of miner's potential

Fresnillo is the world's largest primary silver producer and Mexico's second largest gold producer. In the lead up to the Initial Public Offering (IPO) in 2008, the Company was facing a macro environment of declining investor confidence. In addition, corporate governance structures were being challenged after a number of foreign-owned mining companies had listed in London. To complicate matters further, the financial markets had little understanding of Fresnillo's assets, its management team, silver mining or indeed Mexico as a precious metals mining country.

Fresnillo engaged the US-based Brunswick Group, an international corporate communications partnership, to deliver a communications strategy focused on education, understanding and coordination. The latter was important as teams, assets and stakeholders were in different time zones around the world. A multi-pronged approach was taken to engage with the appropriate stakeholders in advance of and following the IPO. Stakeholders included investors, analysts and media in Mexico and London, as well as regulators, authorities and non-government agencies.

Following Brunswick Group's support, Fresnillo successfully raised £908m in May 2008 and has been in the FTSE100 since 2009 and continues to engage and communicate across all its stakeholder groups.

Securing community support for mining development through an innovative 'Dialogue Table'

Dialogue Table multi-stakeholder process secures consent for the development of Quellaveco copper mine

Anglo American is developing Quellaveco, a greenfield copper project in southern Peru. In the socio-political context of Peru, where several major mining projects have been delayed or shut down due to social conflicts, Anglo American applied a strategy to secure broad-based community consent for the project prior to starting construction. As a result, the company suggested an approach, known as a Dialogue Table. This process was initiated by the regional Government of Moquegua and brought together key stakeholders in the region. The central government also played a key role. Based on agreed principles of respect, cooperation and a willingness to listen to other's views, the Dialogue Table started in March 2011 and concluded in agreement in August 2012.

Through a structured process, each participant presented their position regarding the Project. Anglo American listened to stakeholder concerns, replied to these concerns in detail, and eventually made significant adjustments to the mine development plan. As a result, the Dialogue Table reached a successful conclusion. Among the key commitments were pledges to the local community on the provision of employment opportunities, a secure water supply and a pledge to re-establish the natural route of the Asana river upon mine closure.

Through a protracted and at times difficult discussion, the Dialogue Table was a lesson in what can be achieved when all stakeholders are brought together with clear common objectives, and a commitment to engagement and transparency. A follow-up committee has been formed to monitor compliance with the agreements reached, and Anglo American remains clear that the support achieved through this process will need to be maintained month-in, month-out through effective follow up and delivery.

Learning and knowledge transfer



Skills, learning and knowledge transfer to local communities and businesses are a core element of UK mining and supply chain company activities throughout the world. UK-based firms, universities and training organisations offer knowledge transfer opportunities locally, within the UK and via distance learning to help deliver maximum local content to any mining development.

Mining operations around the world feature examples of learning and knowledge transfer, where UK miners and their supply chain provide opportunities to sustainably up-skill local workforces. Knowledge transfer programmes provide local employment and training in mining equipment and operations, as well as in transferring skills with broader and more sustainable applications to benefit local economies. UK companies provide opportunities for local suppliers to expand their operations nationally and internationally. And many workers employed locally by UK mine operators are provided with skills that enable them to compete in a global labour market.

The UK is home to four of the top ten universities in the world.

UK-based organisations deliver knowledge transfer, training and learning programmes within the UK and via distance learning. UK companies regularly rotate and second personnel recruited locally from field-based mining operations to operations in the UK, widening their skills and employment opportunities. UK academic and research institutions offer unparalleled opportunities to study at many levels across the range of science, engineering, economic, social and business disciplines that mining requires. The UK is the leading global exporter and provider of distance learning programmes, pioneering the online delivery of formal study programmes.

Knowledge transfer that enables mining supply chains to export their goods and services to a global marketplace

Developing a sustainable industry base with the skills and confidence to expand overseas

Chile has harnessed its natural resource wealth and created economic improvements for its citizens. While mining has been a key sector for more than a century, in the last five years it has accounted for over 20 per cent of Chile's Gross Domestic Product (GDP), 60 per cent of exports and 10 per cent of employment. Chile has created sovereign funds, has no public debt and has strong macroeconomic indicators.

There are about 3,000 companies supplying Chile's substantial mining industry. However, most of them have been limited in their capacity to supply internationally.

To address this challenge, UK-based BHP Billiton Plc developed a 'Cluster Programme' to assist Chile to build a sustainable economic model from its mining legacy. The goal is to transform 250 Chilean companies into specialised technology and knowledge intensive mining services, supplying multinational natural resource companies on a global basis. The final objective is for Chile to have a diversified export portfolio.

After four years, there are 60 participants. They have: seen their sales and exports increase; developed new skills, both managerial and technological; improved performance; and established a collaborative way of working with their mining customers. For example, BHP Billiton has benefitted from a 20 per cent increase in the life of tyres thanks to Bailac, a company from Northern Chile. And Bailac has started exporting this solution throughout South and North America, opening up new markets. Suppliers participating in the Cluster Programme account for more than 5,000 employees and over USD \$400m in sales.

Community capacity building: providing a sustainable skills legacy from mining operations

Knowledge transfer to develop local construction and mining skills

Mozambique's Moatize basin has untapped coal reserves described by geologists as the world's next major coal basin. The reserves feature premium hard coking coal and high energy thermal coal, with readily available global markets and the potential to deliver high returns for Mozambique. UK-headquartered global miner Rio Tinto acquired Australian miner Riversdale's assets in the region, which it continues to develop as Rio Tinto Coal Mozambique (RTCM).

As part of its community investment, RTCM supports a training centre in Tete, which registers and assesses local workers for knowledge transfer, training and employment. In addition to identifying workers and future leaders within Rio Tinto's global business, the knowledge transfer programme also provides training in skills and capabilities with much wider applications and potential for local workers. These include building and civil trades, as well as mobile equipment and mine support operations.

Thousands of community members have been receiving training at the centre, some also gaining employment at Rio Tinto's operations. The miner's objective is to continue to grow and add value to its coal assets while contributing to the local economy and improving the wellbeing of people in the local communities. Providing local people with challenging work and development opportunities means Rio Tinto's employees and future leaders will truly represent the increasingly diverse regions and cultures in which the miner operates.

Knowledge transfer programme delivers market evaluation and analysis skills to government scientists

Enhancing the knowledge required for agro-minerals exploration in Sudan

The Republic of the Sudan has significant agro-mineral potential currently being investigated by London-based exploration company Regency Mines, and their Sudanese partner, IMRAS. Regency Mines strongly believes in the involvement of local geologists in its projects and places great importance on the value of local employment and skills training, especially in countries with underdeveloped mining industries. Regency Mines is currently working with the British Geological Survey (BGS) to design a programme of information sharing and training for geologists at the Ministry of Mining and Geological Research Authority of Sudan.

The aim of the programme is to enhance the knowledge and facilities required for effective agro-minerals exploration within Sudan, so that the country is better able to understand the value of its mineral assets and support future exploration efforts. Regency Mines is also looking to aid the Sudanese Ministry of Minerals in amassing a comprehensive collection of British-issued geological works, published over the last several decades.

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International best practice



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From sustainability and human rights, through to professional accreditation, technical standards and regulation, the UK is a global centre with an outstanding track record in creating and exceeding international standards and best practice.

Organisations fostering international best practice have chosen to locate themselves in the UK because of its vibrant and active international mining sector. These include non-governmental organisations (NGO) that not only create and dictate best practice frameworks, but also monitor corporate and state adherence to those standards. Mining-related organisations, such as Publish What you Pay, are situated in the UK, while industry bodies such as the International Council on Mining and Metals (ICMM) and the World Gold Council have also chosen to base themselves in the UK. All of these organisations help shape global mining standards and practice, and UK firms are expert at applying and interpreting those standards to and for mining companies as well as governments and their departments.

A sustainable mining industry, performing to the highest international standards, requires mining companies and governments to work with service providers able to satisfy these standards. UK-based firms meet the high corporate standards set by the strong UK and European Union (EU) legislative framework, and are voluntary adopters of non-binding international initiatives and guidelines.

As a result, UK companies have developed extensive operational excellence and themselves demonstrate integrity in areas ranging from human rights, occupational health and safety, anti-corruption and transparency in reporting, through to sustainability, the environment and carbon footprint reduction. In the advisory and consulting sphere, UK consultancies deliver expert advice to global organisations on efficiently transforming their business practices to satisfy these standards.

Key organisations fostering international best practice have chosen to locate themselves in the UK because of its vibrant and active international mining sector.





Delivering against international standards

UK companies have extensive experience of advising mine owners and managers on the adoption and implementation of international standards for development and diversification.

Whether new mines are financed 'off balance sheet', by sovereign wealth funds or by commercial markets, the ability to demonstrate project sustainability through adoption of international standards is essential. Guidance on the implementation of the Equator Principles and the OECD Common Approaches is provided through the World Bank Group International Finance Corporation (IFC) Policy on Environmental and Social Sustainability and associated Performance Standards (PSs) and Guidance Notes.

Of particular importance to governments, the Equator Principles Financial Institutions (EPFIs) and export credit agencies (ECAs) requires that their financial participation provides additional environmental and social benefits, and that performance goes beyond basic legal compliance. Mine feasibility studies, such as those provided by UK specialists, must meet the basic requirements of the above and other organisations, to set the scene for the long term management of every mine.



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Developing regulatory frameworks and designing transparent tender processes for mining

Expediting international investment into Afghanistan's mineral sector

Afghanistan is thought to have mineral reserves worth as much as \$3tn, containing a variety of metals including gold, copper, iron ore, lithium and rare earths. The United States Department of Defence's Task Force for Business and Stability Operations has sponsored a group of international advisers to assist Afghanistan's Ministry of Mines to enable the nation to realise the full potential from its mineral resources.

Alongside technical advisers, leading UK-based global law firm Mayer Brown has been retained by the government of Afghanistan to expedite international investment in Afghanistan's mineral sector. The law firm and technical advisers will design and implement a transparent tender process that relies on internationally-recognised business practices to open up its mining sector. Mayer Brown will also assist in the development of a legislative and regulatory framework, and in the implementation of the tendering process.

Building the legislative, policy and physical infrastructure from the ground up

Introducing best practice for iron ore mining operation in West Africa

A West African nation with significant iron ore deposits within areas of high biodiversity value, but with a fragile political situation, embryonic legal and regulatory systems and limited institutional and technical capacity, was emerging from a period of civil conflict. The UK-based, multidisciplinary professional services firm Atkins was commissioned to deliver wide-ranging services. These included strategic policy advice to help the nation build on its emerging legislative and policy frameworks, to provide focused environmental and social input, and to develop mining and the associated rail, port and community infrastructures.

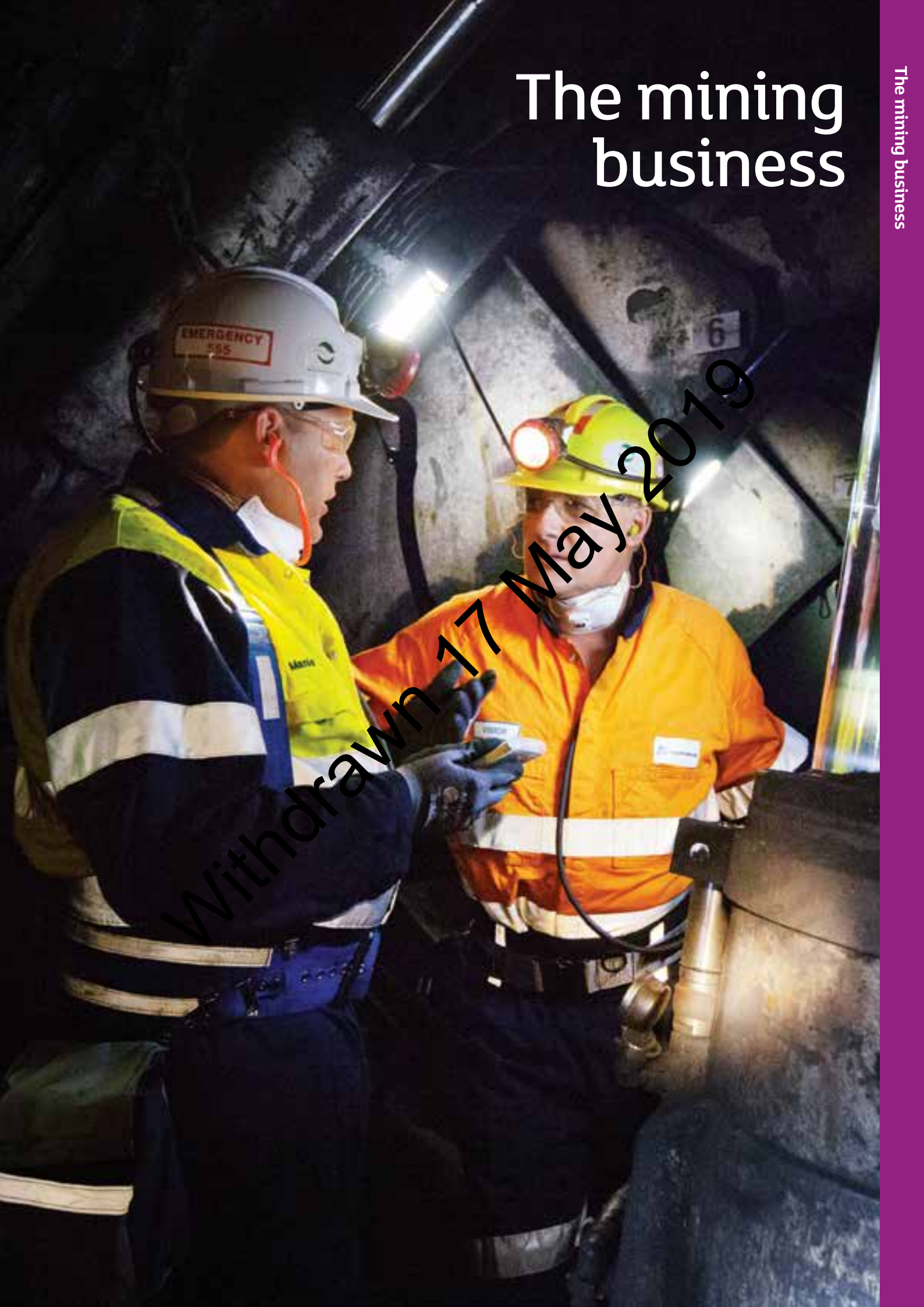
Inputs have included developing environmental and social policies, plus liaison with ministries and key national and international stakeholders to develop national standards. Atkins also designed and implemented communication strategies, detailed desk studies and survey programmes, covering ecology, social, water, soils, landscape and geotechnical aspects.

The project has required community consultation and government engagement to enable assessment of impacts and formulation of management and mitigation plans. All of the work undertaken has been in accordance with international standards relating to environmental and social impact assessments (ESIA) and those of the extractive industries, such as the World Bank's International Finance Corporation and the International Council on Mining and Metals (ICMM).

Atkins has established a network of stakeholders, information providers and project partners with governments, non-governmental organisations, academics and research institutions. Other interested parties, both nationally and internationally, have been invited to comment on emerging environmental impact assessment guidelines, as well as to provide training to government officials and contribute to capacity building in environmental management techniques.

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The mining business





The UK's Industrial Revolution was fuelled by recovering the wealth of natural resources within the British Isles. This legacy has led to the creation of a world-leading mining services, delivery and equipment supply chain. Alongside London's position as the leading source of mining finance, the UK now exports the expertise of companies and organisations to explore, evaluate, design, construct and operate mines across the globe.

UK companies deliver solutions across the mining lifecycle, from initial scoping studies through all phases of feasibility and detailed mine design and ultimately construction and operation. Critical areas around social and environmental impact assessment and closure planning to the determination of water and energy efficiency and management for mine design are supported by UK firms. Regional and country planning for mineral recovery are all addressed by UK companies, who have a strong track record of operating internationally across all forms of social and environmental settings.

Supporting this are world leading services in risk management and security, process engineering and distribution and logistics. They provide operational management and efficiency expertise critical in the modern mining era.

As a result of its long history of mining, the UK has developed specialist expertise around legacy management and closure planning, including setting up of appropriate regulatory bodies which deliver long term affordable legacy management of redundant mine sites.





Exploration and evaluation

The changing face of the global capital markets has made it more difficult for the mining sector to access funding to develop projects. The competence and knowledge of UK firms in undertaking appropriate investment due diligence is in increasing demand as the capital markets recognise the high quality technical and economic appraisal that UK firms are able to provide.

UK firms have a wealth of exploration and mining due diligence expertise with capabilities built on a lengthy history of mining. UK service offerings include geology and mineralisation evaluation, exploration supervision, database management, as well as resource estimation to internationally accepted reporting standards. UK experts routinely maintain appropriate levels of accreditation to allow them to act as 'Competent Persons' under financial markets' rules on reporting.

Natural resources focused investment funds and banks are UK-headquartered, as are many of the world's major mining houses, mid-tier developers and junior explorers. This concentration of resources and skills, together with London's role as a global financial and legal centre, delivers world class investment due diligence capabilities with international reach.

The UK's expertise provides: outstanding due diligence services for project review and audit to funders; advice to insurers and their loss adjustors in claims evaluations; and expert witness support to lawyers involved in arbitration and litigation proceedings, including delivering expert testimony.

Deposits are generally increasingly difficult to find, of lower grade often more difficult to extract and process, all compounded by cost inflation and increasing skills shortages. Therefore, a further vital element of investment due diligence is that the fundamentals underpinning the potential value of any exploration property as a future mining operation are effectively evaluated and understood. This includes the infrastructure requirements, energy supply and product market.

UK-based companies can ensure that technical aspects have been thoroughly studied, and to a high level of confidence, to ensure that the relevant technical risks have been sufficiently addressed and mitigated against – both from a project development standpoint and to secure ongoing investment.

Global funding requires the need for an appropriate level of due diligence to ensure that funds are allocated to those extractive projects with the greatest opportunity, whilst mitigating identifiable risks where possible. The capital markets trust the quality of due diligence that UK companies provide to meet increasingly tougher demands for investment.

Strong international networks provide UK firms with a holistic understanding of global exploration and mining projects.



The challenges of declaring a Mineral Resource Estimate in the High Arctic

Raising a greenfield exploration project to Resource within two years

The Arctic climate in northwest Greenland means that the area is only accessible to field activities over a three month window in the summer. So when Red Rock Resources Plc, a UK-based mineral exploration and production company, acquired the greenfield prospective Melville Bugt licence, initial exploration necessitated a well-planned, targeted field season with realistic aims of what could be achieved.

The first field season was dedicated to exploration-scale mapping and sampling of the entire licence area, with accompanying airborne geophysical survey and post-season geochemical analysis designed to identify targets for future drill seasons. Promising targets from the 2011 season then became the subject of a maiden drill programme the next year, which culminated in the declaration of a JORC-compliant Inferred Mineral Resource Estimate in December 2012.

The project was led throughout by the same small team of dedicated geologists who oversaw every stage of the process – from initial desk studies, through to planning, field season execution and data interpretation. The team worked closely with Joint Venture partners, project consultants, and both Greenlandic and international staff to produce significant, quantifiable results to ‘industry best practice’ within a very limited timeframe.

Independent multi-disciplinary review of mining project feasibility study

Conducting pre-finance due diligence for a copper mine in Kazakhstan

The Karchiga copper project involves the development of a new open pit copper mine situated in eastern Kazakhstan. The mine is 94.75% owned by dual listed, London based junior exploration and development company Orsu Metals Corporation, which had already conducted preliminary economic assessments and a feasibility study. To assist with financing the project, Orsu retained a London-based financial adviser, IMC Group Consulting Limited was then appointed to conduct an independent due diligence review of the project on behalf of a group of potential lenders.

IMC used a multi-disciplinary team of consultants to review the existing feasibility report and other historical project reports, make site visits and hold discussions with company personnel involved in the project. Much of the historical documentation was from the Soviet era, meaning that the mineral deposit had been assessed on a different basis from current methods and criteria. A range of other project elements were reviewed by IMC, including the mine and process plant design and the project infrastructure, and an independent review of the project economics.

A key element of the work carried out by IMC for the potential lenders was to be satisfied that there is unlikely to be any impact on the environment. This required a full review of the environmental and social impact assessment carried out for the project, to confirm that it had been conducted thoroughly and complied with the requirements of the Equator Principles and World Bank’s International Finance Corporation Policies and Performance Standards.

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Feasibility and development

The UK is one of the world's leading centres of mining feasibility and development excellence. It features consultants who are expert at every stage of the feasibility and development process. They are supported by an exceptional supply chain able to undertake infrastructure design and construction.

Mining feasibility studies by UK specialists consider every stage of each potential mine, from pre-construction to closure. UK firms ensure environmental and social issues are addressed through studies designed to achieve compliance with regulatory controls and standards demanded by international financial institutions. Consideration is given to the project's contribution to sustainable local, regional and national development through identification of project stakeholders and effective communication.

UK companies conduct feasibility studies to progressively develop the design of a mining project from initial evaluation through to full 'bankable' design. The studies' scope includes further geological resources and reserve evaluation and deposit modelling; mine and mineral processing design; mine waste management, project water management, and infrastructure design as well as a range of support services to supply fundamental financial, geochemical, geotechnical and hydrological data.

UK consultants and contractors include many of the world's leading geologists, mining and process engineers, civil and transportation engineers, and environmental and social scientists. Together, they offer expertise across the feasibility spectrum to deliver expert advice on a mining developer's options.

UK expertise in developing projects through staged design coupled with effective environmental and social impact assessment delivers technically and economically viable mines that are able to contribute to sustainable development at local, regional and national levels.

Early stage scoping to determine environmental and social impacts in Pakistan

Identifying legislation and frameworks for conducting full scale assessments

The lignite resources identified in the Sindh Province of Pakistan are particularly suited for use in thermal power stations, to address the country's growing energy needs. The mine design will be open pit, which has the potential for significant environmental and social impacts. As a result, mine operator Oracle Coalfields commissioned UK-based Wardell Armstrong International (WAI) to undertake a Scoping Study as the first step in an Environmental and Social Impact Assessment (ESIA) for the Thar Block 1 Open Pit Lignite Project.

The purpose of the study was to set out the main project parameters and identify environmental and social impacts. The relevant legislative framework and international standard for ESIA were identified, alongside reviewing existing information sources, including environmental and social reports and baseline data. WAI conducted an onsite exploration, which included initial public meetings with Project Affected Peoples and other stakeholders. The resulting report identified whether the ESIA met international standards and in-country requirements, as well as where further studies were required.



UK companies provide holistic and pragmatic expert specialist advice and services to help ensure a positive mining legacy.

Feasibility study leading to optimised mine, mineral processing and infrastructure designs

Feasibility and development of Mozambique's Chitima coal resources

Mozambique's Zambezi River Basin features some of the world's largest coal reserves. London-headquartered multinational natural resources company Eurasian Natural Resources Corporation (ENRC) is developing the Estima Coal Mine on the 871L concession area in central Tete province. Multidisciplinary professional services firm Parsons Brinckerhoff has worked in an integrated team with ENRC across varying phases of the project. It is currently the owner's engineer and project manager, providing the mine with all services from green field exploration, feasibility and development to production.

The Estima Coal Project has encompassed: geological interpretation and resource assessment; geotechnical and hydrogeological appraisal; mine design and scheduling; analysis for coal preparation and handling; environmental assessments; infrastructure designs and financial studies. UK-based Parsons Brinckerhoff completed the feasibility study in March 2012, estimating that the mine could produce 5Mt per annum by Q3 2015 and 25Mt by 2020. The firm developed a custom geological model that was used as a basis for mine design, planning and scheduling. This led to a mine plan that suited both the geology and the most cost-effective production. The model specified a process plant for dry operation to minimise water resources needed and waste.

During the feasibility study, Parsons Brinckerhoff determined the optimal process and sequence of excavation for an open-pit mine, as well as the necessary coal washing and handling facilities based on expected coal quality. These plans shaped the design of supporting mine site infrastructure, such as access roads, power generation, and all buildings. Initial site development is now well underway.



Mine to port services: integrating disciplines to mine and process iron ore, transport the beneficiated ore over 200km and develop a new port

Providing coordinated services to enable and optimise mining operations in West Africa

Multidisciplinary engineering consultancy URS is undertaking a prefeasibility study (PFS) for a large West African iron ore project requiring the integration of multiple disciplines. The study involves the entire mine and all necessary infrastructure, including a heavy haul railway or concentrate pipeline running from the mine to the coast. It also encompasses materials handling, power and water supplies, as well as a new bulk handling coastal port. UK-based URS is the lead consultant and project manager, managing its teams of in-house experts as well as two subcontractors.

The scope of work involves: mine planning; mine waste management and tailings storage facility design; beneficiation, processing and optimum product selection; logistics, including road/ railway and/or slurry pipeline options and a bulk handling port; utilities and support infrastructure, which includes electrical supply, water and site accommodation; supervision and integration of environmental and social impact assessments; market analysis; risk assessment; capital and operating cost estimation; financial modelling; and variance analysis.

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Mine and processing design

UK consultants offer the full range of mine design services – from the design of underground or open cast mines through processing and beneficiation to the full range of energy, waste, water and other services supporting mine operations.

UK mining engineers possess the full range of geological and engineering capabilities to perform front end engineering design (FEED) of the mine and its infrastructure. Having established during feasibility that the mine is economically viable, UK-based consultants will develop the 3D computer models of the ore bodies and resulting mine design into pre-contract phase designs. UK geologists will provide the information required by process engineers to determine the most economic methods of processing the product of the mine, and its optimum location. And mining engineers will develop 3D CAD views of the physical structure of the mine, including how mining equipment and extraction, transport, water, ventilation, power and waste utilities will integrate.

Since processing and beneficiation in particular mines water, energy and waste management requirements, UK consulting engineers will design the infrastructure that enables the mine to operate. This may include the design of water extraction and treatment plants, power supplies, waste management treatment facilities, pipelines and equipment requirements, such as drilling, extraction and conveyors, vehicles, heating ventilation and air conditioning (HVAC), and loading. UK transportation, highways, railways and port engineers will play a key role in designing the supporting infrastructure to transport the mine's product to market and to keep the mine itself supplied.



Applying testing technologies to unlock complex ores

Early-stage ore analysis can identify the optimum approach to mineral processing

Selecting a mineral processing technique for complex ores is highly dependent upon the chemical composition and structure of the minerals. Conducting quantitative mineralogy assessments is an essential part of ore deposit evaluation. Mineralogists at the UK's Natural History Museum were contacted by Red Crescent Resources, Turkey to undertake detailed mineralogical studies to help with understanding the complex mineralogy of the unconventional ore types.

Testing technologies used by the Natural History Museum in their laboratories included quantitative phase analysis (QPA) using Rietveld X-ray diffraction methods, alongside whole rock chemical analysis and Scanning electron microscopy (SEM) microprobe quantitative mineral analysis.

Whilst the testing confirmed that the bulk of the zinc is resident in two key minerals, it was also clear that a significant amount of the zinc is present in poorly crystalline iron-oxides. The results have clear implications for processing since the choice of ammonia leaching for one of the ore-types discovered would not be able to recover zinc from another of the ore-types. However, acid leaching could recover zinc from all three of the minerals.

Mine development, construction and operation



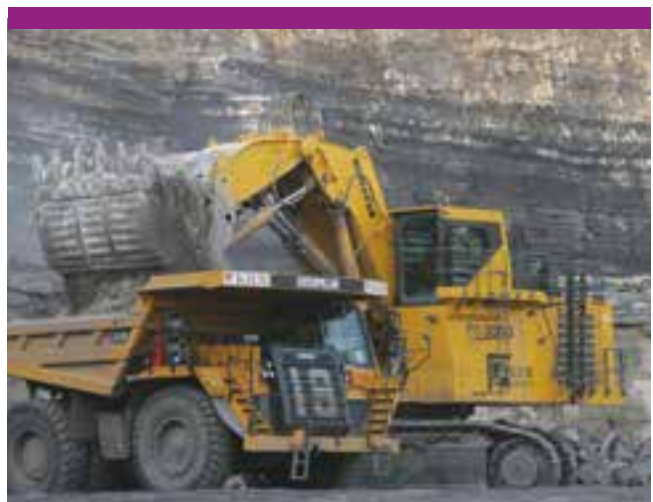
Mine construction and operation

The UK offers world class contracting services for the construction and operation of mines. UK contractors' capabilities span the entire supply chain, enabling them to design, build, operate and close mining operations on behalf of mine owners.

UK contractors employ state-of-the-art operational planning and vigorous cost control processes as part of their integrated mine design, construction and contract management systems. They have significant experience of developing and working within strategic partnerships, both to add value and manage risks. These strategies enable UK firms to offer integrated turnkey projects that combine mine and infrastructure construction and mining capability, whilst minimising programme and operational risks. Strong relationships developed with international equipment manufacturers and suppliers further support the ability of UK contractors to deliver individual solutions for mining projects worldwide, providing outstanding technical excellence and commercial competitiveness. UK firms run in-house learning and development centres that train local employees in the construction and operation of mines to international standards.

These advanced operating procedures enable UK contractors to ensure mine construction project milestones are successfully delivered, while helping mine owners and operators meet health, safety, environmental and social obligations.

UK firms have a strong track record of developing strategies and processes to deliver cost-effective solutions to mining developments in a wide range of challenging environments. This includes significant experience of delivering affordable infrastructure projects required to support mine operations and providing innovative solutions that ensure development of marginal mining deposits in traditionally high cost environments.



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UK contractors have been operating globally for many years, and have a vast amount of experience in those areas of the world where today's new mines are located. Their ability to compete in the global market gives comfort that they are efficient and competitive, whilst retaining their reputation for quality and programme compliance.

The scale of mining infrastructure projects and the need for local content ensure that UK companies often develop local partnerships. The inclusion of UK contractors allows delivery of rigorous value engineering solutions that cut costs while still delivering value.

Effective operational planning, monitoring and proactive management enable UK contractors to remain competitive in global markets, whilst still complying with tough legislative and environmental controls.



Delivering mine design, construction and operation, plus economic benefits in remote desert regions

Operating the Al Jalamid Phosphate Mine in Saudi Arabia

The Al Jalamid phosphate mine is the first major opencast mining project in Saudi Arabia. It has reserves in excess of 800Mt and a production output of 12Mt of phosphate per year. The mine covers approximately 33km² and is located in the Al Hamad Plain region of Northern Saudi Arabia, over 1,500km from the nearest industrial centres.

UK-based engineering and construction contractor Kier Construction (Kier) is a partner in the Saudi Concessions Company Limited (SCCL) which is operating the Al Jalamid phosphate deposit for Ma'aden, the Saudi Arabian state-owned mining and mineral holding company. SCCL provides a complete mining service, including design, operational mine planning, construction of mine infrastructure, and environmental mitigation measures. The contract involves the excavation of over 180Mt of waste rock and phosphate ore, together with the construction of a tailings storage facility, wadi protection embankments and a crusher access ramp.

Kier's expertise was instrumental in the establishment of self-sufficient mine infrastructure, including accommodation developed with 'human factors' as a priority, in this remote and hostile environment. The mining camp includes fully equipped, modern workshop facilities capable of undertaking major mechanical overhauling of the mobile plant as well as routine maintenance, along with a fabrication shop and comprehensive stores facility.

In addition, SCCL has introduced Kier's fully integrated management systems, based on UK standards, to ensure that health, safety, quality and environmental issues are fully addressed. It has also developed an in-house Learning and Development School providing training based on UK-accredited National Vocational Qualifications (NVQs). This provides access to significant employment opportunities for the local workforce, previously un-skilled in mining operations, bringing jobs and wages to a desert area and supporting the economic ambitions of the region.



Programme and project management

UK-based consultancies, cost consultants and project managers deliver solutions to add value in the ‘design, build and operate’ lifecycle. This is essential, as miners around the world are under increasing pressure to optimise capital, reduce costs, improve productivity and increase profitability, whilst cementing stakeholder relationships.

Mine projects are capital intensive, long term and complex. They often have extended and disparate supply chains, and are often managed at arm’s length from corporate headquarters. Each of these factors is a potential major contributor to mining development delays, cost overruns, scope and engineering creep, increased risks and deteriorating stakeholder relationships. However, by adopting best practice project management and operational efficiency frameworks, as developed by UK specialists, miners can ensure they continue to operate competitively.

Within the operational cycle, UK asset strategy consultants, cost consultancies and project managers offer a range of services that deliver greater certainty, reduce risks, improve operational efficiencies and underpin credible stakeholder relationships. With their breadth of experience and scope of operations, professional service firms based in the UK enable miners to benchmark their operations against industry norms to identify areas for improvement.

Alongside programme delivery focused services in mine design and build – estimating, cost control and schedule management, UK-based companies can assist with and ensure supply chain optimisation, operational efficiency and compliant reporting.

Increasing commercial confidence and clarity through cost and contract reviews

Bridging the gap between the EPCM contractor and the client

Norwegian metal alloys producer Elkem AS Foundry Products Division engaged a Chinese state-owned engineering, procurement, construction and management (EPCM) contractor to complete a 72,000m² expansion of its foundry in Nigxia Province, China. Using EPCM as a procurement model is unusual in China, and Elkem commissioned Turner & Townsend’s UK-based mining and metals division to provide estimate peer review and contract related services to increase commercial confidence and contract clarity.

The project entailed providing cost management and cost saving services to review estimates provided by the contractor and to work with Elkem’s Oslo-based technical team on value engineering projects. The scope of Turner & Townsend’s work grew to encompass alternative procurement strategies, contract drafting, value engineering and taking ownership of the contractor’s formal estimates. The client benefitted from greater clarity and confidence in making investment decisions, choosing procurement strategies and understanding contracting risks.

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Improve relationships and performance within the capital projects supply chain

Advising a global mining major on its framework arrangements and project contracts with international consultants and contractors

To help deliver mining projects faster, more effectively and with all stakeholders' interests considered, award winning international law firm Pinsent Masons helped one of the mining majors work better with its key capital projects suppliers. This was achieved through drafting and negotiating framework relationship agreements. These included an option to use pre-agreed contract templates as the basis for contracts for specific projects. The frameworks covered the full range of works and services, ranging from concept study, pre-feasibility and feasibility study contracts, to full engineering, procurement, construction and management (EPCM) services plus construction and erection works.

The framework arrangements enabled the client to secure the best skills, services and personnel from some of the top international mining consultants and contractors. It also provided the consultants with insights into the client's pipeline of projects, working processes and best practices. Pinsent Masons carried out training workshops for the client and consultant teams and provided ongoing project management support on the implementation of project-specific contracts. This helped ensure the relevant contract tools and best practices continued to work well at an operational level.

Processing

The UK's processing and refining capabilities include project management, design, plant construction, operation and process control capabilities. These are supported by a world leading processing and refining equipment supply chain, alongside advanced testing facilities, safety best practice and the effective marketing of the processed output.

UK companies are able to deliver across the entire processing lifecycle, starting with ore testing and evaluation capabilities to determine the optimal beneficiation processes and location, followed by the design and construction of processing plant and facilities. UK metallurgists are leaders in conventional mineral processes, such as flotation, carbon in pulp and carbon in leach (CIP/CIL), as well as roasting. Innovations developed and employed by UK firms include hydrometallurgical technologies, pressure leaching, and solvent extraction and electrowinning (SX/EW).

Services include first stage scoping and feasibility studies, through to engineering, procurement and construction management (EPCM) as well as lump sum turnkey (LSTK) project execution.



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The mineral processing supply chain delivers services that include the design, supervision, and quality assurance and quality control (QA/QC) of metallurgical sampling and test work programmes. UK consultancies and engineers develop and use software for process design, monitoring and control applications. These include mass and energy balances, steady-state and dynamic process simulation, equipment configuration and costing, and plant monitoring and management.

UK know-how and technologies offer advanced processing techniques, allowing many previously mined out areas and sub-economic ores to be re-evaluated for extraction and processing, enabling the mining of old tailings.

Design, construction and operation of the world’s largest gold processing facility on the ‘gold coast’ of West Africa

A West African gold miner turned to engineering consultancy AMEC to undertake a major engineering, procurement and construction management (EPCM) contract for a sulphide gold project. The project lasted over two years and AMEC delivered a range of services that included process design and start-up investigations, construction management and commissioning of a complex world class gold processing facility. The plant was larger than any of its type built anywhere in the world and the complexity of the process flow sheet was also groundbreaking. Commissioning was achieved on time and to budget and plant recoveries proved better than the specified design parameters.

The extensive use of the world’s largest slurry tank agitators of their type, working in tanks containing highly acidic and dense fluids, required high levels of pH and temperature control. The tank design had to take account of torsional vibration, corrosion and settling/solidification issues. It also required the capacity to install and maintain large components that were critical to operational success.

Successful gold processing plant upgrade achieved with minimal downtime to expand capacity by more than 150 per cent

Expansion of the Black Fox Mill Complex in Ontario, Canada

When Apollo Gold’s (now Brights Gold) gold processing facility, the Black Fox Mill Complex, wanted to increase its processing capacity of 800t per day, the miner commissioned GBM Minerals Engineering Consultants to design, construct and project manage the expansion. The initial stage was a review of the existing facility equipment and processing capacity. This was followed by an engineering, procurement and construction management (EPCM) contract, including project scheduling and cost control, to increase existing plant capacity from 800 to 2,000t per day.

The expansion required extensive redesign and modifications to the existing plant through the entire gold processing cycle. The original plant’s crushing, milling and classification stages were upgraded, alongside the leaching, carbon in pulp/carbon in leach (CIP/CIL) and elution processes. Expanding capacity also required up-rating the plant’s utilities, reagents supply and tailings processing.



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Waste Management

UK capabilities in mining waste management, processing and treatment are world class. To meet the challenges associated with mine development and operation in difficult terrains under all climatic conditions, UK firms deliver permitting, design, operation and subsequent closure of mine tailings, mine waste and associated water disposal/management facilities.

Solutions to mining and process waste management are tailored to deal with a wide range of factors. These include the receiving environment, safety and stability, plus appropriate and sustainable land and water management. UK consultancies work under established international standards and codes of practice to design process tailing impoundments and dams, waste rock dumps, and hazardous/toxic special wastes facilities, specifying the appropriate management and monitoring regimes.

UK firms also deliver the associated technical services to support mining waste management designs, including geotechnical, seismic hazard, hydrological, rheological and geochemical assessment. A specific UK strength is deep sea mine tailings placement, where UK firms are among the global leaders in the development of environmental management solutions that allow deep sea mine deposition to be considered. All designs undertaken by UK companies ensure that final decommissioning, closure and landform restoration can successfully deliver a long term environmentally safe solution.

UK companies are world leaders in designing solutions that are protective of environmental resources, such as surface water, groundwater, air quality, flora, fauna and soils, while undertaking risk management and assessment to ensure solutions meet and exceed health, safety, environmental and community criteria.



Waste management solution for gold mining and processing operation

Integrated engineering, social and environmental designs to manage mining waste in Sierra Leone

The Baomahun Gold Project in Sierra Leone, operated by Amara Mining, is designed to extract approximately 2Mt of gold ore from a single large open pit each year. The mining project will use conventional blasting and truck-shovel operations to recover gold-bearing ore. Processing will take place within a carbon-in-leach (CIL) gold plant, which in turn will discharge waste tailings to a nearby tailings management facility (TMF).

UK-headquartered engineering consultancy AMEC was commissioned by Amara Mining to undertake siting studies and preliminary level designs for potential TMF sites. Once the pre-feasibility study was finalised, AMEC was subsequently instructed to develop a feasibility study of the selected TMF site, water storage dam (WSD), roads, pipelines, the waste rock dump sedimentation control system and associated works, covering a 20Mt project. AMEC is also addressing the environmental and social management issues for the project according to international standards and best practice.

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Developing a policy framework for the management of deep sea mine tailings placement (DSTP)

Marine environmental impact assessments underpinning new guidelines for Papua New Guinea

Papua New Guinea and its surrounding islands and chains feature significant mineral resources which include gold, silver, nickel and cobalt. As part of its strategy to build on its existing mine regulatory framework, Papua New Guinea's Mineral Resource Agency was seeking to develop guidelines for the management of deep sea mine tailings placement (DSTP). The Papua New Guinea government commissioned UK-based environmental consultancy and survey services firm SRSL to conduct marine environmental impact surveys of the Lihir, Misima and Basamuk mines.

Based on the survey findings, SRSL developed a set of general guidelines of DSTP waste management. SRSL's General Guidelines have now been accepted by the Papua New Guinea Department of Environment and Conservation, as well as the Department of Mineral Policy and Geohazards. The company has since been commissioned to develop specific regulatory guidelines for several individual mines in the country.

Energy

Sustainable energy solutions for mining delivered by UK firms include assessment and application of the latest renewable and energy from-waste technologies, and provide local employment, knowledge transfer and an energy infrastructure that remains when mining stops.

The UK is an acknowledged global leader in the creation and utilisation of innovative and sustainable energy, power generation, transmission and distribution technologies and services, including renewables. Mines cannot function without a secure energy supply for extracting, processing and transporting the product of mining. UK companies are highly experienced at all aspects of energy design and supply for mines and mine operations.

As mining operations delve ever deeper and are found in increasingly remote locations, the cost of power becomes an increasing overhead. To meet these challenges UK firms have developed unique generation and distribution technologies, including energy management, renewable and energy from waste solutions. Renewable power can supplement base loads with wind, wave and biomass embedded energy solutions, utilising local resources or waste streams for fuel, such as coal methane, biodiesel and discarded coal.

The UK's energy supply chain delivers equipment and technologies at every stage of the energy lifecycle. These include power plant components such as boilers, turbines and condensers, energy management and control technologies, transmission and distribution, including switchgear and cabling, alongside intelligent energy management, energy efficiency, safety and software solutions. With one of the most liberal energy markets in the world, UK consultants and law firms contribute unique expertise in energy market structure, regulation and pricing to emerging energy markets, including where mine operators act as independent power producers.



Increasing energy efficiency and reducing greenhouse gas emissions by converting coal mine methane into power

Mitigating the environmental impact of the world's largest coal mining industry

China has the largest coal mining industry in the world. As mining techniques become more advanced and coal production rates increase, coal bed methane and coal mine methane gas production is increasing. Energy and environmental consultants H&E-E&C carried out an extensive gas resource assessment across a mining group in Shanxi Province with coal production volumes in excess of 100Mt. This required the UK-based consultancy to deliver a gas resource assessment, process safety design, gas extraction plant design and power plant design.

The resulting gas utilisation installations for power and heat generation have a capacity of 75MWe using spark ignition reciprocating gas engines with electrical efficiencies in excess of 40 per cent. This mitigates greenhouse gas emissions by more than 1.9Mt of CO₂ equivalent per year. Embedded electrical power from waste mining resources also reduces the cost of mining and delivers greater security of electrical capacity.

Power from waste: low-quality discard coal fired plant to provide energy security for mining operations

Miner commissions power station to become Independent Power Producer (IPP)

Global miner Anglo American was developing a 450MW discard coal-fired power plant in South Africa's eMalaheni region. The objective was to provide energy security and price stability for Anglo American's extensive platinum mining operations in the region. The power station was planned to operate as an Independent Power Producer (IPP) under a build-operate-own arrangement with Anglo American providing land, fuel and power. This created numerous technical, legal and energy-trading challenges.

UK-based multidisciplinary consultancy Mott MacDonald was selected as technical adviser to Anglo American for the project's development. Their role started with the site and technology selection and a feasibility study for the plant. This included fuel availability and route analysis, a financial evaluation and modelling. Mott MacDonald's extensive power sector capabilities also enabled them to assist with developing project tender documents and an effective engineering, procurement, construction and management (EPCM) contractor evaluation methodology.

IPP use of South Africa's transmission system and pricing and market strategies are relatively uncharted territory within the country's energy sector. Mott MacDonald's extensive experience in the power generation field was invaluable for negotiation with the transmission system operator on connection arrangements and pricing.



Withdrawn 17 May 2019

Water



Mines and mineral processing cannot function without water. Sustainably managing water use within mining operations is vital to mitigate environmental and social impacts. UK consultancies provide the expertise alongside UK-based water technologies companies to deliver water management solutions across the entire mining lifecycle.

Water is often a scarce resource in mine locations, and can be expensive to use. UK firms have addressed this challenge from two directions: by creating water efficient processes and treatments alongside creating mining camps and mineral processing plants designed to minimise water use and maximise reuse.

UK engineers and companies design and operate world-class water management systems that optimise the efficient and sustainable use of water for mining operations, often leading to zero discharge from mine sites. UK expertise starts with exploration equipment, groundwater surveys and developing subsurface water models based on drilling, borehole and water testing technologies developed by UK companies.

The water management solutions delivered by UK firms utilise processing, purification, pipeline, pump and actuator technologies that sustainably and efficiently extract, transport, purify, process and treat water and wastewater used in mine operations. UK-based companies fabricate the tanks, baffles and pipelines used in water and mineral processing, and the UK leads the world with advanced water purification and wastewater treatment plants, such as desalination and reverse osmosis that minimise impact on the environment and local communities.



Withdrawn 17 May 2019



Integrated water management strategy generates 17,500MI of water savings

Measures to improve water use efficiency at Australia's Olympic Dam mining centre

In production since 1988, BHP Billiton's Olympic Dam mining centre is Australia's largest underground mine, the world's largest uranium resource, the fifth largest global copper and third largest known gold deposit. It is located 550km north west of Adelaide in an area featuring internationally recognised rare and endangered animal and plant species. As a result, the mine's water consumption must not affect other users or the region's natural springs. Water for the mine is extracted from the Great Artesian Basin (GAB), which is seven times saltier than seawater. BHP Billiton monitors natural spring flows and ecological communities along the margin of the GAB to assess how water transmits to the GAB's springs.

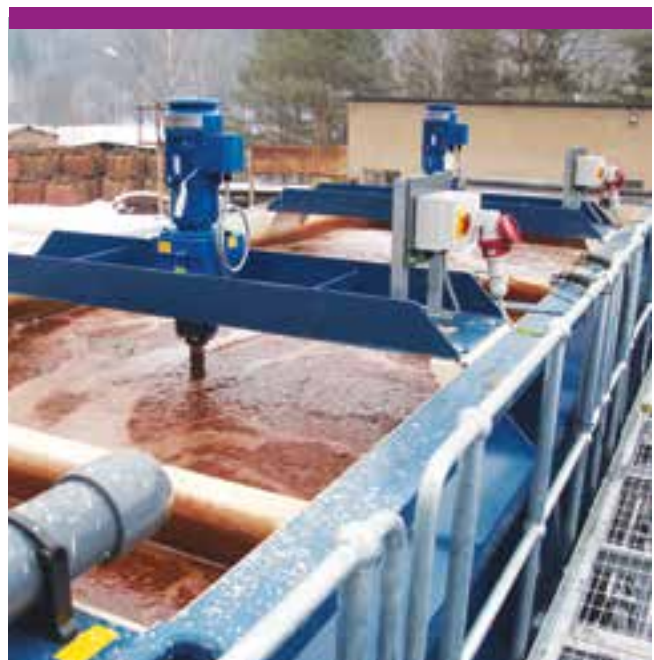
The miner has implemented a water efficiency strategy to reduce water use. Measures include substituting high quality water with saline groundwater for dust suppression and improving coverings to limit evaporation from open water storage. Additional efficiency activities include helping landowners to rehabilitate flowing bores and improving pipeline networks. BHP Billiton's water efficiency strategy has saved 17,500MI per year. This has been achieved through a combination of projects, which include industrial processing water efficiency, shutdown of free flowing bores on pastoral land and improved management of flowing bores.

A single solution for mine dewatering and operational water treatment

Rehabilitation of water contaminated through acid rock drainage with metal leaching

To rehabilitate and reopen the Maria mine in eastern Slovakia to enable it to access newly defined silver and copper reserves, Global Minerals understood that controlled dewatering of the mine would be key to successfully developing the project. Poor water quality is in part due to the formation of acid rock drainage with metal leaching (ARDML) that has developed within the mine's existing workings. The Maria mine contains a high-grade silver-copper-antimony vein-type deposit in an historic mining district, and the ARDML is associated with the exposure of the sulphide mineralogy to air and water by mining activities.

Global Minerals approached UK-headquartered SRK Consulting for a solution and, working with UK equipment company Siltbuster Process Solutions, the firm provided a robust and rapid solution to the water treatment issue. After an initial site visit by SRK to discuss the issues within the mine, Siltbuster Process Solutions then provided an operational water treatment plant. This is not only designed for the rehabilitation dewatering programme, but will also serve as an ongoing water treatment plant for the life of the mine.



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Infrastructure: roads, railways, ports, pipelines and support services



UK engineers and contractors have the advanced capabilities to design and construct the entire infrastructure needed to support mining – from transport, civil engineering, utilities and mine facilities to housing and the built environment.

Mining operations are increasingly found in remote locations that require the infrastructure to be built before the mine can begin production. UK contractors are expert at planning and building transport infrastructure, such as ports, roads, railways and airstrips. UK civil engineers design and construct the bridges, embankments, cuttings and tunnels that enable the transport, utility and pipeline infrastructure to be created.

Alongside the mine itself, UK contractors can build the utilities required to support mining operations, such as power, water treatment and sewerage plants, pylons and pipelines and features such as sewers, ponds and lagoons. UK firms deliver all of the essential components of the mining camp, which include offices, laboratories and workshops, and sustainable towns with housing and recreational facilities.

The UK infrastructure supply chain also manufactures many of the vehicles, rolling stock, equipment, software and systems required for mining infrastructure to operate at its peak.



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Creating an outline design and specification for design, build, operate and transfer (DBOT) coal transportation

Designing transportation solutions which move coal reserves from mine to market

Mozambique's Moatize Coal Basin in the remote Tete Province lies over 1,200km from the nearest potential deepwater export facility at the port of Nacala. UK multidisciplinary consultancy Mott MacDonald was appointed by mine operator Eurasian Natural Resources Corporation (ENRC) to prepare an outline design, build, operate and transfer (DBOT) contract to transport the coal from the mine to a new export facility at Nacala.

The project comprises a 1,200km heavy-haul railway system from a new coal loading yard at the mine to the new coal export terminal at the port. The project includes all materials handling systems and facilities required to load the rail wagons and move coal from the rail wagons to the stockyard, as well as new port infrastructure necessary for delivery of coal to ships. In addition, Mott MacDonald specified, procured and supervised surveys and investigations for the project. This required commissioning geotechnical investigations, LiDAR (Light Detection And Ranging) mapping, plus bathymetric and geophysical surveying.



Remote installations use renewable energy source to power essential pipeline emergency valves

Solar powered actuators for slurry pipeline in the Chilean desert

The Atacama Desert in north-east Chile, one of the world's most arid, inhospitable and remote locations, is traversed by an 80km pipeline owned by the mining company Compañía Minera del Pacifico SA. The pipeline carries iron slurry from the town of Copiapo to the port of Caldera, from where it is exported. The mine operator was seeking actuators with an independent power supply to operate vital emergency valves in the slurry pipeline. In response, award winning UK equipment supplier Rotork developed solar powered electro-hydraulic valve actuators.

Rotork's actuators have been installed at the emergency plant centre, halfway along the pipeline and in the middle of the Atacama Desert, where the annual rainfall is 12mm and the ambient temperature fluctuates between -15°C in winter and +40°C in summer. As a result, the actuators are protected by a waterproof, dustproof and explosion-proof enclosure. They also feature built-in configuration, diagnostics and fault indication systems. The self-contained actuators operate from a 24v DC supply, enabling an efficient, economic and environmentally friendly solar powered battery system to be used.

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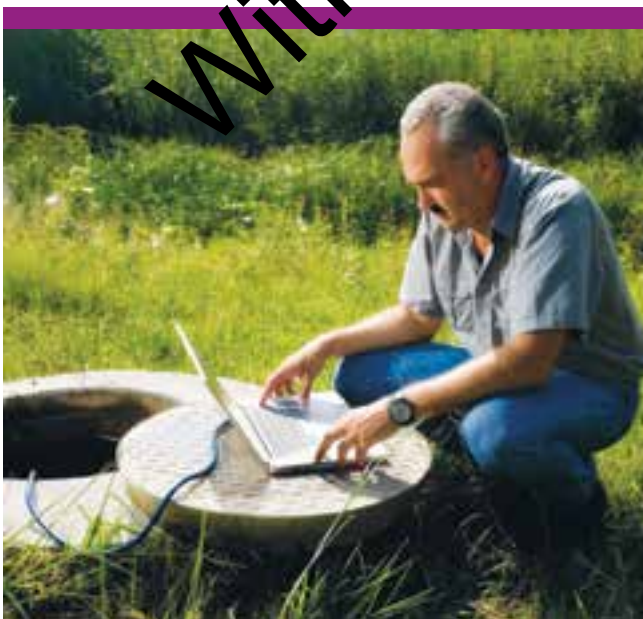
Monitoring and testing

UK companies have the advanced know-how to deliver technologies and software to support the environmental monitoring of mine operations throughout their lifecycle.

Environmental monitoring covers a broad spectrum, including air, ground and surface waters, soil, dust, noise and weather. Planning, monitoring, sampling, testing, validating and interpreting data to meet mining and environmental permit requirements can be challenging.

The UK features leading environmental testing laboratories that offer highly specialised expertise. Interdisciplinary teams of minerals processing engineers, chemists and mineralogists, supported by the latest test facilities, equipment and techniques, deliver test services spanning the entire range of mining requirements. UK-based testing houses can rapidly process samples from the field to support due diligence and feasibility studies. UK supply chain companies manufacture monitoring and testing equipment for use in laboratories, in the field, in mines and in processing plants.

The rigorous Monitoring Certification (MOC) Scheme run by the UK Environment Agency ensures that monitoring equipment has been professionally assessed and is fit for purpose. This scheme extends from monitoring equipment through to monitoring data management systems.



Software delivers worldwide improvement in management reporting

Introducing environmental compliance software that plans, then processes, validates, interrogates and reports on all monitoring data

Rio Tinto's Diavik Diamond Mine in Canada's Northwest Territories had operated an off-the-shelf data monitoring software programme that failed to fully capture relevant data and lacked the functionality required of a large mining company. Diavik needed a system that could handle an ever-increasing volume of data and offer additional benefits of flexibility and ease of use.

They selected UK-based EHS Data's Monitor Pro Enterprise system for its comprehensive suite of features. The software includes the central admin and technical tool, MP-5, the browser based MP-Web application, MP-Field for remote data entry and validation, and MP-Link, to automatically import emailed data. Diavik has consolidated its core environmental data into one central system and uses the increased functionality of the Monitoring Scheduler to plan and manage monitoring requirements. Its MP-Field software allows the mine's technicians to collect onsite quality-checked readings on mobile devices to directly upload them to the Monitor-Pro database. A comprehensive custom internal monthly report template has been provided which is fully automated, and will save considerable time whilst improving consistency and quality.

Monitor Pro is widely used worldwide within the mining industry, and at other Rio Tinto sites in Madagascar, South Africa, and Namibia and India.



Equipment

The UK's mining equipment designers and manufacturers deliver world-leading products across the entire mining lifecycle. At every stage of a mine's planning, construction, operation and closure there is a UK firm providing equipment.

UK companies supply surveying, drilling and testing equipment, electronics and software used during the exploration, feasibility and development of a mine. During construction, tunnelling and mining machinery, excavators and earth-moving equipment are powered by technology delivered by UK suppliers. Mine operations depend on UK-developed heating, ventilation and air conditioning (HVAC), power supply and transmission, water supply and monitoring equipment, sensors and software. The UK is also the base for many mine safety equipment manufacturers, ranging from those providing basic anti-slip solutions to sophisticated explosion-proof instrumentation.

Mine processing plants and logistics are supplied by UK-developed high-output engines, conveyors, gearboxes and actuators. UK companies supply construction and facilities management equipment for the smooth running of mine infrastructure, including transportation, offices, housing and recreation. The UK is a world-class provider of environmental services, which include those for site remediation and clean-up, the supply, recovery and disposal of fine and industrial chemicals, and associated monitoring equipment and instrumentation.

Ultra low noise conveyor gearbox to meet demanding operating and environmental protection requirements

Getting solutions utilising innovative design and materials selection

The transportation and processing infrastructure supporting a mining operation and its logistics can be noisy, potentially involving conveyors, crushers, pumps, pipelines and other machinery. Mine operations are subject to tough environmental regulations, which increasingly include noise pollution controls. South Western Australia's Port Waratah Coal Terminal, like many other mining operations, is subject to strict Environmental Protection Authority (EPA) conditions. The terminal's operator chose UK headquartered equipment manufacturer David Brown to develop conveyor gearboxes that could operate within local noise control regulations.

The result was the Stealth Drive, developed as a result of David Brown's deep understanding and decades of expertise in engineering, designing and servicing extremely quiet, mission-critical military submarine gearboxes. The holistic approach taken by the design was based on eliminating the casing resonance, dampening and transmission reduction and containment. At Port Waratah and at Gladstone Coal terminals there are now more than 40 David Brown Stealth Drive gearboxes successfully installed and now well proven having been in operation for ten years.

David Brown has now taken the technical developments concepts used in the Stealth drives and built those features into its new CX conveyor design, delivering world leading low noise operation as standard.

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Driving force behind heavy haulage and excavation in the global mining sector

High-output engines able to perform under extreme conditions

Haul trucks and excavators must consistently perform under the most extreme conditions, working continuously on mining operations in a range of harsh environments. Over a third of the largest haul trucks and excavators operating at mine sites around the world are powered by Cummins engines.

Cummins UK's high-horsepower plant produces over 2,000 highly specialised engines each year and 98 per cent of production is exported. The mining equipment engines built at the UK facility range in size from 38 to 78 litres in displacement with up to 3500 horsepower output (2610kW). Customers include leading global mining original equipment manufacturers (OEMs), and the firm also supplies to major national equipment manufacturers around the world, including in China, India and Russia.

With 1,200 highly trained employees, Cummins UK's factory is an internationally recognised centre of engineering excellence, producing highly robust engines capable of working in 24/7 operations under high load factors and at high altitudes.



Distribution and logistics

The UK's outstanding logistics firms assess, plan, finance and implement mining and distribution transport requirements – from the construction of the mine, through movement of bulk materials within the mine to delivery to domestic users.

UK firms have gained unrivalled expertise at overcoming logistics problems, helping mine operators and their downstream supply chains overcome unique and complex challenges. The UK's advanced logistics capabilities cover: operating in remote locations; varied freight and haulage requirements; the need to optimise transport assets and resources; secure transportation; and the identification and management of risks throughout the process.

Logistics expertise is needed even before the construction phase, to assess key risks, plan the logistics needs of the mine operations, and to identify and obtain financial support. UK companies typically conduct in-depth transport option assessments, reliability reviews and threat assessments for people, processes and system at every stage of mine development.

As mines become more remote, UK businesses help bridge the gap from the site to the refinery. Customised delivery plans and secure operations procedures move beyond just the physical shipping of goods. The breadth of service and global supply chain links of leading UK logistics businesses now make it easier for operators to deliver valuable minerals and materials safely and on time.

From proactive risk assessments, insurance cover and customs clearances, UK businesses deliver dynamic global secure transportation solutions. And UK expertise is applied globally to integrate rail and port operations, and to deliver environmental assessments and advice, on-site planning and mineral supply chain management.

The UK's world-class service providers also have advanced capabilities in: rail and road haulage; conducting assessments of existing rail and road infrastructure networks; undertaking assessments of rail logistic options, train path costing/least cost routing; operational planning; operation; and fleet management.



UK firms provide leading expertise in port operations and assessment of operational logistics, including consultancy services for projects, port and freight terminal integration

Mining logistics involves much more than moving minerals from the mine to the customer

The importance of international standards in gold transportation

Each step in the logistics chain is governed by international standards. The transportation of gold, in its pre or post-refined form, is a highly sensitive operational task given the potential threats when carried over often considerable distances. A World Gold Council (WGC) standard covers the mine itself, London Bullion Market Association (LBMA) guidance covers the refiners, and the Responsible Jewellery Council (RJC) regulates the refinery's downstream markets.

Furthermore, mine owners and their logistics partners must consider the Organisation for Economic Cooperation and Development's (OECD) due diligence guidance for responsible supply chains of minerals from conflict affected and high risk areas.

UK-based G4S International Logistics is responsible for transporting early stage gold ore from a mine in Mali to a refinery in South Africa to be further refined. The logistical requirements are unique to each mine and can include a combination of all or some of the following components: armoured vehicle, helicopter, charter and passenger aircraft, customs brokerage and vaulting. Outside of the mine operator's own initial risk assessment and due diligence, G4S must apply industry standards around conflict areas and take into account the associated chain of custody when looking at the transportation of such high valued goods. These key considerations are vital to transport gold ore while ensuring that the chain of custody can be independently audited and verified.

Health and safety

UK firms are acknowledged leaders in supplying safety products, services, systems, software and training encompassing the entire mining lifecycle to the international mining sector and supply chain businesses.

The UK's mining sector has a long history which has led the development of health and safety systems and procedures adopted globally in open-pit and underground mining operations. The sector's history has bred an outstanding safety culture that is embedded throughout the UK mining industry, and which UK companies adopt when operating internationally.

The UK safety supply chain, featuring specialist suppliers of safety equipment to training organisations and research establishments, supports and consults on projects located worldwide throughout the project life cycle. In addition to technology based safety solutions, UK companies also provide the full range of basic but essential, mine safety solutions, such as personal protective equipment, safety signs, ventilation systems, specialist tapes and anti-slip products. Innovative safety-in-design processes are applied during the engineering study and design phases to integrate safety systems, legislation and best practice suitable for local conditions.

Partnering with UK mining safety and health consultants on technology, engineering, basic products, systems and training can help ensure mining companies develop, deliver and operate to the highest standards.

Her Majesty's Inspectorate of Mines was established in 1843 to investigate working conditions in the mining industry. The UK continues to be a world leader in mining health and safety.

Reducing explosion risk whilst improving gas extraction efficiency

Knowledge transfer improves safety in Kazakhstan's coal industry

Kazakhstan has extremely gassy coal seams with high outbursts potential, presenting a significant health and safety risk to coal mine operators. At a coal mine in the Karaganda Region, UK consultancy HEL-East carried out an analysis of geology, mining production methods, ventilation and current gas drainage methods.

As a result of its initial findings, new post mining gas drainage techniques were designed that applied UK practices and new lightweight drilling equipment with high efficiency bits to improve gas capture efficiency and underground safety. HEL-East's underground engineers trained local engineers in drilling and gas management techniques. This introduced a greater technical awareness among the mine personnel, which resulted in reduced risks.

Alongside the health and safety knowledge transfer, the mine's productivity was improved by achieving higher capture efficiencies with great continuity. This directly reduces the likelihood of underground explosion. The practices introduced by HEL-East are now spreading across Kazakhstan's mining districts, where the techniques are appropriate.



Withdrawing 17 May 2019



The UK offers considerable technical expertise in all aspects of mine closure and associated land remediation and restoration to international standards. UK companies are experts in the concept of mines being ‘designed for closure’ and deriving socioeconomic benefit for post-mining communities.

The UK’s closure expertise spans: community health and safety; ground and structural stability; ground and surface water management, including acid drainage treatment; contaminated land treatment; ecological and landscape restoration; cultural heritage protection; renewable energy installations; financial provisioning for closure; stakeholder engagement; and socioeconomic regeneration.

The mining development and design practice developed in the UK follows the principle of good international industry practice. This requires a closure and remediation plan to form part of any potential mining feasibility and development study; effectively, ‘design for closure’. However, for existing and older mines closure planning may not have featured as part of the mine design, requiring closure planning and activities to be retrofitted to mines late in life. The UK’s specialist closure skills and experience are regularly applied to mining installations around the world.

Many mining economies are now adopting international standards of mine closure planning directly into their legislation, making closure planning and appropriate financial provision for closure a pre-requisite for the issue of a mining licence. Ensuring that a mine’s closure is appropriate not only for the local environment, but also for the communities affected by the closure via a robust stakeholder and community engagement process is now an intrinsic part of a company’s social licence to operate. The aim is to ensure that every mine’s closure meets the requirements of local legislation and the expectations of good international practice, wherever possible.

The UK also has an impressive track record in the socioeconomic regeneration of post-mining communities. As a result, the UK can offer world class specialisms in community and stakeholder engagement, as well as land remediation. The aim is to create a viable post-mining landscape that also sustains the socioeconomic wellbeing of local communities.

UK firms are expert at deriving social and economic benefit from mine restoration while ensuring long term protection of the environment.

Post-closure development of a china clay pit into a world renowned educational charity and tourism site

An iconic example of turning mining's legacy into a global visitor attraction

Eden Project is a successful visitor attraction and environmental education charity based in Cornwall, in the southwest of the UK. As an economic regeneration project, Eden has welcomed more than a million visitors each year and generated more than £1bn for the local economy since it opened in March 2001.

Built in a former china clay pit, Eden Project is also an ambitious landscape regeneration project, having created a global garden from a scarred hole in the ground with no topsoil. The vast, enclosed Rainforest and Mediterranean biomes are Eden's horticultural highlights and are set within outdoor temperate gardens. Eden's collections feature plants that are important for a huge range of purposes – from food to medicine, construction to bio-technology.

As an education charity, Eden Project celebrates ways in which the world supports humankind and explores how it can be looked after in return. The key message is not just about conservation, but also repairing things, re-inventing the world, working with and above all respecting nature. The Eden team has developed a unique approach to interpretation, involving a range of techniques including story-telling and hands-on activities.

Eden is continually developing and evolving, as well as spreading its influence to projects nationally and around the world. During its development and on-going operation, Eden has assembled a group of talented and committed professionals in a wide range of disciplines who are able to share their experience and expertise on other projects.



Planning and managing one of the largest owner-funded mine and plant closure programmes in the world

Delivering design, engineering and construction to close a 10,000 acre site in central Arizona

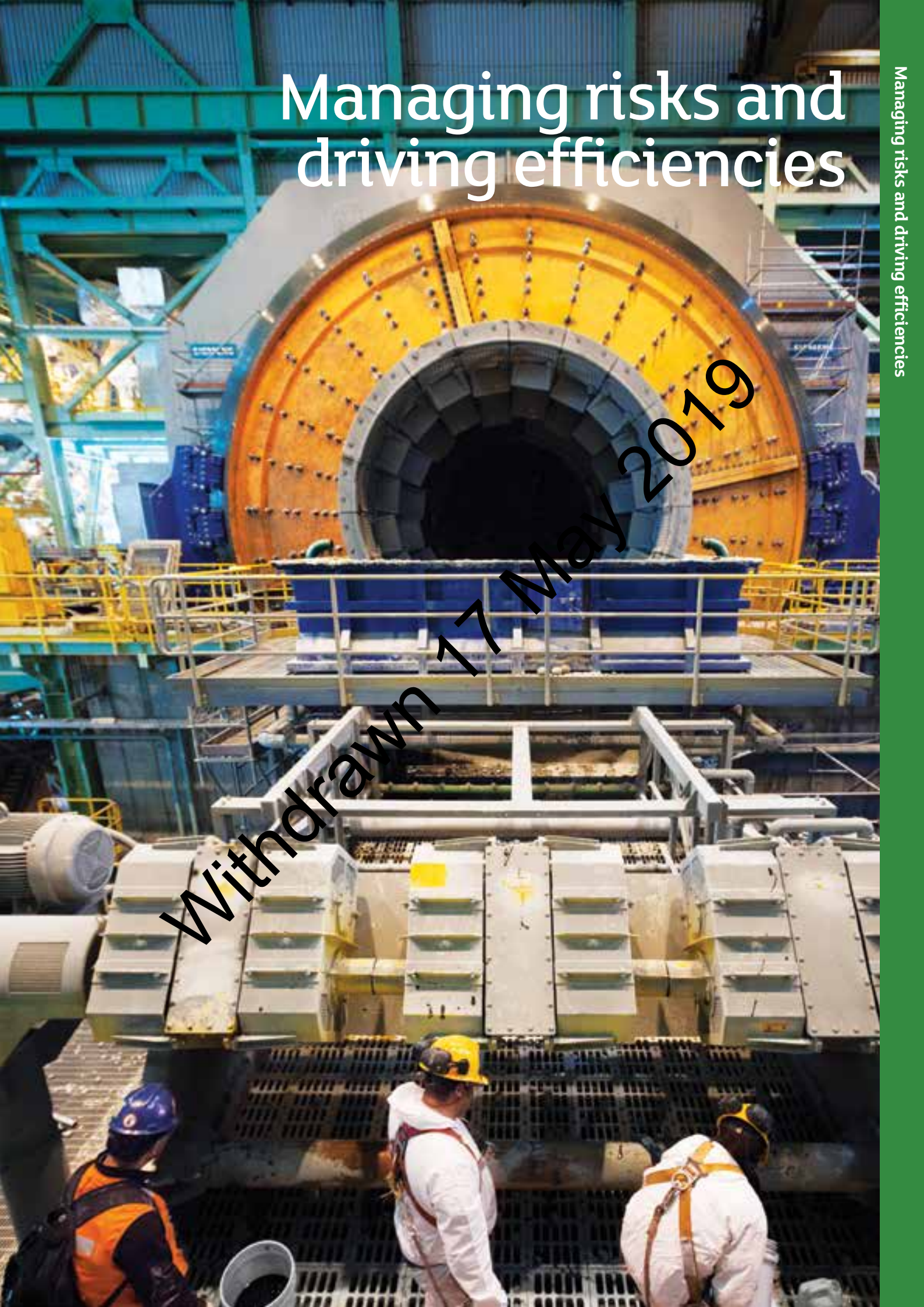
BHP Billiton's San Manuel property is a former integrated mining, milling and smelting operation located in central Arizona, USA. Mining activities started with underground block cave operations in the 1950s. In the mid-1980s, mining was expanded to include a surface heap-leach facility and an in situ leach operation. By 2004, when BHP Billiton elected to permanently close the mine and plant, the mining operation encompassed over 300 acres, the plant site operation covered about 400 acres, and the tailing storage facilities over 3,000 acres.

From 2000, SRK UK staff worked closely with the BHP Billiton project team during the critical decision phases of the project. After the public announcement of closure of the mine site in 2002, SRK provided technical support for conceptual closure planning, site investigation, and assessment of value recovery. This support included evaluating short- and long-term closure strategies, from cost estimating to preliminary designs.

Once the closure strategy was defined, SRK proceeded with detailed permitting and engineering support, and by 2005 this had advanced to the point that construction was possible. SRK provided field engineering and construction oversight throughout the two-year construction. The estimated cost of the combined closure programme totalled more than US \$200m. Over a six-year period, SRK helped BHP Billiton move from a strategic evaluation of closure alternatives to the successful, full-scale implementation of the preferred closure design.

Managing risks and driving efficiencies

Withdrawn 17 May 2019





Supporting the successful development and operation of a mine are the support services that enable mine owners to mitigate and manage risk alongside maximising returns through efficiencies.

Legal and accountancy support from the UK's world-leading professional services firms enables miners to operate compliantly and in accordance with legislation – both in their country of origin and the jurisdictions in which they do business.

Mining is a capital intensive and inherently risky activity. So UK risk engineers, underwriters and insurance firms provide miners and their stakeholders with measures to mitigate and manage risk, as well as to promote safe mining operations. To better understand the value of their assets, UK-based research and analysis companies publish timely and accurate market and trading data.



The UK offers leading academic and corporate research and development that pushes back the boundaries of mining knowledge. In addition to research into disciplines directly related to mining, the UK's research base includes world-class centres of excellence in those areas of future importance to the global mining industry. These include energy and low-carbon technologies, sustainability and biodiversity and water and waste resources management.

With such a solid base of expertise, the UK's universities and corporate providers of training and education operate across the globe delivering education and skills transfer expertise and pioneering distance learning services.

Withdrawn 17 May 2019



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Legal

UK law firms deliver policy, regulatory and contractual frameworks that shape whole-life strategies for natural resources use. They provide world class legal expertise and dispute resolution that underpins every stage – from acquisition and funding, through development and operations, to closure and post-closure.

UK-based firms advise governments, mine owners and operators, as well as supply chain companies on policy, regulatory and contractual frameworks relating to the sustainable extraction of natural resources. This includes delivering expert counsel to both mining companies and state governments in relation to acquisition, exploration and regulation of mining rights.

During early acquisition and funding phases, UK law firms advise on every step of the process: from Initial Public Offerings (IPOs), seed funding and private placings, through secondary fundraisings on the equity capital markets, to project financing during the later stages. Investors and corporate institutions receive expert guidance on acquiring interests in mining companies, projects and licences, as well as on all aspects of mining investments. With their global reach and expertise, UK firms support comprehensive tax structuring and provide negotiation expertise with the highest quality advisory skills for domestic and international jurisdictions.

Mining infrastructure can have a greater impact on the host region than the mining operations. UK-based legal experts deliver contractual frameworks for the infrastructure required, from the concept study through to the full execution of a mine's construction, and from extraction through to processing and transportation from mine mouth to port. With multi-jurisdictional capabilities, the UK's legal sector can also support complex planning permissions for new mines or extensions to existing facilities; in addition to advising mine operators on the disposal, storage and transport of waste.

Throughout the operating phase, UK law firms harness their extensive experience of advising clients on the heavily regulated UK and European regime. These include all areas of health and safety to improve risk management and client relationships with regulatory bodies. At the end-of-life closure and abandonment point, the UK's legal sector advises on all aspects of the closure and regeneration planning of closed mines. This includes dealing effectively with the relevant legislation on environmental liabilities and how to manage risk.

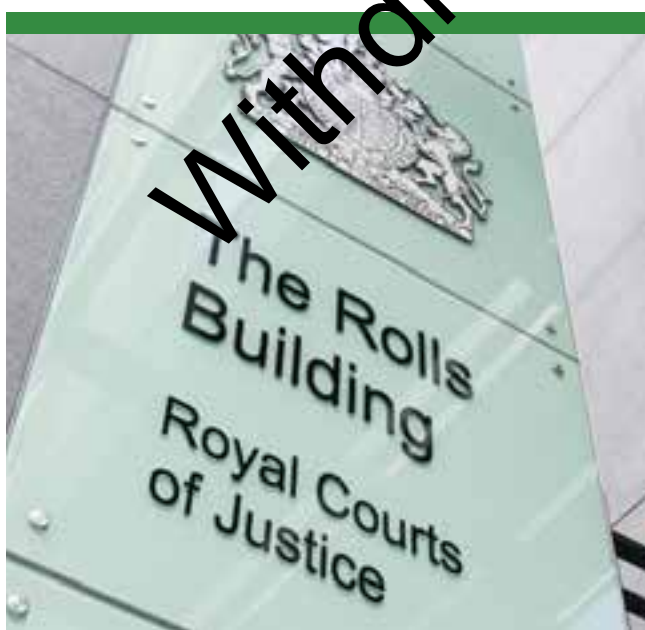
UK based barristers who specialise in advising clients on technically complex disputes are represented by the Technology and Construction Bar Association (TECBA). This includes disputes connected to the mining industry, whether in dispute boards, arbitration or in court proceedings. Their experience and knowledge of such disputes allows them to provide employers, clients, professionals and investors in the global mining sector with focused and relevant advice.

Arbitration and dispute resolution

UK law firms have long-standing and extensive experience in all forms of international dispute resolution, including international arbitration, and are positively associated with all the international arbitral Institutions. These firms are very familiar with the dispute resolution provisions in international standard forms, such as Dispute Adjudication Boards under the Fédération Internationale Des Ingénieurs-Conseils’ (FIDIC – the International Federation of Consulting Engineers) suite of international standard form construction contracts. These are commonly used in the development of mining projects.

London is a major centre for international arbitration and home to the London Court of International Arbitration. A number of law firms with their headquarters in the UK also have offices in the other international centres of arbitration, including Paris, Hong Kong, Singapore and Dubai. UK law firms are therefore well placed to export their experience from the UK to other jurisdictions.

Many UK law firms also operate arbitrations across multiple jurisdictions, with a number having dual qualified lawyers or offices in Civil Code/Sharia jurisdictions. This is invaluable to international mining companies operating projects and businesses across jurisdictions. In addition, UK law firms have extensive experience of enforcement of arbitral awards and the use of treaties in international arbitrations across jurisdictions.



Representation and due diligence on behalf of investors seeking ownership of mining assets

Advising a client on the acquisition of a stake in Eritrean Mining Assets

Zara Mining Share Company has optimistic gold reserves forecasts at its nine sites in Eritrea, which led to the China Shanghai (Group) Corporation for Foreign Economic & Technological Cooperation (China SFECO) expressing an interest in acquiring its shares valued at \$80m from listed Australian company Chalice Gold.

Award winning international law firm Pinsent Masons with offices in Shanghai and Beijing, has developed an impressive ‘outbound transactions’ track record acting for Chinese clients in Africa. So the firm was instructed to represent China SFECO in various acquisition negotiations with Chalice Gold and Eritrean government representatives.

Services supplied by Pinsent Masons included conducting legal due diligence, preparing various transaction documents and agreements, and coordinating with consultants involved in the project. The deal illustrates UK law practices’ particular strengths in advising Chinese companies in Africa on investment in the energy/mining and minerals sector.



Advisory, accountancy, tax and audit

Miners operate globally and across multiple jurisdictions, requiring professional services firms that are truly international. UK professional advisers, including accountancy practices and management consultancies, enable mine owners and the mining supply chain to operate and structure their finances compliantly within demanding governance frameworks.

The provision of finance, tax and audit services is a key UK global professional services offer. UK companies have a long record of providing additional value to the mining sector by provision of associated advisory services that help the sector manage governance and investment risk.

Mining companies look to professional advisers for support and advice across the key challenges in the sector – dealing with economic and commercial change, the regulatory environment, ensuring resilience to risk, establishing the most effective business operating model, strategies for talent management, and how to utilise the best technological resources. All of this is put in the context of a growing drive for greater sustainability, through which organisations are tackling these issues head on, managing the risks and exploiting the opportunities; not just ‘walking a good game’, but genuinely doing something positive.

Many of the global accounting, consulting and advisory firms have a base in the UK and have a long history of working with mining and natural resources companies. There is continuing pressure on the industry to maintain financial discipline, and therefore the industry is now receiving more attention from its many and varied stakeholders than ever.

The expertise, global coverage and track record of the UK’s professional services sector plays to the agendas of public and private mining companies and industry associations, providing miners with solutions that add value to their business.

UK professional services companies provide combined commercial and strategic advisory services designed to help deliver long term sustainable economic benefit to mining companies and to the regions in which they operate.

Developing human rights policies on ethical behavior, employee protection and care for the environment

Indonesian coal miner commissions human rights and social compliance audit

Indonesian coal miner PT Berau Coal (Berau) was seeking to show leadership with regard to the human rights of its employees and the communities affected by its operations. International professional services firm Mazars, which has a base in London, was engaged by the miner’s management to provide assurance on its human rights policy statement and to audit Berau’s compliance with its policies on a regular, periodic basis.

The audit project took four months, during which Mazars conducted an extensive interview process with Berau’s management team and employees to gain an understanding of company processes and procedures relating to its social performance. Employees’ facilities and working conditions were observed during site visits to the Berau head office and its mining sites.

Mazars also engaged with local communities, non-governmental organisations and other groups to canvass their views and experiences. The results of the interview process and site visits were presented in a report to Berau’s board, and included recommendations for improvement of Berau’s human rights policies implementation.

Withdrawn 17 May 2019



Delivering strategic and tactical support to develop iron ore resources

Skills and knowledge transfer to deliver long-term local capabilities

Rio Tinto’s Simandou Project and integrated infrastructure operations in Guinea will produce approximately 100Mt of iron ore each year for the Asian and European markets. The project will establish the mine, a 650 km long railway and port facility, as well as create multiple supporting value chains across the economic region. Delivered in collaboration with the Government of Guinea, Chalco and the World Bank’s International Finance Corporation, the investment is one of the largest of its kind. Once in full operation, the new enterprise has the potential to develop a revenue base of more than USD \$10bn a year, more than doubling the current GDP of the country of Guinea.

A global team from UK-headquartered professional services firm Deloitte was created to provide strategic and tactical support. This included end business operating model design, programme planning, study coordination, contracting strategy, regional economic development and contracting management advice, as well as integrated communications to joint venture partners.

Close engagement with local communities across Guinea is required ahead of the major construction works on the mine, railway and port, where the acquisition of over 6,500ha of land requires the resettlement and compensation of local communities. Deloitte has played a critical role in the delivery of the communities’ objectives. The firm has designed the operating model and organisational structure to deliver this complex land acquisition programme. It established a detailed plan, budget and cost control framework. Then Deloitte put into place a team to deliver a governance and compliance framework to manage contracts and payments for compensation and commitments to communities; this is monitored by the International Finance Corporation (IFC).

Deloitte has also provided knowledge and skills transfer to the Guinean team to ensure their long term capability to operate this robust and systemic organizational approach. All of this has helped to improve design decisions and control costs, while delivering commitments to multiple stakeholders.

Risk management and security



Risk management

The UK's risk management sector provides a world leading service, delivering analysis, insight, protection and support to manage risk. UK firms are expert at analysing and managing all classes of risk to ensure risks are minimised for all stakeholders.

UK risk management companies have the capabilities to assess and manage risk across all classes, delivering risk management solutions across areas such as technical, financial, security, operations, health and safety, and social and environmental aspects across the entire mining life cycle. They deliver both risk assessments and solutions, risk managers develop risk matrices of mine development, conduct decision and uncertainty analyses, as well as performance modelling.

UK companies deliver proactive risk management and reduction by conducting risk assessments in respect of the social and human rights impacts of their operations. This minimises the risk of disruption to local stakeholders and mining companies' operations. Reflecting the diverse nature of risks mining companies now face, UK risk management consultancies provide strategic analysis prior to investment, risk management during a project and crisis response in the event of risk materialising.



UK companies provide a deep understanding of technical and non-technical risk at each stage of a mine's lifecycle. Their analysis of risk delivers many benefits, such as cost certainty, safety and security, social and environmental benefits and higher economic returns.

Planning for and managing threats to mining personnel and assets in high-risk mine locations

Delivering an integrated risk management solution ready to respond to a crisis

A mining company in a developing West African country required help managing its security risks. It also needed assistance to manage local relationships and the local security force, tackling security challenges at the mine site, and creating contingency planning in the event of a crisis.

In response, UK risk-management consultancy Henderson Risk Limited (HRL) was commissioned to provide an integrated risk analysis and report for strategic and operational use. The report identified the miner's exposure and offered recommendations on navigating the local risk environment to produce commercially valuable results.

HRL deployed a consultant to conduct an assessment of the threats facing the client's administrative base in the capital, the intended production site and other more remote, exploration sites. Supported by a quantitative mechanism to calculate the risk potential, HRL identified the impact of these threats and the client's vulnerability, its infrastructure and people, to produce recommendations to mitigate and manage these risks. A regional risk analyst also performed a strategic analysis of the country and specific locale.

The report focused on risk areas such as political fragility, election prospects and key relationships for client to build; identification and mapping of protest locations; economic prospects and policies; impact and prominence of ethnic and tribal rifts; social responsibility requirements; regional relationships and impact of the Arab Spring; mapping of the zone of terrorist operations, illegal trafficking routes and areas of vulnerability to terrorist attack and kidnap and pre-existing risk management measures used by government or other commercial operators.

A successful risk analysis was attributable to HRL's experience in the specific local environment, combined with strategic understanding and analysis of information to produce actionable intelligence and focused recommendations. As a result the client was able to implement the appropriate risk and security measures and reduce the cost implications of the risks it faced.

Security

UK firms are at the forefront of the provision of global security services, built on years of successful investment and innovation. The holistic approach they adopt integrates the latest technology, reduces process complexity, removes inefficiencies and drives down client costs, all while retaining high standards and engaging with local communities.

Mine operations are subject to increasingly stringent standards. These vary from market to market and add to the complexity of running efficient mine security. UK-based security firms are signatories to the International Code of Conduct for Private Security Providers and the United Nations Global Compact, providing the best guarantee of a mining company complying with tough legislation and establishing a political and social licence to operate. By putting these standards at the heart of its offering, UK firms set best practice benchmarks for mining security across the globe, while complying with legislation in the markets in which they operate.

UK risk consultancies provide on-the-ground intelligence and strategic analysis of the physical and operational risks and threats each company is exposed to now and in the future, along with physical protection and preparedness measures. The UK's leading security firms bring extensive global experience, offering best practice standards that help ensure the safe and efficient operation of a mine from the outset. A community minded approach, providing employment, education and other social improvements, ensures communities become more sympathetic to a mine.

As the search for mineral resources moves deeper into less developed and more high-risk markets, the UK security sector consistently delivers effective solutions to mine operators and owners worldwide.

Re-establishing control over mining operations and assets through changes to security

Providing integrated mining security solutions to South African platinum mines

South African miner Aquarius Platinum is the fourth ranked global platinum producer, operating highly mechanised and low cost mining operations in South Africa and Zimbabwe. As part of its business strategy, Aquarius Platinum fine-tunes its operations and partnerships with key service providers who play a vital role in making its highly mechanised operations successful, safe and efficient.

The miner's security provider is UK-based global security solutions provider G4S. Following an extensive assessment of the security areas that needed attention at Aquarius Platinum's Kroondal Mine in South Africa, G4S was given the go-ahead to make a wide range of changes. These included creating a control room and regular reporting, with standardised incident reports and daily security flashes plus incentives for whistle-blowers.

G4S made improvements to perimeter and access control, ensuring proper control over the movement of materials and assets, and redesigning security access to prevent unauthorised possession of explosives and contraband. It also provided supervision and response vehicles, specialist security officer training and armed reaction security officers with armed response vehicles. As a result, mine security drastically improved and the mine gained back more control of its operations and asset management.



Insurance

Insurance plays a key role in every stage in a mine from planning and construction, through operations and eventually closure and rehabilitation. As the world's largest insurance market, the UK is the natural place for miners to turn.

Insurance is an integral part of the risk management cycle in transferring the risks, loss and damage from events. UK-based insurers, including brokers and underwriters, deliver the full spectrum of insurance services to mining mine owners and other organisations in the supply chain.

Typical cover for mining contractors supplied by UK insurers would include construction all risks (CAR), public and general liability during construction, contractor's pollution liability and professional indemnity (design and advice). UK brokers provide comprehensive insurance to mine owners and operators, and provide specialist advice and cover for sudden and unexpected pollution and environmental legal liability, including environmental damage.

Most mining operations will also need to provide for post-closure rehabilitation and reclamation costs, and such costs are often legal requirements that form part of the licence. UK firms advise on a number of policy types, including: self assessment, where company strength is used to guarantee future payments; bonds; surety; trust accounts; and escrow accounts.

London is the only place in the world where all 20 of the world's largest insurers and re-insurers have offices.

Plant management and operational efficiency



UK-based consultancies, cost consultants and project managers deliver strategic and operational solutions enabling miners to operate more efficiently. This is essential, as miners and mine owners around the world are under increasing pressure to reduce costs, improve productivity and increase profitability.

Mine projects are capital intensive, long term and complex. They often have extended and disparate supply chains, and are managed at arm's length from corporate headquarters. Each of these factors is a potential major contributor to mining development delays, cost overruns, project and engineering creep, increased risks and deteriorating stakeholder relationships. However, by adopting best practice project management and operational efficiency frameworks, as developed by UK specialists, miners can ensure they continue to operate competitively.

UK cost consultancies and project managers offer a range of services that deliver greater certainty, reduce risks, improve operational efficiencies and underpin credible stakeholder relationships. With their breadth of experience and scope of operations, professional service firms based in the UK enable miners, mine owners and governments to benchmark their operations against industry norms to identify areas for improvement. Alongside project delivery focused services, such as estimating, cost management and engineering, UK-based companies can provide procurement, planning and scheduling, change control and project accountancy services.

Project control and delivery support to engineering, procurement and construction (EPC)

Doubling the output of Chilean mine whilst controlling costs

Anglo American's Los Bronces copper mine is located in the Andes Mountains, 65km north-east of Santiago in central Chile. The miner was increasing mine capacity to more than 450,000 tons per annum, making Los Bronces the fifth largest copper mine in the world. The project was completed by an engineering, procurement and construction (EPC) contractor. Project management and cost consultants Turner & Townsend's UK-based mining and metals division was hired to assist the miner manage the programme.

The core component of the project was to increase cost control across a range of areas, delivering staffing plan analyses, construction equipment usage optimisation, and extensions of time evaluations. Turner & Townsend's embedded team also conducted invoice verification and reconciliation, as well as a procurement audit of the EPCM contractor's procurement processes. Through its variance analysis, benchmarking and procurement audit, Turner & Townsend enabled Anglo American to contain cost increases.



Optimising asset management so the right equipment is available in the right place at the right time

Repair, maintenance, finance and procurement of a heavy mobile equipment fleet

Lafarge, a world leader in building materials, had managed its heavy mobile equipment fleet in-house based around the needs of its individual businesses across multiple territories. The practice limited the global view of the fleet to inform smarter decision making. Much of the data gathered was designed to meet the needs of its financial systems. It was not always suitable for informing decisions about fleet availability, deployment, maintenance and procurement.

UK-based Babcock International Group, a global engineering support services organisation, is assisting Lafarge by optimising equipment performance, driving down cost and delivering full sight of Lafarge's fleet across the UK, US and Canada.

Babcock currently manages Lafarge fleets across 300 sites in the UK, US and Canada. Over a ten-year period, Babcock's contracts cover full repair and maintenance service on over 1,000 pieces of equipment. It also provides structured finance, procurement, condition monitoring and asset disposal.

Babcock delivers a combination of management, analytical and engineering capability and experience through its proprietary ALCAMiE model. This is a customised set of asset management systems and processes that enable assets to be managed cost effectively.

Since the contract started in 2011, Babcock has ordered £25m of new assets to replace aged or worn out equipment, rebuilt 152 assets, met stringent equipment availability targets and undertaken over 10,000 jobs across the three territories.



Commodities and financial market exchanges



Understanding the markets for commodities is essential when assessing the value of assets, wherever they are located. The UK, and London in particular, has a long history of involvement in the international mining industry and continues to provide finance to mines around the globe.

The London Metal Exchange was the first terminal market developed to facilitate trading in copper in 1877. The exchange has grown steadily to meet the expanding needs of global markets for metals, adding aluminium (1878), lead (1920), zinc (1920) and, more recently, molybdenum and cobalt (2010). Those providing finance for mine development, whether it is debt or equity, need to understand the commercial advantages associated with a particular asset in order to manage this aspect of risk; the UK's history of asset marketing and trading is unrivalled in this respect.

Some of the world's largest and most respected market trading and analysis companies are headquartered in the UK. These companies provide expert analysis and regular publications to provide mining's stakeholders with accurate analysis and forecasts. In addition, UK companies deliver consulting expertise on all market and commercial aspects of mining. They are ideal partners for mine operators in emerging markets, where local skills and expertise may be less developed. UK firms have a strong record of working collaboratively with clients and project partners to overcome challenges and achieve success.

Risk management for mining companies

Securing price certainty for miners

Since the 19th century, the London Metal Exchange (LME) has functioned as a venue for price discovery and a market of last resort for the delivery of base metals.

For companies buying or selling metals, risks can come from uncertainty in financial markets, project failures, legal liabilities, credit issues, economic downturns, accidents and natural disasters. Suppliers and consumers of metals can only work on forecast prices that are dependent on expected supply and demand, but these forecast prices can quickly become invalid if the fundamental drivers of metal prices change. This is where LME member firms can help.

Banks, trading houses and brokerage firms provide services that cover research and market analysis, real-time market data, credit facilitation, margin financing and structured finance. However, it is the expertise of metal traders at member firms which interest mining companies after identifying that they are exposed to price risk and wish to put in place a hedging programme.

For example, a mining company may sell futures or buy a financial instrument known as a put option ensuring that, should the final sale price for the physical metal be lower, this will be offset by a profit on the futures or option position. This has the major advantage of securing a higher percentage of capital for financing inventory or additional production. Mining companies derive a twofold advantage from futures trading: insure against price decline; and they can secure larger and cheaper loans from finance providers and LME member firms.

Research and development



UK academic and corporate research institutes conduct world-leading pure and applied research into every facet of the mining industry and its supply chain. Four of the world's top ten universities are in the UK, with each featuring world-class geoscience, minerals and materials, and engineering research centres.

The breadth and depth of leading international research by the UK's academia and industry underpins the country's world-class mining expertise and supply chain. Pure and applied research covers disciplines essential for the future of global mining, such as sustainability, energy, biodiversity, and water. The research and development capabilities of UK companies, universities and research institutes span: the physical, natural and social sciences; engineering; safety; IT; management; the law; finance; and many other disciplines. Much of the UK's mining research is interdisciplinary and conducted jointly between industry and academia.

In addition to partnering with leading university research departments, UK companies have dedicated in-house research and development capabilities, and are pioneering new technologies throughout the supply chain. Research programmes focus on areas including: exploration; prospecting support technologies; mining and minerals engineering; mining equipment, with a focus on heavy engineering; IT; and safety technologies.

Innovative environmental science and engineering research is considering the sustainable mine lifecycle, seeking to design out waste streams to minimise environmental impact and optimise return-to-use of mining areas following closure.

The UK's Engineering and Physical Sciences Research Council (EPSRC) and Natural Environment Research Council (NERC) jointly invest £1.2bn in research, including into the earth sciences and engineering. Nearly half of the research is collaborative, between academia, corporate and other researchers.

NERC is funding research into extending the UK's research base, which is seeking to understand how to make better use of natural resources by better exploiting mineral surveys data. And UK research facilities include test mines for trialling explosives research, geomechanics and energy for mining.



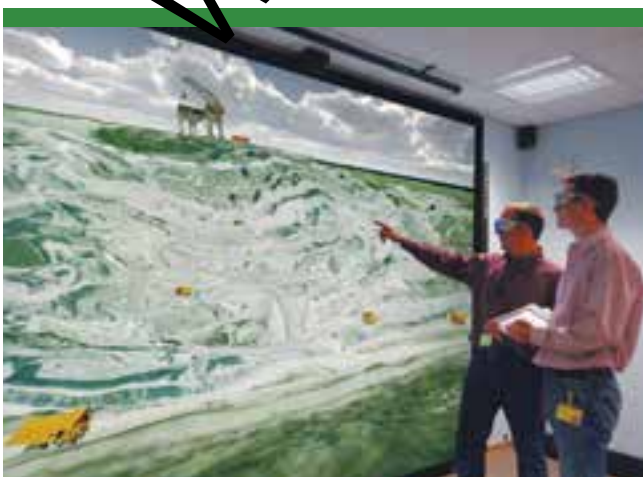
Planning mining projects in 3D using advanced virtual reality to view geospatial data in real time

Collaboration creates unique tool for exploration and mine management

Conventional 3D visualisation software cannot integrate very large volumes of data from multiple sources, and this can reduce certainty in exploration and mine management. Working with the British Geological Survey, UK-headquartered Virtual Reality and advanced visualisation business, Virtualis, has developed its GeoVisionary software.

The software enables exploration geologists and mining engineers to visualise, analyse and share large geoscientific datasets within the same environment, and to identify the relationships between the data. GeoVisionary brings together historical geological and topographic maps with remote sensed and satellite imagery, so that all the available spatial information can be viewed seamlessly in an immersive 3D, real-time environment. This allows mine planners to make stronger and more confident interpretations of their data.

When conducting feasibility studies and the development of existing mines, geologists and engineers drilling new shafts can view exactly where new shafts should be sunk. It's possible to overlay planned infrastructure and see the impact on the environment of new structures, providing a powerful socioenvironmental impact assessment tool.



Developing passive mine water treatment technologies to remove heavy metals

University department develops compost bioreactors with no chemical inputs

Newcastle University led the national-scale assessment of impacts from abandoned metal mines across England and Wales for the UK's Department for Environment, Food and Rural Affairs and the UK's Environment Agency. The research has identified methodologies for prioritising mining pollution, monitoring and characterising river catchments and developing passive treatments to clean up the pollution.

Compost bioreactors used for the attenuation of metals such as zinc, cadmium and lead, from acidic and neutral mine drainage, have been developed and operated at laboratory and pilot-scale. The results show that it is possible to effectively remove metals in reactor residence over just 10-15 hours with no chemical or energy inputs. Ongoing research continues at the UK-based university to investigate the lifespan of such treatment units and the influence of different mine water chemistry on the performance of compost bioreactors.

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The UK is internationally recognised as a centre of excellence in the provision of skills and education to the mining industry, exporting its exceptional knowledge and training capability globally. As a distance learning pioneer, the UK has a substantial learning and education infrastructure that benefits overseas companies, governments and NGOs.

The UK has an outstanding reputation for excellence in education and skills – from the development and export of educational equipment, resources, technology and software to sustainable education, corporate training, further and higher education. Education and skills is not only a very important sector in its own right, but also a key component in every other industry and profession, including mining. The UK is a global leader in developing partnerships between education and business to match the skills that industry needs with the education and training the country provides.

As knowledge-based industries become ever more important in the global economy, so too does the education and skills sector that these industries rely on to provide the highly educated workforce they need. This fact has not been lost on the UK's world-class education, training and learning providers, who are already geared up to supply the growing needs of the international arena including distance and e-learning material and programmes.

The UK is home to six of the top ten universities in Europe, with four in the global top 10. Its education and skills exports are worth over US \$21bn pounds annually, making the country a world leader in meeting the accelerating demand in this dynamic sector.

The UK's private-sector training providers and universities offer innovative and effective courses in a wide range of corporate and management training. The UK has a wealth of first-class educational consultants. Their expertise includes curriculum design and development; staffing structures and legislation; training and professional development; educational policies development; governance; appeals management; financial management systems/budgeting; building suitability; specialist teaching-room design and equipping; quality control and inspection; and educational establishment improvement programmes.

The demand for appropriately skilled or experienced staff in the global mining sector continues to outstrip supply, placing training and development firmly on the UK's academic and corporate agendas. The global mining skills shortage has been cited as one of the biggest risks to the industry over the next decade, and the UK academic and education sector can help to meet this challenge.

The UK's world class science, research and innovation capabilities are the G8's most productive. And, as the home of the English language, the UK delivers effective English-language learning to students in the UK and through UK institutions internationally. The UK leads in the teaching of business English.

Tailoring mining skills and education to the needs of supply chain companies and their employees

Sandvik International Mining and Construction School

Camborne School of Mines at the UK-based University of Exeter is a founder member of a consortium of seven of the world's leading university mining departments. It works with engineering group Sandvik on the delivery of a postgraduate degree specifically tailored to its employees. The accredited qualification, as an International Mining and Construction Engineer, provides task-focused, specialist training and intensive education in the field of raw materials extraction compliant with international standards and industry best practice.

Effectively bridging the gap between academia and business

Industry blended learning

A number of UK universities, including Derby, Exeter, Imperial College and Leicester, provide company specific blended learning courses to miners, mining support companies and the mining supply chain. Topics include mineral extraction, processing, safety, sales, marketing and finance. The courses are aimed at developing essential operational staff to ensure future success. They are also focused on developing talented staff from major mineral producing countries to become industry leaders of the future in multinational organisations.

Rebuilding geological and mining engineering capabilities weakened by decades of conflict

Assisting the Afghanistan Geological Survey to promote and support mining

Afghanistan possesses a wealth of mineral resources that are largely undeveloped, including precious metals, base metals, rare metals, precious and semi-precious stones, coal, oil, gas and industrial minerals. Amongst these are world class deposits of copper, gemstones and iron. Given the very significant mineral potential of the country, it is hoped that this may be exploited to generate revenue to help revive the economy and rebuild the country following decades of conflict. The re-establishment of the Afghanistan Geological Survey (AGS) and Ministry of Mines and Industries (MMI) is seen as a high priority in the overall strategy to promote and support the country's minerals sector.

The British government's Department for International Development (DFID) commissioned the British Geological Survey (BGS) to undertake a capacity-building project to help strengthen the AGS. BGS' main focus was on training people, generating mineral databases, helping develop the mineral economy, and encouraging good governance. BGS also supported the development of a global and Asian centred mineral market economics capability to examine the economic feasibility of mineral development in Afghanistan.



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The mining lifecycle – UK capability

The UK is the leading global source of mining finance, providing liquidity for all sizes of projects and operations. Support is delivered by a broad range of professional services and consulting organisations that work to recognised global standards. UK companies deliver comprehensive social, environmental and economic assessments to provide world class infrastructure master planning for the benefit of mine operations and the countries and regions they are based in. Through skills, learning and knowledge transfer to local communities and businesses, the UK helps deliver sustainable economic prosperity.



Establishing a climate for mining

UK companies and organisations have the expertise and experience to develop and create all the factors that promote a mutually constructive, welcoming and profitable climate for the development and management of mining operations – and beyond.

- Accessing finance
- Creating a policy and governance framework
- Creating a balanced economy
- Social, economic and environmental assessment and planning
- Stakeholder relations and management
- Learning and knowledge transfer
- International best practice

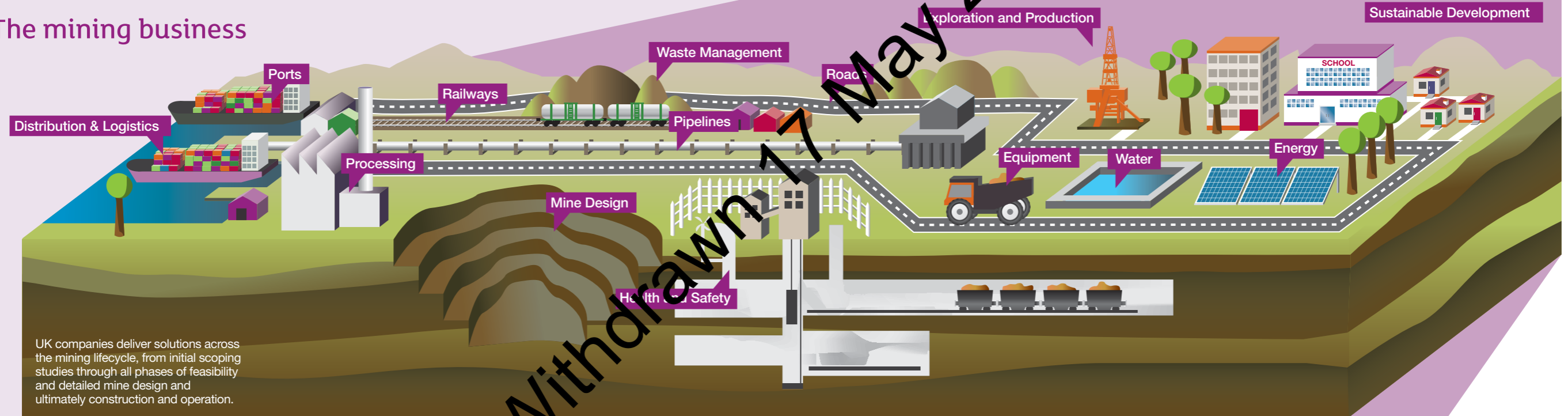


Economic Development



Closure

The mining business



UK companies deliver solutions across the mining lifecycle, from initial scoping studies through all phases of feasibility and detailed mine design and ultimately construction and operation.



Monitoring and Testing



Feasibility & Development



Managing risks and driving efficiencies

The UK provide support services that enable mine owners to mitigate and manage risk alongside maximising returns. E.g.

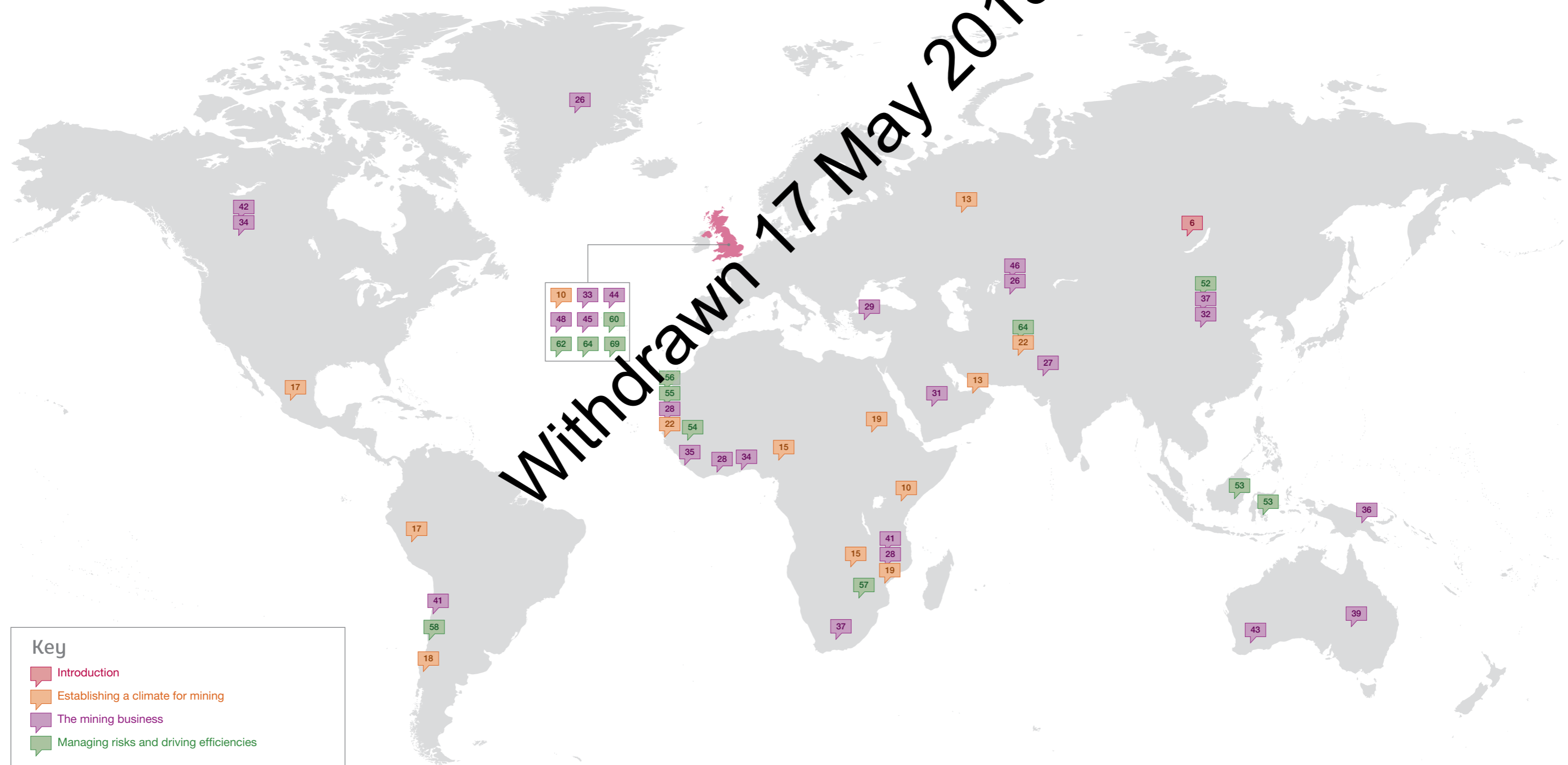
- Professional services
- Risk management and insurance
- Plant management and operational efficiency
- Commodities and financial market exchanges
- Research and development
- Skills and education

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UK – Delivering global mining solutions

UK mining businesses are providing solutions to the world's mining industry across the mining lifecycle, illustrated by the case studies featured in this publication.

Withdrawn 17 May 2019



Key

- Introduction
- Establishing a climate for mining
- The mining business
- Managing risks and driving efficiencies



Association of British Mining Equipment Companies
www.abmec.org.uk

The UK trade body representing manufacturers promoting safety, efficiency and technical developments in the global mining industry.

Association of Mining Analysts
www.ama.org.uk

The Association of Mining Analysts (AMA) is a non-profit organisation representing the broad mining community in the UK with a membership of around 300.

British Chemical Engineering Contractors Association
www.bceca.co.uk

BCECA is the trade association representing the principal companies in the UK and provide engineering, procurement, construction and project management services to the process industries.

British Electrotechnical and Allied Manufacturers Association Ltd
www.beama.org

BEAMA is the independent expert knowledge base and forum for the electrotechnical industry for the UK and across Europe, representing over 300 manufacturing companies in the electrotechnical sector.

British Expertise
www.britishexpertise.org

British Expertise is the leading UK private sector organisation for British companies offering professional services internationally. Our member companies range from large general consultancies to specialist individuals.

British Fluid Power Association
www.bfpa.co.uk

The British fluid Power Association, BFPA, represents Hydraulic and Pneumatic businesses commercially and technically throughout the UK.

British Materials Handling Federation
www.bmhf.org.uk

The main aims of the Federation are to encourage the extension of the use of materials handling equipment in all industries and to foster, by all practical means, the development of the materials handling industry in the interests of users and the national economy.

British Safety Industry Federation
www.bsif.co.uk

The British Safety Industry Federation (BSIF) is the UK's leading trade body within the safety industry. We have over 160 members including manufacturers, distributors, test houses, certification bodies, safety professionals and service providers.

British Security Industry Association Limited
www.bsia.co.uk

The British Security Industry Association is the trade association for the private security industry in the UK.

British Water
www.britishwater.co.uk

British Water is the trade association for the UK water industry supply chain, with a wide and varied membership covering all sectors of the water industry. From consultants, legal and financial partnerships, manufacturers of equipment and multi-disciplinary contractors to SMEs and independent consultants.

Chartered Institute of Management Accountants
www.cimaglobal.com

CIMA is the world's largest professional body of management accountants.

Chartered Institute of Public Finance Accountancy
www.cipfa.org

CIPFA is the only professional accountancy body exclusively dedicated to public finance in the world.

Chemical Industries Association**www.cia.org.uk**

The Chemical Industries Association (CIA) is the largest organisation that represents chemical and pharmaceutical businesses throughout the UK.

CityUK**www.thecityuk.com**

The City UK's purpose is to promote the competitiveness of UK financial services – to make the UK the best place in the world to establish and grow a financial services business and, in turn, to maximise the sector's contribution to the UK.

Construction Equipment Association**www.coneq.org.uk**

The CEA is the UK trade association representing the manufacturers of construction equipment, its components, attachments and associated services.

Construction Products Association**www.constructionproducts.org.uk**

The Construction Products Association represents the UK's manufacturers and suppliers of construction products components and fittings.

Energy Industries Council**www.the-eic.com**

Established in 1943, the EIC is a not-for-profit organisation with a membership of over 670 UK-registered companies who deliver goods and services to the energy industry worldwide.

Engineering Construction Industry Association**www.ecia.co.uk**

The Engineering Construction Industry Association (ECIA) is the principal trade and employer Association for the UK engineering construction industry. Their 300 members include many of the largest companies in the world that carry out engineering projects across the globe.

Engineering Industries Association**www.eia.co.uk**

The Engineering Industries Association is an organisation with over 60 years experience in promoting trade and representing the interests and aspirations of the UK engineering manufacturing sector.

Federation of Environmental Trade Associations**www.feta.co.uk**

FETA is the recognised UK body representing the interests of over 400 manufacturers, suppliers, installers and contractors within the heating, ventilating, building controls, refrigeration & air conditioning industry to policy makers and the wider public.

Geological Society**www.geolsoc.org.uk**

The Geological Society of London was founded in 1807. It is the UK national society for geoscience, and the oldest geological society in the world.

The Society provides a wide range of professional and scientific support to over 10,000 Fellow (members), about 2000 of whom live overseas. More than 2000 Fellows are also Chartered Geologists.

Industrial & Power Association**www.ipa-scotland.org.uk**

Industrial & Power Association (IPA) supports its members in providing technology, equipment and services to the power industry in the UK and the world market. Membership includes generation and network owners & operators, international manufacturing groups, mechanical, electrical and civil consultants, construction companies, energy specialists, academia and legal advisers.

Institute of Civil Engineers**www.ice.org.uk**

ICE is an international membership organisation that promotes and advances civil engineering around the world.

Institute of Materials, Minerals and Mining**www.iom3.org**

The Institute of Materials, Minerals and Mining (IOM3) is a major UK engineering institution whose activities encompass the whole materials cycle, from exploration and extraction, through characterisation, processing, forming, finishing and application, to product recycling and land reuse.

Institute of Mechanical Engineers**www.imeche.org**

Working with leading companies, universities and think tanks, the Institute creates and shares knowledge to provide government, businesses and the public with fresh thinking and authoritative guidance on all aspects of mechanical engineering.

Institute of Quarrying**www.quarrying.org**

The Institute of Quarrying is the international professional body for those either employed in, or supplying to, the aggregate, asphalt, cement, concrete recycling and mineral processing industries.

International Council on Mining and Metals**www.icmm.com**

The International Council on Mining and Metals (ICMM) was established in 2001 to act as a catalyst for performance improvement in the mining and metals industry.

Law Society**www.lawsociety.org.uk**

The Law Society represents solicitors in England and Wales.

Law Society of Northern Ireland**www.lawsoc-ni.org**

The Law Society of Northern Ireland is the regulatory and representative body of solicitors in Northern Ireland.

Law Society of Scotland**www.lawscot.org.uk**

The Law Society of Scotland is the professional body for Scottish solicitors.

London Bullion Market Association**www.lbma.org.uk**

The LBMA is the international trade association that represents the wholesale market for gold and silver, which is centered in London but has a global client base. The ongoing work of the Association encompasses many areas, among them refining standards, good trading practices and standard documentation.

Manufacturing Technologies Association**www.mta.org.uk**

The Manufacturing Technologies Association is a trade association for companies working in the engineering-based manufacturing sector.

Materials Handling Engineers Association**www.mhea.co.uk**

The Materials Handling Engineers' Association (MHEA) supports the interests of UK and overseas companies supplying and using powder & bulk handling equipment.

Mineral Industry Research Organisation**www.miro.co.uk**

The Mineral Industry Research Organisation is a leading international collaborative research and technological development facilitator and provider of collaborative research project management services to the mineral and related industries.

Mineral Products Association**www.mineralproducts.org**

The Mineral Products Association (MPA) is the trade association for the aggregates, asphalt, cement, concrete, dimension stone, lime, mortar and silica sand industries.

Mining Association of the United Kingdom**www.mauk.org.uk**

Association for non-energy industrial mineral underground companies.

Minor Metals Trade Association**www.mmta.co.uk**

The Minor Metals Trade Association (MMTA) is a not-for-profit organisation, which serves to benefit and promote the interests of its international membership, comprising companies actively involved in all aspects of the international minor metals sector.

Perimeter Security Suppliers Association**www.pssasecurity.org**

The PSSA is the trade association for companies involved in the supply of equipment and services designed to provide the highest levels of physical protection for sites and their perimeters from terrorist or criminal attack that involves the use of extreme force or explosives.

Pipeline Industries Guild**www.pipelineguild.com**

The Pipeline Industries Guild is the only association worldwide to cater directly for the needs of the pipeline industry, regardless of engineering discipline, application, or qualification.

The Guild's membership comprises those with interests in pipelines world-wide, transporting hydrocarbon products, chemicals, water, wastewater, and many other substances, both on and offshore.

Railway Industry Association**www.riagb.org.uk**

The Railway Industry Association is the representative body for UK-based suppliers of equipment and services to the world-wide industry. It has around 170 member companies, active across the whole range of railway supply.

Society of Maritime Industries, Ports and Terminals**www.maritimeindustries.org/Specialist-Sectors-/Ports-and-Terminals-infrastructure**

The Society of Maritime Industries is the voice of the UK's maritime engineering and business sector promoting and supporting companies which build, refit and modernise commercial and naval vessels, and supply equipment and services for all types of ships and underwater vehicles, ports and terminals infrastructure.

Solids Handling and Processing Association Limited**www.shapa.co.uk**

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