

# Coal Age<sup>®</sup>

The Magazine for Coal Mining and Processing Professionals

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## 2012 Annual Forecast

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# Coal Age

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## ORGANIZED LABOR FINALLY TAKES A STAND



**BY STEVE FISCOR**  
/ EDITOR-IN-CHIEF

Every year *Coal Age* surveys readers for its Forecast Survey. Many of the questions remain the same, but the answers always differ, except for one. The survey always asks an open-ended question: What's the biggest issue facing the U.S. coal industry and how do we prepare for it? For three years now, the overwhelming answer has been excessive government regulation. It started with the MINER Act of 2006 under the Bush administration. Then, the Obama administration took control in 2008 and began to apply more pressure using the Environmental Protection Agency (EPA). Now, U.S. power generators have the train wreck of proposed environmental rules.

Granted, the coal mining industry has had to deal with more intense scrutiny from federal regulators regarding mine safety due to recent incidents. What angers people is seeing how this administration could potentially hamstring the country and future generations for the sake of environmentalism.

An internal conflict is brewing among those on the left. Union workers have always been a core constituency for the Democrats. The Obama administration kowtows to the large important unions, such as those involved in the public sector, who are funneling taxpayer dollars to the regime. What happens when the president placates his environmental constituency by erasing thousands of jobs at mines, power plants and factories? The Democratic Party has a problem it does not like to discuss.

Last month, Cecil Roberts, president and CEO of the United Mine Workers of America (UMWA) was the first to break rank. He finally spoke out after three years of watching the administration pound on this business. His quote appears as part of a larger news story on the EPA's new national standards for mercury. He refers to President Obama and the EPA as being "tone-deaf" when it comes to dealing with the coal community (See news, p. 5). Unfortunately, his statement leans more toward social welfare when it should be talking about coal as a domestic source of low-cost energy. Nonetheless, Roberts has finally seen the light. Perhaps, the Obama administration will be hearing from the International Brotherhood of Electrical Workers, International Union of Operating Engineers, and maybe even the AFL-CIO.

This is an election year. Who will organized labor support? Assuming they could not support a president who has declared war on coal, they would have to support a Republican candidate. To make their voices heard, they should start to rally around one of the Republican candidates prior to the coal state primaries. Coal exports are one of the few positives the industry has at this point, so Ron Paul and isolationism would not be a viable option. That leaves Mitt Romney, Newt Gingrich and Rick Santorum. Romney understands business, but could he could be a little cold-hearted when it comes to dealing with organized labor. Newt is politically astute and has the means to effect change in Washington, but he is somewhat misinformed about the climate change. Santorum has already identified his coal roots and could be the safest option for organized labor, but would he be able to defeat Obama?

Unfortunately, organized labor's hands are probably tied at this point and they will have to secretly hope that the American people vote Obama out. Internal efforts will not work because the rank and file cannot vote in the primaries. They will have to roll with the Republican nominee. If the election is a referendum on Obama's performance during the last four years, it should be a slam dunk. The coal community can voice its opinion in the general election.

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# WESTMORELAND TO ACQUIRE KEMMERER MINE



The Kemmerer mine averages 4.7 million tons per year.

Westmoreland Coal Co. has agreed to purchase Chevron Mining's Kemmerer mine in the Hams Fork Region of southwestern Wyoming for \$179 million plus approximately \$14 million in working capital. It is anticipated that the purchase price will be funded through a combination of cash consideration of approximately \$74 million, plus the assumption of approximately \$118 million in certain liabilities, including post-retirement medical, pension, black lung and asset retirement obligation liabilities. Over the last five years, Kemmerer has produced, on average, 4.7 million tons of high-quality subbituminous coal for sale to the adjacent Naughton power station, as well as various industrial customers located in the proximate geographic region.

The transaction includes approximately 118 million tons of coal reserves, enough for 20 years of production; a skilled and stable workforce; recently installed state-of-the-art coal preparation and loadout facilities; strong customer commitments; and an expansive fleet of well-maintained mining equipment. Additionally, substantially all of Kemmerer's projected produc-

tion for 2012 through 2016 is committed and priced under existing sales contracts.

"Strategically, the Kemmerer mine fits well with our existing mine mouth operations," said Keith Alessi, president and CEO, Westmoreland. "The mine has a diversified base of stable customers, both utility and industrial. Under Chevron's stewardship, the mine has been well managed and its capital equipment is in excellent condition. We hope to close the transaction by January 31, 2012.

"We view the Kemmerer workforce, which totals approximately 290 people, as a core component of the transaction. The employees of Kemmerer will be a tremendous addition to our company and we look forward to welcoming them to the Westmoreland family," said Alessi. "These skilled employees share our core values of uncompromised safety and environmental excellence."

The transaction is subject to certain customary conditions and approvals and has already been approved by the Westmoreland board and the appropriate governing bodies at Chevron Mining.

## EPA Issues First National Standards for Mercury

The U.S. Environmental Protection Agency (EPA) issued the Mercury and Air Toxics Standards, the first national standards for mercury and other toxins (arsenic, acid gas, nickel, selenium, cyanide, etc.) from power plant emissions.

"The EPA has ignored the concerns of thousands of American workers and millions of consumers that rely on affordable and reliable coal-based electricity to power their factories and light their homes," said Hal Quinn, president and CEO, National Mining Association. "At every opportunity, the EPA has chosen the most costly and economically damaging options over a more prudent and balanced approach for achieving continued emission reductions at our nation's power plants."

"The final language of the EPA rule requiring maximum achievable control technology for the nation's power plants



## BREAKING NEWS

### Federal Court Suspends CSAPR

A federal court suspended the Environmental Protection Agency's Cross-State Air Pollution Regulations (CSAPR) December 29, 2011, two days before it was to take effect. The U.S. Court of Appeals for the District of Columbia Circuit granted requests to stay the rule pending the outcome of legal challenges to the case. The rule is one of several advanced by the EPA recently, and the remaining rules may still force power companies to put cleaner technologies in place.

A separate rule limiting the emissions of mercury and other toxins was made final earlier in December and will start requiring emissions cuts in 2015. According to *The Wall St. Journal*, the cross-state rule would have required pollution reductions in 2012. To comply, companies with

older coal-fired power plants would have had to run those plants less often or pay for credits to offset the pollution. Those facilities will still have to control some pollution because the court said a Bush-era version of the rule would remain in effect. The EPA's new version was stricter.

In an unsigned order, a three-judge panel said it would hear the case by April.

Power companies and state regulators challenged the rule this fall on the basis that, among other things, the agency didn't give power generators enough notice and it made significant errors in its calculations regarding costs. Others argued that the law over-reached on a state's ability to determine its pollution-control plans, as the Clean Air Act requires.



## TOP 10 COAL-PRODUCING STATES



(in Thousand Short Tons)  
Week Ending (12/31/11)

	YTD '11	YTD '10	% Change
Wyoming	436,092	442,522	-1.5
West Virginia	136,592	135,307	1.0
Kentucky	108,586	105,267	3.2
Pennsylvania	60,193	58,964	2.1
Texas	44,546	40,982	8.7
Montana	41,591	44,732	-7.0
Indiana	36,758	35,317	4.1
Illinois	36,471	33,465	9.0
Colorado	27,776	25,163	10.4
North Dakota	27,477	28,949	-5.1
U.S. Total	1,089,200	1,084,368	0.4

shows just how tone-deaf the Obama administration and the EPA have become when dealing with issues that will effect coal miners, their families and their communities," said Cecil E. Roberts, president, United Mine Workers of America. "Instead of taking a reasonable approach that gives utilities the time they need to meet the stringent requirements set by these rules, the White House and EPA Administrator Lisa Jackson have decided to stick with rigid requirements that will lead to the premature closing of dozens of power plants around the nation and the potential loss of 56,000 megawatts of electric generation capacity."

According to the EPA, more than half of all coal-fired power plants already deploy pollution control technologies that will help them meet these achievable standards. Once final, these standards will level the playing field by ensuring the remaining plants take similar steps. The agency estimates that manufacturing, engineering, installing and maintaining the pollution controls to meet these standards will provide employment for thousands, potentially including 46,000 short-term construction jobs and 8,000 long-term utility jobs.

"The cumulative economic impact of this and other rules pouring out of the EPA has been spared rigorous analysis—leading many experts to project dire cost increases and threats to the reliability of the nation's electricity supply," Quinn said. "Unfortunately, consumers and businesses will not be spared the projected 25% increase in the cost of electricity nor the consequences of a far less reliable electricity grid that must somehow compensate for the loss of one-fourth or more of coal-based generation."

The standards are accompanied by a Presidential Memorandum that directs the EPA to use tools provided in the Clean Air Act to implement the Mercury and Air Toxics Standards in a cost-effective manner that ensures electric reliability. The EPA said it is not only providing the standard three years for compliance, but also encouraging permitting authorities to make a fourth year broadly available for technology installations, and if still more time is needed, providing a well-defined pathway to address any localized reliability problems should they arise.

"The modest adjustment to the compliance timeline in the MACT standard merely papers over a deeply flawed rule," Quinn said. "The MACT, along with other EPA requirements, have been needlessly rushed through the regulatory process without the benefit of constructive analysis, meaningful interagency review or

## WORLD NEWS

**Shenhua to Build Asia's Largest Coal-fired Power Station**

Shenhua Group Corp. plans to build Asia's largest coal-fired power plant in China's southern province of Guangxi to help reduce electricity shortages in the region. According to the *Xinhua News Agency*, Shenhua Energy signed an agreement with the local government to build an 8 gw plant at the port city of Beihai. Construction will take about five years. In related news, China Shenhua Energy Co. Ltd., the country's largest listed coal producer by output, its commercial coal production rose 21.8% year-on-year to 24 million metric tons (mt) in November. Last month, the coal company sold 31.6 million mt of coal, 13.7% more than that in the same period of 2010.

**Newcastle Ship Queue Hits 60**

*ABC News* reported that Newcastle's ship queue has hit 60 for the first time in several years, as global demand for coal continues to rise. In October, the Hunter Valley Coal Chain Coordinator warned of increased ship queues due to planned coal chain maintenance outages, combined with strong demand. More than 50 vessels were waiting to be loaded at Port Waratah Coal Services Newcastle coal loaders at the end of November. Now there are 60 vessels, a number not seen for several years. But a vessel arrival system means only 20 ships can stay in the Newcastle anchorage, with others anchored elsewhere or in transit. But the ship queue spike is not expected to affect export targets through the Port of Newcastle. The ship queue should drop soon with the number of vessels waiting expected to be below 40 at the end of January.

**Southern Kuzbass Processes Elga Sample**

Russian coal and metal producer Mechel OAO said that Southern Kuzbass produced the first coking coal concentrate from the massive Elga deposit. A sample lot of 4,000 metric tons (mt) of Elga coking coal was washed at the Southern Kuzbass Sibir prep plant. The quality of the concentrate ranks the Elga deposit among the higher-value grades of coking coals, according to Mechel.

"Use of the Elga deposit's coking coal will provide Mechel's coke and chemical facilities with fully internally-sourced fuel, which will enable us to significantly improve our coke products' quality and guarantee our independence from external suppliers. Moreover, Elga Coal Complex's products will allow Mechel to increase exports of coal grades that are in demand," said Igor Zyuzin, chairman, Mechel.

Mechel will also use this information to design and construct a prep plant at the Elga Coal Complex. Production at the complex began in August 2011. During the first few months, the open-pit produced only oxidized coals, characterized as steam coals with high calorific value. Since August, about 200,000 mt of coal have been mined, according to Mechel.

**Coal Producers in Indonesia & Vietnam Undertake New Export Strategies**

Fast rising economies in Southeast Asia, Indonesia and Vietnam have taken different strategies in handling rising coal demand in the region, according to *Nasdaq*. Vietnam will calibrate its exports to meet

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increasing coal demand in the domestic markets. Indonesia, on the other hand, plans to increase exports and meet rising demand in the Asia Pacific Region. The Indonesian Coal Mining Association said Jakarta is expected to upgrade its output in 2012 to no less than as 390 million metric tons (mt) of the fuel in 2012 to satisfy demand from Asian buyers particularly India and China. Indonesia is the world largest thermal coal exporter. Vietnam state-owned coal exporter, Vinacomin, said coal exports will be reduced by 19.6% to 13.3 million mt in 2012 from 16.8 million mt in 2011. Vinacomin said Vietnam coal exports will gradually be scaled back to 8 million mt in 2013 and between 4 million mt and 5 million mt from 2015.

#### **Asciano Wins 10-year Rio Tinto Coal Contract**

Ports and rail operator Asciano has entered into a new 10-year contract with Rio Tinto to move 8 million metric tons (mt) of coal each year in central Queensland. The performance based contract will see Asciano haul coal from Rio Tinto Coal Australia Hail Creek and Kestrel coal mines to the Dalrymple Bay coal terminal near Mackay. The contract commences in November 2013 and is in addition to existing haulage contracts between Asciano and Rio Tinto.

#### **Eta Star Mozambique Finds Major Moatize Met Reserves**

Eta Star Mozambique SA, a joint venture between Dubai-based Eta Star group and Mozambican companies Minas do Zambeze and Índico Investments, said it has found around 2 billion metric tons (mt) of coal in Moatize, in Tete Province, *Macauhub* reported. The concession on the coal mine covers an area of 4,000 hectares. According to Eta Star, it plans to get a mining license from the Mozambican Government in 2012 and start producing 5 million mt of coal per year, of which 1.5 million mt will be coking coal and the remainder will be thermal coal.

#### **Cokal Confirms Indonesian Met Resources**

Metallurgical coal prospector Cokal Ltd. recently completed the initial geological report for its Bumi Barito Mineral (BBM) coal project in Indonesia, which confirmed a 60 million metric ton inferred resource of metallurgical coal. The coal quality consists of about 60% coking coal and 40% PCI.

Cokal Executive Director Pat Hanna said the maiden inferred resource estimate covers an area which occupies only 8% of the total lease area. There is significant upside potential as the drilling program extends into the remaining areas of the BBM lease.

"The low in-situ ash content indicates there is a reasonable opportunity that a direct ship style operation can be developed, avoiding the need to construct a coal washing plant which would involve significant time and capital, this is indeed a distinct advantage," said Jim Middleton, managing director, Cokal.

The BBM lease covers an area of 19,920 hectares, immediately adjacent to BHP Billiton's Juloi lease, straddling the Barito River and has numerous outcrops of bright coal.

#### **Indian Coal Imports Likely to Reach 200 million mt by 2017**

India is likely to import 194 million metric tons (mt) of coal in 2017 as against 135 million mt at present to meet the demand of the power sector, *Economic Times* reported. "Current year, we have to import 135 mil-

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candid conversations with the American public about the consequences of these policies to our economic future."

#### **Peabody Will Appeal the ALJ Decision on Willow Lake**

A Peabody Energy subsidiary announced plans in December to appeal an administrative law judge's decision to toss out the company's objections to a May union representation election narrowly won by the United Mine Workers of America (UMWA) at the Willow Lake underground mine near Equality in Saline County, Ill.

Big Ridge Inc. had asked the National Labor Relations Board to conduct a new election at the mine based on allegations that UMWA supporters resorted to "intimidation and threats, coercion and fraudulent conduct" in an effort to interfere with the rights of Willow Lake miners. The nation's oldest industrial labor union prevailed 219 to 206 in the balloting to succeed the International Brotherhood of Boilermakers union which had represented the mine's hourly workers for several years.

The UMWA, meanwhile, claimed the company threatened to close the mine and discharge individuals who supported the union.

In dismissing the company's objections, Jeffrey Wedekind, an ALJ for the labor board, said Big Ridge's claims were "without merit." He ruled the UMWA should be certified as bargaining agent for the approximately 450 miners at Willow Lake.

Wedekind also determined that "by threatening employees with mine closure, job loss and other unspecified reprisals if or because the employees supported the UMWA...the employer has engaged in unfair labor practices."

He added: "Contrary to the employer's contention, there is no evidence that the union orchestrated a campaign to intimidate and mislead employees." Wedekind's decision followed a nine-day hearing in late summer.

Big Ridge, while noting the ALJ decision is not final, said Wedekind's ruling included numerous conclusions that had no basis in fact.

The company said it believes that employees have the right to choose to be represented or union free, "which includes the right to a free and fair election that is not driven by intimidation, threats and misinformation."

Big Ridge said its NLRB complaint "brought forth clear evidence that union advocates created an atmosphere of coercion that threatened employees and their families with bodily harm if they did not support union representation. False and fabricated UMWA documents were also distributed during the campaign."

Conversely, UMWA International President Cecil Roberts hailed Wedekind's decision, saying it affirmed the union's victory "and brings a renewed sense of hope to the workers at that mine." The ruling also shines a strong light of truth on the campaign of fear and intimidation the company terrorized these workers with for months—and has continued to engage in after the election.

Roberts urged Big Ridge to come to the bargaining table and begin negotiations for a UMWA contract. For now, Willow Lake miners continue to work under terms of their previous agreement with the Boilermakers.

The Willow Lake election represents the UMWA's biggest victory in years in the high-sulfur Illinois Basin where it once was a dominant force. Currently, the union represents only one mine in Illinois—Springfield Coal's Crown III underground mine near Farmersville in Montgomery County.



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lion mt of coal to meet our power sector requirement. The demand will increase further as we are setting up new power plants. It is expected that we will have to import 194 million mt of coal in 2017," said Pratik Prakashbapu Patil, Minister of State for Coal. "There will be more dependency on imported coal. The dependency has increased from 6% to 13% in the last five to six years."

As per the Planning Commission, the demand supply gap for coal in the ongoing year is likely to reach 142 million mt with domestic availability of only 554 million mt against the requirement of 696 million mt. Output in 2011-12 was expected to reach 680 million mt but the estimate was later scaled down to 630 million mt in a mid-term appraisal.

### **Wesfarmers Premier Coal Sale Approved**

The sale of Wesfarmers Premier Coal mine to Chinese-owned Yancoal has been given regulatory approval, *Collie Mail* reported. Wesfarmers is expected to get a \$90 million pre-tax profit on the sale of the business. Wesfarmers announced the sale in September for a price of \$296.8 million. The deal needed approval from Australia Foreign Investment Review Board and Chinese government authorities which has been received. The transaction trims Wesfarmers coal business to two mines, the Curragh metallurgical and thermal coal project in Queensland and the Bengalla thermal coal operation in NSW.

### **Illawarra Coal Expansion Trimmed**

Sparing environmentally sensitive land from mining may have won Illawarra Coal approval to expand but it has come at a cost to the economy. According to *Illawarra Mercury*, the US\$360 million expansions of the Appin and West Cliff mines approved by the state's peak planning body this week is significantly smaller than what was proposed in 2009. The plan was scaled back after fears it could cause unacceptable damage to rivers and creeks.

But the compromise means that, over 30 years, royalty payments to the NSW treasury will drop from US\$3 billion to US\$2 billion and the number of direct and indirect jobs will fall by 1,115. NSW Planning and Infrastructure concluded the exclusion of sensitive land from mining had come at a high cost to both Illawarra Coal and the state government and with significant flow-on effects to the local, regional and state communities. Despite the reduction, the project still expected to deliver a \$6.9 billion total benefit to Illawarra Coal, the NSW Government and the Illawarra region.

Continuing longwall mining operations at the Appin Mine and West Cliff Colliery will extend the life of mining operations by 30 years. Illawarra Coal has been granted permission to extract 10.5 million metric tons of coal a year.

### **China's Inner Mongolia Coal Approaching 1 billion mt**

The coal output in China's largest coal producing region, Inner Mongolia, rose 26.6% year-on-year to 908 million metric tons (mt) in the first 11 months of the year, *Xinhua Online* reported. The output in November was 94.1 million mt, up 18.1% year-on-year, the autonomous regional economy and information technology commission said. The northern Inner Mongolia autonomous region had proven coal reserves of

Continued on pg 10...

### **Signal Peak Brings Longwall Production Back Online**

After a three-week idling due to high carbon monoxide levels in December, Montana's Signal Peak longwall mine was back in operation and again trying to ramp up production as 2011 drew to a close.

The mine's latest woes arrived unexpectedly on December 1 when the Mine Safety and Health Administration ordered it to close after CO concentrations exceeding 300 parts per million were detected in a mined-out area about 1.7 miles from the working face. CO levels above 125 ppm must be reported to the federal agency.

For the next couple of weeks, Signal Peak Energy, the mine operator, pumped nitrogen into a portion of the mine to lower the gas to acceptable levels. The mine finally received MSHA's blessing to reopen in late December.

But the idling was potentially costly for the mine located near Roundup in Musselshell County and formerly known as Bull Mountain. Not only did it lose about three weeks' worth of production, the company declared force majeure during the shutdown, according to mine spokesman Mike Dawson. In a December 30 interview, Dawson said he did not know if the force majeure had been lifted.

In several ways, 2011 was a noteworthy year for Signal Peak, a producer of high-quality bituminous coal. It began with the operator looking to step up production in excess of the 3.5 million tons extracted in 2010. Eventually, the mine's annual output is targeted at about 12.5 million tons.

But roof falls in August temporarily sidelined the mine. Then, in October, FirstEnergy and Boich, which jointly purchased the mine three years ago, sold a one-third share to Gunvor's Pinesdale LLC subsidiary for \$400 million. FirstEnergy got \$260 million and Boich \$140 million in proceeds from the transaction.

As part of the deal, FirstEnergy, which owns several electric utilities in Ohio, Pennsylvania and New Jersey, reduced an original coal purchase agreement with the mine from 7.5 million tons annually to no more than 2.5 million tons a year.

Gunvor and its new partners, meanwhile, began pursuing a strategy of selling large volumes of Signal Peak's coal overseas, in particular to markets in South America and Asia.

Then in November, the U.S. Bureau of Land Management rejected as insufficient a \$5.3 million offer from Signal Peak, the only bid the agency received, at a federal coal lease sale. The five unleased coal tracts in Musselshell County contain an estimated 35.5 million tons of publicly owned coal.

BLM plans to hold another lease sale sometime in 2012—no date has yet been set—and Dawson confirmed Signal Peak plans to submit another bid.

### **Arch Coal Winning Bidder for South Hilight Lease**

Arch Coal, Inc. announced it was the successful bidder for a federal coal lease known as the South Hilight tract in the southern Powder River Basin (PRB). Arch bid \$1.35/ton for the 1,977 acre tract, which contains an estimated 222 million tons of minable coal reserves in Campbell County, Wyo. South Hilight is contiguous to Arch's Black Thunder mine and contains some of the highest quality (9,000 Btu/lb) coal in the southern PRB.

"Because of their very high quality, the South Hilight reserves are exceptionally well positioned to serve both the growing export market and expanding domestic demand for ultra-low-sulfur coals," said Steve Leer, chairman and CEO, Arch Coal. "Black



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Continued from pg 8...

741.4 billion mt, the largest nationwide, at the end of last year. It surpassed neighboring Shanxi province to become the largest coal producing region last year with an annual output of 782 million mt. Shanxi's coal output reached 790 million mt in the January-November period, an annual increase of 18.6%, according to the provincial statistics bureau. The November output rose 15.3% to hit a monthly record of 80.8 million mt due to a spike in the demand for the fossil fuel to power generators and provide heating in winter.

#### **Bayan Unit Signs Coal Contract Extension with Buma**

Gunungbayan Pratamacoal, a unit of coal miner Bayan Resources signed an US\$640 million extension of its mining service contract with Bukit Makmur Mandiri Utama. According to *The Jakarta Globe*, Bayan said the contract will run from January next year until the end of 2017 two days after the companies signed the extension. The contract covers the shipment of up to 260 million bank cubic meters of overburden materials with an option to cover a further 50 million. Buma, the country's second biggest mining contractor is a unit of Delta Dunia Makmur. Revenue at the company is forecast to increase to US\$1.2 billion to US\$1.4 billion. Net income at Bayan rose to IDR 1.3 trillion in the first nine months this year and revenue rose to IDR 9.2 trillion.

#### **Ukraine Coal Production Rises by 8.8%**

According to *Xinhua Online*, coal production in the Ukraine rose 8.8% this year. Coal and Energy Minister Yuriy Boyko said output increased to 81.8 million metric tons (mt). "For the first time in 10 years, we have achieved such a high level of production," said Boyko. He said the increased productivity was partly attributed to more investment in modernization of the coal industry. In 2011, around US\$210 million was invested in an upgrade of the country's coal mines. The State Statistic Service said Ukraine's coal output rose 4% year-on-year to 75 million mt in 2010. Ukraine ranks among the world's top 10 coal mining countries. The nation's total coal resources are estimated at 52 billion mt with commercial coal reserves at nearly 34 billion mt.

#### **Peabody Energy Opens New Indonesian Office in Balikpapan**

Peabody Energy announced the opening of an office in Balikpapan, Indonesia, a seaport city in the East Kalimantan province. The move further expands the company's presence in the world's largest supplier of seaborne thermal coal. Peabody's Balikpapan office complements ongoing sourcing and business development activities in Indonesia and supports an office in the capital city of Jakarta. Indonesia is the fastest-growing supplier of thermal coal to both China and India, and Peabody is positioning itself to assist local suppliers in moving Indonesian coal throughout the Pacific Rim. The company has secured multiple term offtake agreements from resource-rich East Kalimantan.

Yosef Setiawan, director of engineering-Indonesia, will lead the office and has responsibility for supporting business development and structured transactions. Setiawan brings extensive experience in mining engineering, technical services and business development from his tenure at BHP Billiton in Australia and Indonesia. He reports to Keith Downham, vice president of resource development-Indonesia.



Thunder is already producing the highest-Btu coal in the southern PRB, and the addition of the South Hilight reserves should extend that quality advantage still further over time."

Shipped tons from Black Thunder have averaged close to 8,900 Btus/lb year-to-date in 2011, compared to an average of less than 8,600 Btus/lb for all other mines in the southern PRB, according to Energy Information Administration data. In 2010, Black Thunder produced 116.2 million tons of coal from an assigned reserve base that totaled 1.4 billion tons at December 31, 2010.

The U.S. Bureau of Land Management has determined that Arch's bid meets the agency's fair market standards. The \$300 million bid amount will be paid in five installments of \$60 million each, with the first installment paid immediately.

Arch will begin pursuing the necessary permits for South Hilight right away, with the goal of integrating the new lease into the existing mine plan at Black Thunder. Arch said it has no current plans to expand production at the Black Thunder operation.

#### **Capito Introduces New Mine Safety Bill**

Rep. Shelley Moore Capito (R-W.Va.) introduced the Mine Safety Accountability and Improved Protection Act (H.R. 3697) in the wake of the Mine Safety and Health Administration's (MSHA) recent report on its investigation into the 2010 Upper Big Branch (UBB) mine tragedy. The bill, similar to a measure Rep. Capito introduced last year, according to the National Mining Association (NMA), primarily addresses the conference and appeals process, implementation of mine safety and health regulations and increased penalties for safety violations.

The bill also transforms the pattern of violation (POV) language by amending Sec. 104 (e) of the Mine Safety Health Act to create a statutory system that mirrors the current POV process used by MSHA. This is an important change and will warrant close attention by the NMA and its members. In the coming months, the results of additional investigations of the events at UBB by the State of West Virginia and MSHA's internal review of its actions are expected to provide further insights into what happened at UBB and whether additional mine safety legislation is needed to ensure continued progress in mine safety and health.

#### **Kentucky Black Lung Law Struck Down**

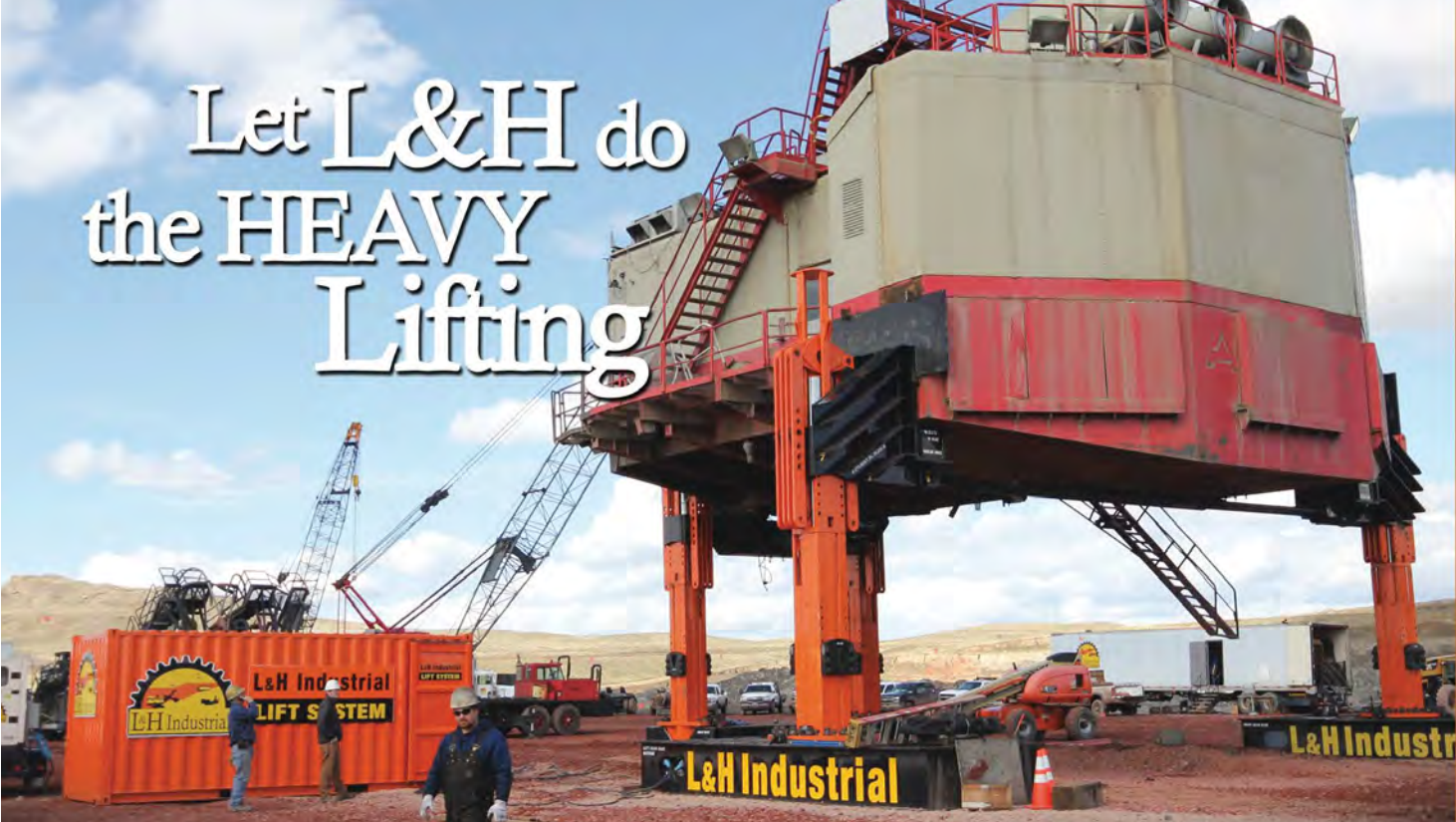
In a ruling that could lead to higher costs for the coal industry, a divided Kentucky Supreme Court struck down the state's black lung law, saying it discriminates against sick coal miners by depriving them of a constitutional guarantee of equal protection under the law.

The court issued its opinion just before Christmas in an appeal brought by two veteran coal miners who had been denied black lung benefits under a law enacted by the General Assembly several years ago.

The majority opinion written by Justice Will T. Scott said coal miners must meet more stringent standards, and are subjected to a more extensive battery of tests, than other workers before they can qualify for the benefits. "Despite the fact that there is no real distinction between the various forms of pneumoconiosis, (Kentucky law) treats coal workers differently than those from other occupations with respect to workers' compensation," the court said. To establish the presence of pneumoconiosis, the official term for black lung disease, Kentucky law "requires a different procedure to establish its presence than it requires for all other types of pneumoconiosis." In addition, the



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law requires “clear and convincing” evidence to rebut a panel consensus for coal workers’ black lung claims while the law requires only “a reasonable basis” to rebut a similar evaluation for other workers.

In a dissenting opinion, Chief Justice John Minton said the court should not overturn the Legislature’s action on equal protection grounds “unless the varying treatment of different groups of persons is so unrelated to the achievement of any combination of legitimate purposes that we can only conclude that the (General Assembly’s) actions were irrational.”



## PEOPLE IN THE NEWS



Roberto Junguito

**Cerrejón** has appointed *Roberto Junguito* CEO. He succeeds *Leon Teicher*, who left the company at the end of 2011.



Curtis Brighton

**Templeton Coal Co., Inc.** has appointed *W. Curtis (Curt) Brighton* president. He succeeds *Thomas E. Templeton*, who is stepping down.

**Peabody Energy** has appointed *Marc Hathhorn* senior vice president of Midwest Operations, with responsibility to lead Peabody’s five surface and five underground coal mines across Illinois and Indiana. *E. Jason Davis* has been appointed general manager of the Metropolitan mine in New South Wales, Australia, with responsibility for the underground operation and surface facilities. *Patrick Sollars* has been appointed general manager of Colorado Operations. He assumes responsibility for the Twentymile mine in Colorado.

**Mississippi Lime Company** has appointed *John D. Huhn* vice president of strategy and corporate development.



Peter J. Bethell

**Marshall Miller & Associates, Inc.** recently appointed *Dr. Peter J. Bethell* an associate and principal mineral processing consultant. He will direct the mineral processing services associated with the firm’s growing international project portfolio and lead a team of engineers and support staff in delivering services to a large client base.

**Skelly and Loy** has appointed *Rex A. Peppler* engineering manager; *Darryl L. White* CAD designer; and *Paul J. Fischer* mine permitting specialist in the firm’s Wise, Va., office.



Maury Bagwell

**Blastcrete Equipment Co.** has appointed *Maury Bagwell* general manager.

**Conveyor Accessories, Inc.** has appointed *Chris McCarty* sales manager.



Chris McCarty

*Dr. Jürgen F. Brune* has been appointed research professor at the **Colorado School of Mines**. He will focus his research at the Colorado School of Mines on coal mining, mine ventilation and specifically, mine fire and explosion prevention.

Jürgen F. Brune

Moreover, the court should be “quite reluctant to overturn (legislative) action even if the law seems unwise or works to the disadvantage of a particular group, or if the rationale for it seems tenuous,” he said. “In my view, the majority opinion reaches its intended result by ignoring these well-settled tenets of law, invading the province of the Legislature to force a sea-change in workers’ compensation law and leaving Kentucky’s equal protection precedent in shambles.”

The immediate effect of the ruling was unclear in late December. The General Assembly is scheduled to convene in Frankfort in January for the start of its 2012 session. Observers predict lawmakers will address the court decision then.

### AEP Reaches a Deal for the Turk Plant

A four-year battle between American Electric Power Co., one of the nation’s largest electric utility companies, and environmentalists over a new 600-megawatt coal-burning power plant in Arkansas ended in December with an out-of-court settlement that left both sides claiming victory.

Under the deal, AEP’s Southwestern Electric Power Co. subsidiary will be allowed to place the \$2.1 billion John W. Turk Jr. plant near Hope in Hempstead County in commercial operation in late 2012 without having to continue fighting a host of legal and administrative challenges aimed at killing the project. In return, the Sierra Club and National Audubon Society won a commitment from Columbus, Ohio-based AEP to retire 528-megawatt unit 2 at the Welsh coal plant in Texas no later than 2016 and to not construct any additional generating units at the Turk site. Moreover, as long as Turk operates, which should be at least 30 years, AEP also will not build any new coal-burning generating units at any location in Arkansas within 30 miles of the plant.

The agreement also calls for Turk, which is about 80% completed, to burn only low-sulfur coal from the Powder River Basin or subbituminous coal with similar characteristics.

AEP said the accord eliminates any uncertainty that Turk might not go into operation. “We have long believed the Turk plant is the right generation solution for our customers in three states, our electric system and the economy in southwest Arkansas,” said Nicholas Akins, president and CEO, AEP. “The provisions of the agreement are consistent with our commitment to renewable energy, energy efficiency and overall environmental stewardship. Now that all of the legal challenges are resolved, we can focus on completing the advanced ultra-critical technology of our Turk plant to provide reliable and affordable power for SWEP- CO, the Arkansas electric cooperatives and our other partners in the project.”

The settlement requires SWEP- CO to install 400 megawatts of “clean energy,” most likely wind power; contribute \$8 million to The Nature Conservancy for land conservation in Arkansas; and give \$2 million to the Arkansas Community Foundation for grants to support policy initiatives promoting clean energy resources and energy efficiency measures.

Glen Hooks, an Arkansas Sierra Club member, said that while the group preferred that Turk not be built, the settlement “brings some very good news for Arkansas, which would not have been possible without years of citizen opposition to dirty coal plants.”

SWEP- CO owns 73% of Turk. Co-owners are Arkansas Electric Cooperative Corp., 12%; East Texas Electric Cooperative, 8%; and Oklahoma Municipal Power Authority, 7%.



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## Americas Energy Attempts to Reorganize After Bankruptcy

Americas Energy Co., a small publicly traded coal company in Knoxville, Tenn., and its wholly-owned subsidiary, Evans Coal Corp., are attempting to reorganize after filing a voluntary Chapter 11 bankruptcy petition December 7, 2011, in the U.S. Bankruptcy Court for the Eastern District of Tennessee.

According to information submitted to the court, Americas estimated its liabilities in a range between \$1 million and \$10 million and its assets in a range between \$500,000 and \$1 million.

Americas, in a separate filing December 13 with the U.S. Securities and Exchange Commission, said a Chinese firm, Beijing Guohua Technology Group, has agreed to provide it with \$6 million in capital in return for a 30% stake in the company.

However, that arrangement hinges on Americas' acquisition of certain metallurgical coal assets from Alpha Natural Resources' Tennessee Consolidated Coal Co. subsidiary in the Tennessee counties of Grundy, Bledsoe, Marion and Sequatchie. On December 1, Americas entered into a letter agreement with Abingdon, Va.-based



## DATELINE WASHINGTON

# SEEING COAL IN THE BIG PICTURE

BY LUKE POPOVICH



Happy New Year! Here's a suggestion for making it happier: start 2012 with a cleaner slate by discarding stuff you don't need. And one thing you can discard, that you don't need, is the now prevalent notion that coal's best days are behind us. Admit it, you too may have felt this dismal sentiment on occasion.

Who could blame you if you did? We face a government that some believe wages war on coal. Newspaper headlines report oceans of shale gas awaiting fracture. Enviros sue to block every coal plant, blaming coal for everything from shrinking ice flows to weak Christmas sales. It's enough to make you pull your hair out if you had any.

But this is the small picture about coal, not the big picture. And it's the big picture you should be mindful of in 2012. To see it though, you have to literally look outside the news bubble here in this country to the worldwide market for electricity and steel, where coal has been...is today...and for decades will continue to be The King.

According to the latest report from the International Energy Agency (IEA), coal will remain by 2035 the dominant source of electricity in the world's largest economies and comprise 30% of global energy demand. That's up from 25% in 2000. Put another way, coal demand is forecast to grow by 600,000 tons every day over the next five years. And when the IEA looks at anticipated generating capacity coming on line by then, it finds coal will account for more than a third—far more than any other competing fuel.

Coal has been the world's fastest growing fuel for more than a decade largely because first China and then India have turned to coal to power Asia's industrial revolution. Much as coal powered the first industrial revolution two centuries ago in Europe, coal is repeating that trick today on a colossal scale an ocean away. Asia's revolution is by no means over, either. In India alone, about 400 million people lack electricity, which means they lack healthy food, clean drinking water and basically what we call civilization. They call it "electricity poverty."

If you were one of today's 1.4 billion poor people without electricity, or among the 3 billion with little access to it, ask yourself if you'd care where your juice came from. Electricity poverty isn't recognized here because there isn't any. But without coal, millions of the world's poor will remain in the darkness of poverty without the benefits of ordinary necessities we take for granted.

Here's the best part: what the world seems to want more than ever is what we have in abundance. With the world's leading coal reserves pegged at 488 billion short tons, U.S. producers are in an enviable position. As Mae West wisely observed, "Too much of a good thing can be wonderful." That's certainly true for U.S. coal mines, whose exports of coal to generate the world's electricity and make its steel, climbed last year to a record 100 million tons.

Some developing countries have a lot of coal too, but not enough to feed economies growing at between 8% and 12% per year. Nor will they have the expertise and the infrastructure to bring all the coal they have from distant, remote regions to heavily populated urban regions where demand is greatest.

This is little remarked on today, just as we ignored a crucial event in 2007 that likely changed coal's fortunes. That was the year China first became a net coal importer, supercharging demand for coal and permanently changing world trade routes. Coal regions that formerly served the Eurozone now serve Asia, leaving underserved EU markets for U.S. producers. PRB coal once destined mainly for Eastern Seaboard cities now targets Asian markets as well. We're no longer just swing suppliers to foreign markets, but valuable suppliers, especially now that a post-Fukushima chill on nuclear power is making more room for base load coal capacity.

Don't you feel happier already?

*Popovich is a spokesperson for the National Mining Association, the industry's trade group based in Washington, D.C.*



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Alpha to purchase the assets for \$71 million. Currently, Americas holds leases on an estimated 6.5 million tons of high-quality specialty coal in southern Kentucky.

If the Alpha deal can be closed, the Chinese company would pay \$3 million in cash to Americas with the \$68 million balance to be paid by two unsecured promissory notes—the first note for \$3 million due 12 months after the closing, the second note for \$4 million due 24 months from the date of closing, and the remaining \$61 million to be paid as an overriding royalty at the rate of \$3/ton mined from the acquired assets, Americas told the SEC.

Americas said it has been told by Alpha that the met coal assets contain about 44,000 acres of leased property, two permitted underground mines, a permitted coal processing plant with a permitted impoundment area, and a 40-barge terminal on the Tennessee River.

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## CALENDAR OF EVENTS

**February 2-3, 2012** *12<sup>th</sup> Annual Coaltrans USA*—will be held at the JW Marriott Marquis Hotel in Miami, Fla. Contact: Coaltrans Conferences (E-mail: coaltrans@euromoney-plc.com; Web: www.coaltrans.com).

**February 12-15, 2012** *38<sup>th</sup> Annual Conference on Explosives & Blasting Technique*—will be held at the Gaylord Opryland Resort in Nashville, Tenn. Contact: The International Society of Explosives Engineers (Tel: 440-349-4400; Fax: 440-349-3788; Web: www.isee.org.)

**February 15-17, 2012** *30<sup>th</sup> Anniversary World Trade & Transport Conference*—will be held in New Orleans at the Omni Royal Orleans. Contact: Mississippi Valley Trade & Transport Council (Tel: 866-782-6882; Fax: 504-588-1441; Web: www.mvttc.com).

**February 19-22, 2012** *2012 SME Annual Meeting & Exhibit*—will be held in Seattle, Wash. Contact: Society for Mining, Metallurgy, and Exploration (Tel: 303-948-4200; E-mail: meetings@smenet.org; Web: www.smenet.org).

**February 20-22, 2012** *Annual National Weighing and Sampling Association Technical Meeting*—will be held in St. Louis, Mo. Contact: Contact: David Hansel (Tel: 610-765-6753; E-mail: david.hansel@exeloncorp.com; Web www.nwsasn.org).

**March 4-7, 2012** *PDAC*—will be held in Toronto, Canada. Contact: Prospectors and Developers Association of Canada (Tel: 416-362-1969; Fax: 416-362-0101; E-mail: info@pdac.ca; Web: www.pdac.ca).

**March 19-22, 2012** *114<sup>th</sup> National Western Mining Conference & Exhibition*—will be held at the Westin Tabor Center in Denver, Colo. Contact: Colorado Mining Association (Tel: 303-575-9199; E-mail: jcourtney@coloradomining.org; Web: www.coloradomining.org).

**May 1-3, 2012** *Coal Prep 2012*—will be held at the Lexington Convention Center in Lexington, Ky. Contact: Penton Business Media (Tel: 800-927-5007; Fax: 508-759-4552; E-mail: registration@penton.com; Web: www.coalprepshow.com).

**May 30-31, 2012** *AIMS 2012 7<sup>th</sup> International Symposium: Rockbolting and Rock Mechanics in Mining*—will be held in Aachen, Germany. Contact: Mirjam Rosenkranz, RWTH Aachen University-Institute of Mining Engineering (Tel: 49-(0)241-80 95673; Fax: 49-(0)241-80 92272; E-mail: rosenkranz@bbk1.rwth-aachen.de; Web: www.aims.rwth-aachen.de).

**May 30-June 1, 2012** *Western Mining Electrical Association Bi-annual Meeting*—will be held at the Harrah's in Reno, Nev. Contact: WMEA (Web: www.wmea.net).

**July 24-26, 2012** *31<sup>st</sup> International Conference on Ground Control in Mining*—will be held at the Lakeview Golf & Spa Resort in Morgantown, W.Va. Contact: Karen Centofanti (Tel: 304-293-3901; E-mail: Karen.Centofanti@mail.wvu.edu) or Karla Vaughan (Tel: 304-293-3886; E-mail: karla.vaughan@mail.wvu.edu); Web: icgcm.conferenceacademy.com.

**September 24-26, 2012** *MINExpo*—will be held at the Las Vegas Convention Center in Las Vegas, Nev. Contact: Hall-Erickson Inc. (Tel: 866-717-6463; E-mail: minexpo@heexpo.com; Web: www.minexpo.com).

**November 14-16, 2012** *Western Mining Electrical Association Bi-annual Meeting*—will be held at El Tropicano Hotel in San Antonio, Texas. Contact: WMEA (Web: www.wmea.net)

## Indiana Utility Regulator Indicted

David Lott Hardy, Indiana's former top utility regulator, was indicted in December on three felony misconduct counts by a Marion County grand jury investigating an ethics scandal related to Duke Energy Indiana's approximately \$3 billion Edwardsport integrated gasification combined cycle plant nearing completion in Knox County.

Hardy, former chairman of the Indiana Utility Regulatory Commission, was accused by the grand jury of knowingly aiding and abetting efforts by Scott Storms, the agency's former general counsel and chief administrative law judge, to pursue a job with Duke while presiding over cases related to Edwardsport at the IURC. The 602-megawatt plant, one of the largest IGCC projects ever built in the United States, has suffered from cost-overruns that have driven up its estimated price tag by about \$1 billion since it was approved by the commission in November 2007. The plant is more than 80% completed and targeted for commercial operation in October 2012.

Storms left the commission and was hired by Duke as its associate general counsel in the fall of 2010. He subsequently was fired by Duke as part of an internal inquiry launched after the release of confidential e-mails that showed Hardy and top Duke executives enjoyed a close relationship and had discussed Storm's prospective employment with the company.

Hardy was fired in October 2010 by Indiana Governor Mitch Daniels, a Republican who had appointed Hardy to the commission several years ago. Daniels, a two-term governor who leaves office at the end of next year, in early 2011 considered seeking his party's presidential nomination but decided not to run.

Hardy also was accused by the grand jury of failing to disclose ex parte communications that occurred on March 17, 2008, and February 24, 2010, with a Duke Energy employee regarding revised cost estimates for Edwardsport.

If convicted, Hardy faces up to three years in prison on each count plus a \$10,000 fine.

## A Reprieve for Big Sandy?

If the Kentucky Public Service Commission gives its blessing this spring, a large four-decades-old, coal-burning generating unit once ticketed for retirement by Kentucky Power Co. will be granted a reprieve. In mid-2011, 800-megawatt unit 2 at the Big Sandy power plant near Louisa, Ky., was among the approximately 6,000 megawatts of coal-fired capacity earmarked for early retirement by American Electric Power Co., the Columbus, Ohio-based parent of Kentucky Power. Besides shutting unit 2, the company proposed converting 278-megawatt unit 1 at Big Sandy to natural gas as a way to reduce the plant's air emissions.

But in a late 2011 about-face, the company told the PSC it wants to spend approximately \$940 million on environmental controls to enable unit 2 to meet U.S. Environmental Protection Agency rules while most likely shutting unit 1. The utility proposes to install a dry scrubber system on unit 2 by 2016.

Greg Pauley, president and COO of Kentucky Power, said the utility looked long and hard at the best way to comply with government environmental regulations at Big Sandy and, after much study and analysis, "the scrubber system emerged as our least-cost option." By investing in the plant and new scrubber system, "We will be able to comply with environmental regulations as well as retain local jobs," he said. "It will also enable Big Sandy plant to continue burning millions of tons of coal each year and ensure



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that Kentucky Power remains a large part of the area's economy for years to come."

Big Sandy has more than 100 full-time employees. Moreover, the company estimates that as many as 700 jobs will be created during the construction period. For Kentucky Power's 175,000 customers, the scrubber project will not be inexpensive. The utility estimates an average residential user will pay about 31% more for electricity once the project is completed.

### Kentucky Regulators Authorize Pollution Controls

Some of Kentucky's largest coal-burning power plants will continue operating for years after state regulators in December approved a settlement that authorizes Louisville Gas & Electric Co. and Kentucky Utilities Co. to invest an estimated \$2.3 billion in pollution controls over the next several years to comply with U.S. Environmental Protection Agency rules.

As approved by the Public Service Commission, LG&E will spend \$1.4 billion and KU about \$896 million on environmental upgrades mainly at the 2,225-mw Ghent and 1,717-mw Mill Creek plants. Retrofits also are planned for an older, 547-mw unit at the Trimble County plant, where a new 750-mw coal unit went into commercial operation in early 2011.

LG&E and KU, the largest electric utilities in the Commonwealth, were purchased in 2011 from Germany's E.ON AG by PPL Corp. of Pennsylvania.

The PSC endorsed a September settlement between the utilities and several intervenors, including Attorney General Jack Conway, the Kentucky Industrial Utility Customers, the Metropolitan Housing Coalition of Louisville, Kroger Co., U.S. Department of Defense, and two national environmental groups—Sierra Club and the Natural Resources Defense Council.

As part of that deal, LG&E and KU agreed to defer at least until July 1, 2013, filing an application with the PSC for a \$225 million project to install fabric-filter "baghouse" systems to capture particulates and mercury emissions at units 1 and 2 at the 1,720-mw E.W. Brown coal plant. Sierra Club attorney Kristin Henry said the group hopes the utilities will decide to permanently forego any retrofit of Brown, although LG&E spokeswoman Chris Whelan said that is not necessarily the case. "We are only delaying the improvements on Brown until we get a cleaner view of the national air quality standards," she said.

Among the planned improvements: LG&E intends to modernize the scrubber system on all Mill Creek units and Trimble County unit 1. KU, meanwhile, will install baghouse systems at Ghent and at Brown unit 3. At Brown, the existing coal ash landfill also will be converted to a dry storage landfill.

In addition to adding new environmental controls, the utilities are planning to retire LG&E's 563-megawatt Cane Run plant and KU's 163-megawatt Green River and 75-megawatt Tyrone plants over the next few years. All are older coal-fired generating stations.

## STATLERS DONATE \$34 MILLION TO WVU

West Virginia University's engineering and mineral resources school will be named the Benjamin M. Statler College of Engineering and Mineral Resources in honor of businessman, philanthropist and alumnus Ben Statler, WVU President Jim Clements and other officials announced January 12.

Statler and his wife, Jo, both natives of Monongalia County, pledged \$34 million to the college—the largest single gift commitment ever to the university and to a college—at a special ceremony at Erickson Alumni Center; \$11 million of the donation will qualify for a match from the state Research Trust Fund, making the total value of the naming gift \$45 million. A portion of the pledge comes from a previously announced commitment.

With this historic gift, CEMR becomes only the third college at WVU to be named for a benefactor. Over the years, the Statlers have supported many WVU initiatives including the comprehensive breast cancer program at WVU's Mary Babb Randolph Cancer Center; the new Erickson Alumni Center building; the basketball practice facility; and other athletics capital improvements, including the Coliseum scoreboards. The direct impact of their lifetime of support to WVU, including this gift announcement, is nearly \$60 million.

Clements said the naming recognizes the generosity and support of two extraordinary individuals committed to academic excellence and WVU's land-grant mission.



Ben and Jo Statler.

"This is an extraordinary gift from extraordinary people," said Dr. Clements. "Ben and Jo Statler's ties to WVU go back to their childhoods when they met in 4-H and through their many gifts those ties will go on forever. From health care, to athletics, to academics, the Statlers have been extremely generous in helping WVU help others. The College of Engineering and Mineral Resources is already outstanding on many fronts and this gift will truly take the college to the next level and benefit the students, faculty and staff in countless ways."

The gift includes funds for the new advanced engineering research facility to be built on the Evansdale campus beginning in 2012, and the establishment of the Statler Research Scholars program.

"While Jo and I are pleased to be in a position to make this commitment, our goal with this gift is not merely to provide financial support to the university and the state, but rather to identify areas that could have a meaningful and long-lasting impact on WVU and on the lives of West Virginians," said Ben Statler. "West Virginia is blessed with a wealth of natural and human resources and we believe that our university should lead the nation in areas such as energy research and engineering. We're confident the faculty, staff and students, whose efforts these funds will help support, are the ones who will turn the vision behind our gift into reality."

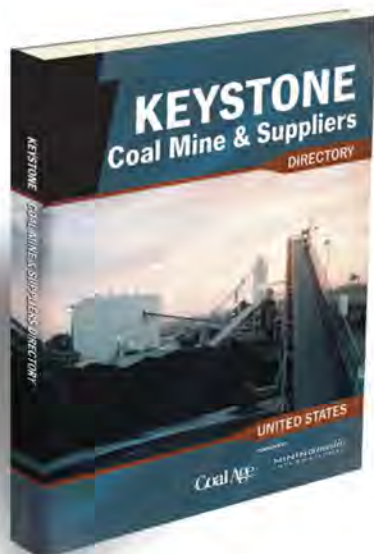
A third generation coal miner, Ben Statler received his bachelor's degree in mining engineering from WVU in 1973. While attending WVU, he began his career at CONSOL Energy, working as a laborer. For 30 years, he held various positions at CONSOL Energy before starting his own mining company, PinnOak Resources LLC. Statler served as president and CEO of PinnOak until he sold the company in 2007.

Currently, Statler is co-founder and CEO of Gulf Coast Capital Partners, a private investment firm founded in 2008 that is focused on acquiring and providing capital to middle market companies in special situations. He has served on the advisory committee for WVU's Department of Mining Engineering and was named to the WVU Foundation board of directors in August 2008.



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# PRB COAL DUST CONTROL—NEXT STEPS KICK OFF IN 2012

BY DAVID GAMBREL

Several months after BNSF's original dust control tariff (Dust 1) was found to be unreasonable by the Surface Transportation Board (STB), BNSF unilaterally issued a revised tariff (Dust 2) which went into effect October 1, 2011. The Western Coal Traffic League (WCTL) filed a petition with STB asking the Board to (1) reopen its Dust 1 proceeding, (2) order BNSF to participate in non-binding mediation, and (3) postpone the Dust 2 tariff pending mediation. They were rejected in all requests. However, the same STB order opened a new proceeding allowing several provisions in Dust 2 to be examined for reasonableness. Following is the Proposed Procedural Schedule:

STB Finance Docket No. 35557 Proposed Procedural Schedule	
Day 0	Procedural schedule for declaratory order proceeding adopted
Day 10	Notice of intent to participate due
Day 50	Close of discovery
Day 95	Opening evidence and argument due from all PORs
Day 100	Reply evidence and argument due from all PORs
Day 150	Rebuttal evidence and argument due from all PORs

STB's docket number for the Dust 2 proceeding is FD 35557. The Procedural Schedule was published with a service date of December 16, 2011. The Day 10 "notices of intent to participate" would have been due December 26, but since this date would be so soon after Christmas, it seems likely STB would overlook late filings for awhile. After all, STB will be testing for reasonableness and should exhibit same.

So far the following parties have filed to participate: Edison Electric Institute, American Public Power Association, National Rural Electric Cooperative Association, National Coal Transportation Association, Ameren, Burlington Northern Santa Fe, Department of Transportation and Western Coal Traffic League. All shippers of PRB coal are urged to participate.

The wording of the Motion for Adoption of a Procedural Schedule may make it seem that WCTL and BNSF have agreed on a procedural schedule, and are working in harmony to bring about a fair solution. In reality, BNSF has filed a lengthy discovery request on WCTL and on each of WCTL's 17 member utilities individually. It made a similar request in Dust 1, causing some members to withdraw because of the expense of compliance.

### What Happens in the Meantime?

Does the Motion for Adoption of a Procedural Schedule effectively stop BNSF from proceeding with Dust 2 rules until the motion is decided roughly half a year from now? The Board has said that since BNSF has not included a penalty provision in its Dust 2 tariff, no financial impact may be imposed on shippers who fail to comply. It has also made quite clear its intention to deal sternly with BNSF if it should attempt to impose penalties without first getting Board approval. Thus it would appear that BNSF is not in a good position to continue forcing the issue of Dust 2 compliance. While it may continue to jawbone a shipper to compliance, it will not have the backing of the STB, and could run the risk of incurring STB reaction.

### The Water Issue

While the PRB is located in a very arid region, BNSF seems to believe there is sufficient water in the PRB to supply its surfactant mixing needs. This may be true for normal weather years, but during times of drought there could be serious shortages. In any case there will probably be trouble from ranchers and environmentalists as soon as it becomes known that great quantities of water will be required from their dry and arid land. This would be true even if water wells were drilled and cased to previously untapped deep aquifers because the surface evidence would show water coming out of the ground.

As long as surfactant mixing with water remains the choice of the railroads, perhaps it is time to look at a new source of water. Many of the BNSF and UP trains cross some of the largest rivers in the

country on their return trip to the PRB. Thousands of rail cars cross the Mississippi and Missouri Rivers, causing one to ask why not load tank cars at 33,000 gallons each to supply the needs of the mines spraying surfactant? Using an average of 15 gallons of water per car for surfactant spraying, one water car should provide enough water to spray 2,200 coal cars. River water could be loaded in strings of cars that would await pickup and delivery by PRB-bound trains.

Just as BNSF has been unconcerned about the shippers' cost of supplying mixture water, it should be equally unconcerned about its own cost of providing free river water. Of course, there would be the complaints about providing tank cars and stopping to attach tank cars of water to empty strings of coal cars, but cost was of no concern to the STB in Dust 1 proceedings. This would permit the railroads to participate in a low-cost way to solve the coal dust problem. Moreover, it would remove the accusation that the railroads are trying to get the suppliers' to pay all the costs of spraying the coal with surfactants.

Certainly, the ranchers would have no objection to using river water from rivers located hundreds of miles away. The Sierra Club and other environmental foes might find it difficult to oppose the use of river water, especially if it were treated and filtered to protect fish. In short, the use of river water would have two advantages: endless supply and low environmental concern. All parties should embrace the river water idea, but for some strange reason it has never been suggested—until now.

### Other Ideas for Dust Control

Those familiar with the two May 2005 derailments that ultimately led to focusing on coal dust may recall that the FRA on-site investigation of the UP wreck blamed BNSF for poor track maintenance, and said nothing about compacted ballast due to coal dust. Without insisting on how the focus was changed to coal dust, shippers and coal producers certainly have a right to insist on proper and timely track maintenance to avoid



bump-outs of coal dust at points of changing track modulus.

Possibly the only certain means of minimizing coal dust escape would be to cover the rail cars. Such covers already exist, and are being actively marketed by companies such as Ecofab, Structural Composites of Indiana or Coalcap. Of course now we would get into a true test case because it is clear BNSF and UP would both have to buy covers for their own cars, and might have to endure some slowdowns to allow cover handling at load and discharge ends. Nevertheless, practically all states require bulk haulage trucks to cover their cargoes, so it seems fair and logical that railroads should be willing to do the same. Due to streamlining caused by covers, one would also expect fuel savings on cover-equipped trains.

Finally, we cannot overlook the possibility of coal compaction. Systems for compacting coal already loaded into rail cars have been built and are undergoing testing. Preliminary tests have shown promise, but much work remains to prove desired compaction can be achieved without damaging coal cars.

**Looking Ahead**

From the looks of things the dust control issue will grind on another year before the Board decides the Procedural Schedule case. The big question is “Where will they be then?” Will the two parties (BNSF and PRB coal shippers) be happy that the dust control issue is finally solved, or will one party triumphantly feel the Board has decided in their favor while the other party feels like a whipped puppy? We know one thing: the Board must have felt there was unreasonableness in its previous decisions, or it would not have instituted the Procedural Schedule on their own.

For almost seven years BNSF has taken the role of aggressor, first working to prove the guilt of coal shippers in creating coal dust, then working to force its own solutions upon the coal shippers. There is little evidence that BNSF has worked cooperatively with coal shippers. What it calls “cooperation” has really been getting some coal shippers to sign pre-drafted agreements they did not negotiate.

Shippers have shown willingness and even a desire to work with BNSF to produce a mutually-acceptable solution to the dust problem, but BNSF has continued to lawyer up and remain the aggressor. It may take a minor miracle to get

BNSF to change its modus operandi, but it has been well-advised that you can catch more flies with honey than with vinegar. The dust control issue will end more quickly if they can just relax and work with the shippers on an arms-length basis. No one will threaten their authority over their land and their operations, and they may even find that life is more pleasant when trying to reach solutions that are accept-

able to both parties. One thing is certain: under the present expectation that water needs will be met by PRB sources, trouble lies ahead. The parties are advised to work together if they are to have any hope of success.

*Dave Gambrel is a private consultant to the coal transportation industry. He may be reached at [bunkgambrel@earthlink.net](mailto:bunkgambrel@earthlink.net).*

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# U.S. COAL MARKETS SOFTEN WITH WEAK ECONOMY

*Growing international markets should support supply-demand fundamentals*

BY STEVE FISCOR, EDITOR-IN-CHIEF

Coal markets in the U.S. have reached a turning point. The economy has not improved substantially and neither has the demand for electricity. Coal operators have openly expressed their frustration and disbelief with the Obama administration and the Environmental Protection Agency (EPA). Utilities have depleted stockpiles waiting to see what direction regulators will take. Complicating matters further, it's an election year, which means things could get better or worse, but no one will know the answer until November.

Outside the U.S., it's a completely different story. Imports into China and

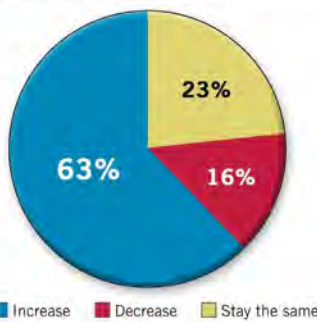
India have grown steadily. Even Europe is seeing a modest increase in coal imports due to reduced nuclear capacity in response to the Fukushima disaster in Japan. Floods and tropical storms took coal exports offline last year in Australia and many suppliers capitalized on the situation. The Australians have been working hard to restore capacity and that market may fade barring any further disruption.

Every January, *Coal Age* conducts its Annual Forecast survey. The informal study gives an assessment of the current market situation, as well as the state of mind among coal operators. Based on

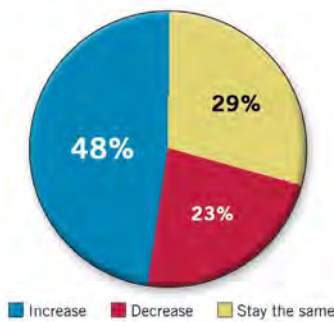
that information, and information from the leading coal companies, the Energy Information Administration (EIA) and the Edison Electric Institute, *Coal Age* tries to make an informed decision about future market trends. Last year's Annual Forecast predicted a 2.4% in 2011 or 26 million tons to 1,110 million tons. As can be seen from the Top 10 Coal-Producing States chart (See News, p. 5), that did not materialize. Total U.S. coal production grew by less than 0.4% in 2010, or only 5 million tons, to 1,089 million tons. A little growth is better than no growth, and observers should not lose sight of the fact that the U.S. mines nearly 1.1 billion tons of coal annually.

**Figure 1—Production, Consumption & Attitude**

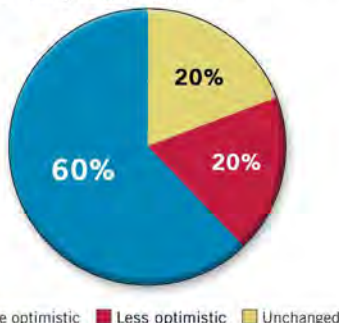
Looking ahead to 2013, how do you expect production levels to compare to 2012?



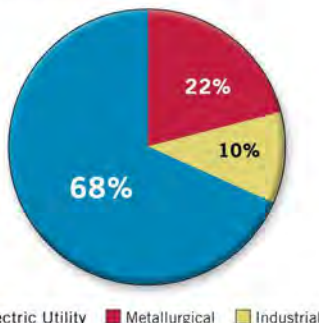
For 2012, how will total production compare to 2011?



Going into 2012, how would you describe the attitude in the coal industry compared to 2011?

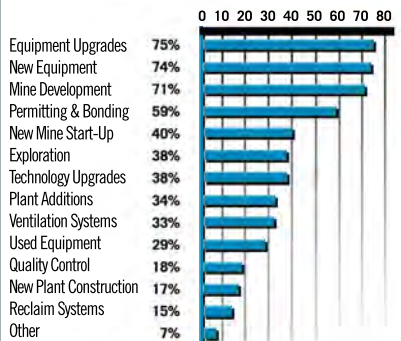


How is your coal used? (percent)



**Figure 2—Capital Expenditures**

How will the mine spend the money?



What is the capital expenditure budget for 2012?

Less than \$10 million	25%
\$10-\$25 million	22%
\$25-\$50 million	18%
\$50-\$100 million	12%
More than \$100 million	23%

For 2011, did capital expenditures:

Increase	48%
No change	22%
Decrease	30%



Electricity demand was flat and coal consumption declined in 2011. As a baseload fuel, coal consumption can be considered an economic indicator. As America's factories power up so does the country's appetite for fuel. Overall demand for power increased 0.2% last year after increasing 4.1% in 2010. Coal-fired generation decreased 4.2% in 2011. Regulatory uncertainty, low natural gas prices and high hydroelectric capacity, kept utility coal buyers thinking short term. Meanwhile stocks eroded and spot coal prices began to track upward later in the year.

Setting supply-demand fundamentals aside for a moment, the survey also asked coal operators about their feelings, the amount of money they plan to spend this year and how they intend to spend it. The survey also asked them to rank issues affecting the industry. A similar open-ended question, designed to identify possible overlooked issues, elicited an overwhelmingly similar set of responses that singled out the Obama administration in general and the EPA in particular as an impediment toward future U.S. growth. While the short-term mood of the respondents was angry, frustrated and negative, long-term they remain optimistic.

**This Year Will be an OK Year, 2013 Could be Better**

*Coal Age* contacted 1,000 readers and received 103 completed surveys. The demographics largely resemble the U.S. coal industry. The majority of them (74%) produced bituminous coal. Subbituminous, lignite and anthracite accounted for 16%, 5% and 5% respectively. As far as production capacity, most of the respondents represented large mine operators (more than 5 million tons, 47%), followed by medium (1-5 million tons, 31%) and small (less than 1 million tons, 22%); 33% described themselves as underground coal operators exclusively, while 19% said they only operated surface mines. The remainder (48%) said they worked for a company that mined coal using both surface and underground techniques. Similar to years past, most of the respondents said their

coal went to electric utilities (68%). The remainder said their coal was destined for steel mills (22%) or industrial boilers (10%). Previously, those two segments were more evenly divided. For the past few years, met production has taken a little market share away from steam coal by a few percentage points. Nonetheless, steam coal is the overwhelming use for the majority of U.S. coal production.

Of the executives surveyed, 48% thought coal production would increase in 2012, while 23% felt production would drop and 29% said production would remain the same. Last year, 59% of the respondents thought 2012 coal production would increase and 12% thought it would decrease, what a difference a year makes. Even though the industry has seen this massive mood swing, 63% thought the industry would see a rebound from 2012 in 2013.

The question regarding productive capacity generated a similar pessimistic response (See Figure 4). A total of 61% of the respondents thought their mines would run at less than 90%. Last year, the industry made some ambitious predictions regarding productive capacity that simply did not pan out due to market forces. It looks as though the industry might be entering a period of over capacity.

Despite all of the regulatory hassles, more than one-half (60%) of the respondents view 2012 with optimism. That is a surprising response considering more believe production will decline and more think the industry will not operate a full capacity. It could be the low stockpiles at electric utilities or the fact that it's an election year or both.

Coal mining is a capital intensive business. When asked about their capital budgets, 23% of the respondents reported they would spend more than \$100 million this year. A total of 25% said they would spend less than \$10 million; 22%, \$10-\$25 million; 18%, \$25-\$50 million; and 12%, \$50-\$100 million. A little less than one-half (48%) reported the capital budget for 2011 had increased, while 30% said it had decreased. When asked how they would spend the money, they said new equipment upgrades (75%), new equipment (74%), mine development (71%), permitting (59%) and new mine start-up (40%). Equipment upgrades overtook new equipment for the first time in recent memory. While the level is about even, last year only 54% were planning equipment upgrades.

The survey also asked about the single most expensive item the mine planned to purchase in 2012. The answers (See Figure 5), as one would

**Figure 3—Current Spot Prices for Coal (\$/ton)**

	Btu/lb	lb SO <sub>2</sub>	Dec 07	Dec 08	Dec 09	Dec 10	Dec 11
Northern Appalachia	13,000	3.0	\$55.25	\$101.50	\$52.50	\$70.00	\$73.30
Central Appalachia	12,500	1.2	\$57.70	\$81.55	\$57.40	\$72.75	\$76.30
Illinois Basin	11,800	5.0	\$33.50	\$78.00	\$40.50	\$47.50	\$50.00
Powder River Basin	8,800	0.8	\$11.50	\$13.00	\$9.25	\$13.60	\$12.50
Western Bituminous	11,700	0.8	\$24.00	\$73.00	\$40.00	\$41.00	\$41.00

Source: EIA/Platts Coal Outlook Weekly Price Survey

**Figure 4—Productive Capacity: At what percent of your total capacity do you expect your company will operate in 2012?**

	2008	2009	2010	2011	2012
Less than 90%	43%	58%	68%	50%	61%
90% to 100%	57%	42%	32%	50%	39%

expect, ranged from \$40 million for a dragline to \$5,000 for a new sampling system. A total of five respondents said they planned to buy new dozers and two

said they would build a new prep plant. Really impressive numbers (hundreds of millions of dollars) were mentioned in association with reserve acquisition,

longwall mining equipment and new mine start-ups.

When asked how their money would be allocated on a percentage basis, the respondents said 34% of their money would be spent on new equipment and 22% would be spent on equipment rebuilds (See Figure 7).

Coal operators expressed a lot of frustration in the survey. When asked: What will affect the U.S. coal industry the most and how should it prepare? Here is a small sampling of the replies:

- The Obama administration ruling by executive order and through regulation is the greatest threat to our overall economy and to the coal industry;
- Obama, send him packing; and
- The EPA will impact the coal industry most significantly followed by economic demand. Need change in Washington to limit the authority of the EPA, a roll back of draconian regulations (MACT, CSAPR, etc.) that are killing the economy, and a pro-business administration that believes in the free market.

When asked about what specific issues will affect the coal industry the most in 2012, the obvious, overwhelming response was politics. Power plant regulation and permits remained more of a concern than prices. What the miners are saying is that prices and the economy do not matter if they can't operate a mine or their customers are not allowed to burn coal. Limited production capacity was the least of their concerns.

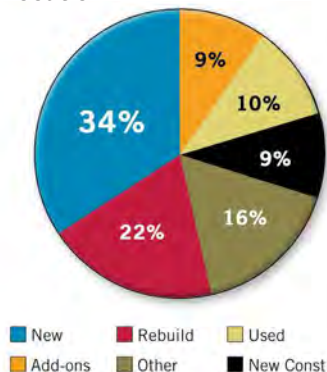
**Figure 5—What will be the single most expensive item the mine purchases in 2012? What will it cost, in round figures?**

Continuous Miner(s) (6)	\$750,000 - \$2.4 million
Dozer (5)	\$2.1-\$3 million
Dragline (2)	\$40 million
Dragline upgrade (2)	\$6-\$25 million
Electric shovel(s) (2)	\$125 million
Exploration (2)	\$20 million
Front-end Loader (2)	\$0.3-\$2.75 million
Haul trucks (4)	\$2.2 million
Highwall miner (2)	\$7-\$10 million
Hoist	\$3 million
Hydraulic excavator (4)	\$6-\$12 million
Longwall(s) (3)	\$65-\$400 million
Mine development (6)	\$6-\$77 million
New Equipment (8)	\$3-\$100 million
New Mine Start-up (5)	\$8-\$250 million
Prep Plant Equipment	\$1 million
Preparation Plant (2)	\$17-\$30 million
Prpe Plant Upgrade (2)	\$4-\$9 million
Replacement mobile equipment	\$10 million
Reserves (3)	\$0.7-\$500 million
Sampling system	\$5,000
Shovel Upgrade	\$4 million
Technology upgrades	\$20 million
Underground haulage	\$5.5 million
Underground Mining Equipment (2)	\$2-\$75 million
Ventilation (2)	\$5-\$40 million

**Figure 6—On a scale of 1 (not very important) to 5 (extremely important), how do the following concerns rate?**

1. Politics and policy (4.57)
2. Power plant regulation (4.35)
3. Permits (4.13)
4. Economy (4.06)
5. Prices (3.89)
6. Retiring workforce (2.98)
7. Limited capacity (2.88)
8. Other (2.79)

**Figure 7—Average Expenditure Allocation**



### International Markets Remain Tight

Coal is in high demand globally. According to the International Energy Agency (IEA), global demand for coal will continue to expand aggressively over the next five years “despite public calls in many countries for reducing reliance on the high-carbon fuel.” In a recently released report, *Medium-Term Coal Market Report 2011*, which presents a analysis of recent trends in coal demand, supply and trade, as well as an IEA outlook for coal market fundamentals for the coming five years. It projects average coal demand to grow by 600,000 metric tons every day over the next five



years. This is obviously disappointing for a group that believes the world can meet its needs through windmills and solar panels.

Asian-Pacific coal markets are still the big story. Chinese power generation was expected to increase 13% this year. Similarly, Chinese steel production was expected to increase by more than 10%. Coal imports into India had reportedly climbed as high as 40%. Other markets, such as Japan and South Korea have reported increased coal imports in 2011.

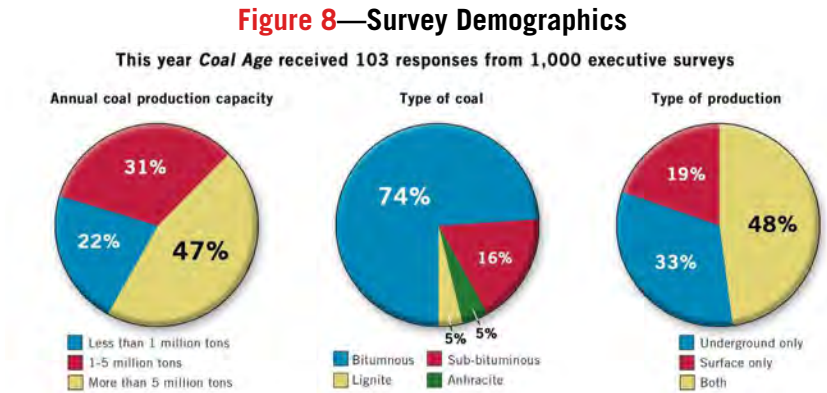
A lot has changed in the last year for coal exporters. Met coal prices surged after Australian floods took capacity offline for most of the year. The tide may change for met exports in 2012. Prices for metallurgical coal have now slipped to pre-flood levels and more Australian exports could exert more downward pressure on pricing.

U.S. coal exports are expected to exceed 107 million tons in 2011. At the end of September, coal exports stood at 80 million compare to 61 million this time one year ago. Quarterly exports stand at 26 to 27 million tons. In 2010, the U.S. exported 80 million tons.

### Domestic Markets Improve a Little

A slight production increase of 0.4% masks a year of great production swings. Total 2011, U.S. increased 5 million tons to 1,089 million from 1,084 million tons in 2010. Wyoming production dropped 7 million tons to 436 million tons from 443 million tons. Similarly, Montana's production dropped 3 million tons to 42 million tons from 45 million tons. North Dakota's production also dropped 2 million tons. The numbers for the rest of the Top 10 coal states improved: West Virginia (2 million tons), Kentucky (4 million tons), Pennsylvania (1 million tons), etc. All-in-all, the rest of the producers were able to offset a 12 million decrease from three key western states and grow total U.S. production another 5 million tons.

Some coal producing regions will gain at the expense of others while overall demand decreases. Many coal operators see Central Appalachian (CAPP) production declining subsequently



shifting to either Pittsburgh No. 8 seam mines or the Illinois Basin. CAPP has some challenges, including unfavorable geology, regulatory issues, railroad performance, litigation from environmental activists, etc. Permits for future surface coal mining jobs, mountaintop mining in particular, remain in jeopardy, but that represents only a slice of CAPP production. West Virginia also has some key advantages, namely a high-quality product in close proximity to power plants and export markets, and a more powerful political voice in Washington, D.C.

American factories run on electricity and demand will reappear when that manufacturing base begins to grow again. As of October 2011 (latest stats available from the EIA), utility coal consumption stood at 793 million tons, compared to 817 million tons at the same time in 2010. Total coal consumption for 2010 amounted to 980 million tons. Giving an optimistic level of consumption for November and December 2010 of 75 million tons per month (a total of 150 million tons), final 2010 utility coal consumption might amount to 943 million tons, a total decrease of 37 million tons.

Regulatory uncertainty has led to a draw down in coal stocks. Utility stockpiles reached a record of 204 million tons in November 2009. They shrank and then grew back to 175 million tons by October 2010. At the end of September coal stocks at utilities stood 144 million tons, some of the lowest levels since 2006.

Over capacity and low natural gas prices tend to exert downward pressure on prices for prompt deliveries. Spot

prices for coal, however, have increased to mid-2007/2008 levels. As an example (See Figure 3), December 2011 spot prices for Northern Appalachian (NAPP) coal grew to \$73.30/ton from \$70/ton. CAPP prices were \$76.30 compared to \$72.75/ton last year; Illinois Basin \$50 vs. \$47.50/ton last year. Prompt prices for PRB had dropped considerably to \$12.50/ton from \$13.60, while Western bituminous remained the same.

The EIA said it expects coal-fired power generation to decrease by 3.1% in 2011. The EIA expects coal-fired power to decrease by 2.1% in 2012 with overall electric power demand to remain steady.

If the U.S. economy improves as predicted and international markets remain tight, prices for prompt coal deliveries could spike again. Unfortunately, the jobless rate in the U.S. still remains high and Main Street has still not seen any significant improvement in the economy. Considering the levels of stockpiled coal at electric utilities, along with production constrained by regulators and increasing utility demand with competition from exports, coal markets will remain brisk in 2012 and could tighten further in 2013.

More U.S. coal operators will find a way to export coal to Asian markets. Anymore major supply disruptions will only exacerbate the situation. Taking all of this into account, and assuming the economy continues to plod along, but foreign demand remains high, *Coal Age* predicts U.S. coal production will decrease by 1.2% in 2012 or 13 million tons to 1,076 million tons.

# THROUGH THE EARTH COMMUNICATIONS

*MagneLink offers another option for emergency response*

The MagneLink Communications System (MCS) is a Through-the-Earth (TTE) communications technique developed by defense contractor Lockheed Martin in conjunction with NIOSH. It is defined by two systems, an in-mine and surface unit. The in-mine MCS consists of a transceiver, receiver antenna and large loop antenna. It's about 400 ft, intended to wrap around a coal pillar.

The surface unit uses the same antenna as the in-mine unit, but it is comprised of a smaller suitcase size transceiver. The unit's capabilities are low-bandwidth text and voice. The voice is voicemail, not real-time voice, much like a satellite phone. It also has a periodic emergency beacon system. In addition, it has been tested with miner emergency radios (MERs). It allows the in-mine unit to communicate with MERs then uplink the voice data to the surface unit and then another radio system.

This system has been designed to be fairly simple to use, explained Warren Gross, the specialist from Lockheed that developed the system. "The in-mine MCS has a built-in test to verify system readiness and to support the weekly and monthly checks, and to identify and correct faults," Gross said. "We have incorporated event logging for post incident reconstruction. It has been designed to be used in a harsh environment."

Essentially this is a software-defined radio that uses automotive embedded computers, Gross explained. The receive antenna subsystem has three ferrite rods, which provide the signal to a very quiet, ultra-low noise pre-amplifier. "That brings it into the digital domain where we do signal and data processing and then display it at the keyboard or send to the handset," Gross said. "We have a very simple display. We provide voltmeters and battery health status to enable rapid visual verification of the system status."

## Key Technical Aspects

The transmit subsystem is dual-channel that allows the user to communicate in

text or voice-and-text. "We support a multi-band capability that allows the user to communicate in text on one channel while communicating on voice and text on the other channel," Gross said. "In addition, we have two receivers that allow one unit to talk to another unit on one channel, while talking on another channel. This allows operators to communicate without pre-coordinating the receive channels." Unlike hand-held radios, where users have to pre-select the channels, the MCS will overcome that by receiving on all channels.

"Our receive subsystem is a ferrite core receive antenna arranged on three axis," Gross said. "We process the data and correlate the processing to provide advanced noise cancellation. It then comes up with a rotational matrix to determine a bearing for the transmitted signal."

The ultra-low noise amplifier is based on a design developed for submarine and radar applications. "It's a very low noise, yet it provides significant signal gain," Gross said. The advanced noise

cancellation system can be trained to look at the noise in the background. After every transmission, users will train the signal cancellation so they can look for variable noise in the environment. Warren believes this technology is much better than a sinusoidal noise-cancelling system.

Match filtering uses minimum shift keying reformulated as quadruple phase shift keying (QPSK). "This allows us to integrate over multiple sample intervals and reduce error rates," Gross said. "With the tri-axial receive antennas, we do correlated processing that provides a bearing and depression angle, and also allows us to look for the noise."

In sonar applications, sound specialists talk about a directivity index that allows them to see through the noise. "Our signal processing allows us to deal with bit error rates in the 3% range," Gross said. "That's three bits per 100 in the digital domain. A digital television would have  $10^{-6}$  error rate before you get a good balanced signal."

## MagneLink™

### Magnetic Communication System (MCS)



**In-Mine MCS Transceiver Unit**

22.0" D x 35.5" W x 33.25" H  
~1250 LBS



**Surface MCS Transceiver Unit**

16.125" D x 26.125" W x 11.5" H  
<70 LBS

*\*In-Mine and Surface Units use common antennas*

**Capabilities**

- Low Bandwidth Text and Voice communications
- Periodic Emergency Beacon
- Optional Miner Emergency Radio (UHF/VHF) Interface

**Design Features**

- Simple user interface
- Built In Test (BIT) to verify system readiness and identify/ correct faults
- Event Logging for post-incident reconstruction
- Specifically designed for harsh mine environments
- In-Mine MCS Transceiver in XP Enclosure to meet 30 CFR Part 23 requirements
- Surface MCS Transceiver two man portable packaged to meet IP65 requirements



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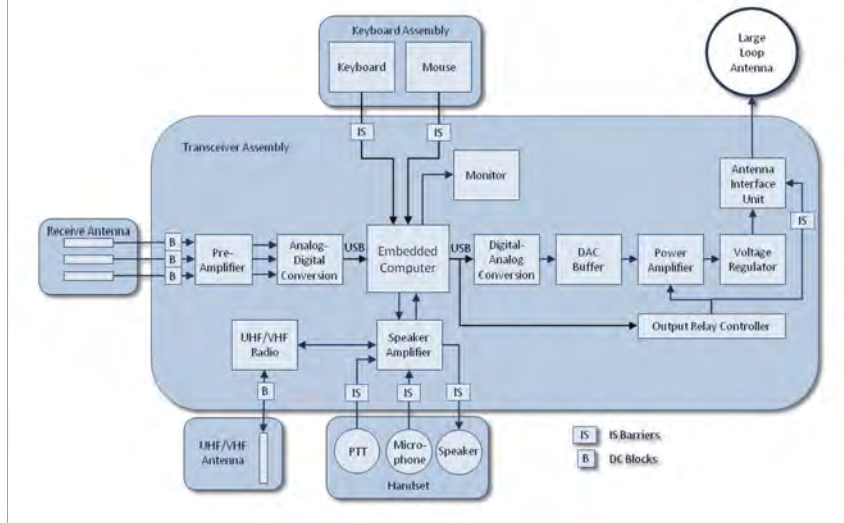
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## MagneLink™ MCS Overview



For this project, a voice CODEC was developed, which has good quality voice. "It handles very low data rates," Gross said. "We're able to support recognizable voice using a 3 kHz carrier. The voice quality is good enough to discern who is speaking, recognize their voice and their emotions."

### Successful Demos

The MCS has been demonstrated successfully for several ranges. "When we first started working with NIOSH, they set some thresholds and objective ranges," Gross said. "They were looking for 1,200 ft for voice and text. They were really looking for

1,500 ft. Within the mine, we have demonstrated greater than 1,750 ft for voice, 2,400 ft for text and 2,800 ft for the beacon.

"Within the mine, we are transmitting along the coal seam, which is a consistent environment," Gross said. "We have demonstrated, using intrinsically safe levels within the mine to the surface, 1,550 ft voice and text and almost 2,000 ft beacon. Those were very consistent ranges that we have detected. We have had some ranges that were quite a bit more." The conditions from mine-to-mine vary. These ranges have been seen repeatedly, Gross explained, but they are not guaranteed at this point. "But, it's what we have seen so far," Gross said. "Based on the data, we think the MagneLink system meets or exceeds the government's objectives for voice and text."

The in-mine unit is fairly large. "We see it being strategically placed along with refuge chambers in the working sections and potentially along escape routes with SCSR caches," Gross said. "If miners become trapped during an incident and lose communications, they would turn on the system, enable the beacon mode and retreat to a shelter." From within the shelter they could use




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their MERs and communicate to the in-mine MCS which would transmit the data to the surface. Even with a roof fall, where a portion of the communications infrastructure was destroyed, the MCS would still be able to operate. It's self-contained and operates on batteries.

Emergency responders on the surface would then take the surface unit and place it in a strategic location based on where the engineers believe the miners would be located and the position of the MCS underground. They would lay out the antenna and try to establish communications.

The approval process began in September 2009. "We have completed all of the testing with MSHA with our safety related electronics. The enclosure was explosion tested during May 2011. MSHA granted the MCS 30CFR Part 23 approval during July 2011.

Preliminary production units have been built and field tested. "We have been working with our mine industry partners to establish supply chain, production line, distribution channels, setting up training and making sure its supportable in the field," Gross said. "Carroll Engineering and Delta Electric will be responsible for mar-

keting, installing and training, and providing the technical services." Lockheed Martin will provide 24-7 support to Carroll Engineering and Delta Electric.

*This article was adapted from a presentation that Warren Gross made on the MagneLink for Longwall USA 2011, which was held during June in Pittsburgh, Pa.*

## MagneLink™ MCS Demonstrated Performance Ranges

### *Intrinsically Safe Demonstrated In-Mine Ranges*

*\*Actual Range will vary depending on overburden and other conditions*

	<b>NIOSH Threshold Requirement</b>	<b>NIOSH Objective Requirement</b>	<b>Demonstrated In-Mine Range</b>	<b>Demonstrated Mine-Surface Range</b>
<b>Voice</b>	1200'	1500'	>1750'	1550'
<b>Text</b>	1200'	1500'	2400'	1550'
<b>Beacon</b>	-	-	2800'	1950'

**MagneLink Meets or Exceeds  
Government Objectives (Voice & Text)**

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# COST-EFFECTIVE DRILLING COMES AT A PRICE— BUT PAYS BIG DIVIDENDS

*Recent conference highlights the information needed to plan, drill and shoot efficiently*

BY RUSS CARTER, WESTERN FIELD EDITOR

The success or failure of an individual blast-hole to achieve its intended effect doesn't carry much statistical clout in a blast pattern comprising up to 1,500 holes, or at a mine that routinely conducts multiple daily blasts—or across a global industry that measures total daily blasthole production in the five-figure range or higher. It's only when the reasons for consistent drilling and blasting (D&B) success or failure become systemic to an operation that a noticeable change in productivity becomes apparent, occasionally leading to spirited discussions within and between mine departments about "what are we doing wrong?" or much less frequently, "What are we doing right?"

As described by an experienced applications engineer for one of the major drill-equipment suppliers, D&B is "all about putting the right amount of energy in the right place at the right time at minimum cost to achieve maximum control over the shot rock volume and the resulting particle size distribution in the muck pile." The benefits of a well-designed blast—or the repercussions of a poorly executed D&B plan—reverberate far away from the actual blast site, as shown in the accompanying diagram that depicts how various elements of D&B practice can influence downstream operations.

Although the physics of sinking a simple hole into the ground seem straightforward, the path to consistently effective D&B strategy meanders through a thicket of thorny issues that demand attention, ranging from an understanding of local geological conditions, proper drilling equipment selection and climate considerations, to the type of explosives required or locally available, for example. Accompanying those considerations are other factors such as volume of material to be excavated according to mine plan, hole diameter, optimum bench height, stemming material source, fragmentation requirements, and desired level of equipment utilization and availability, among others.

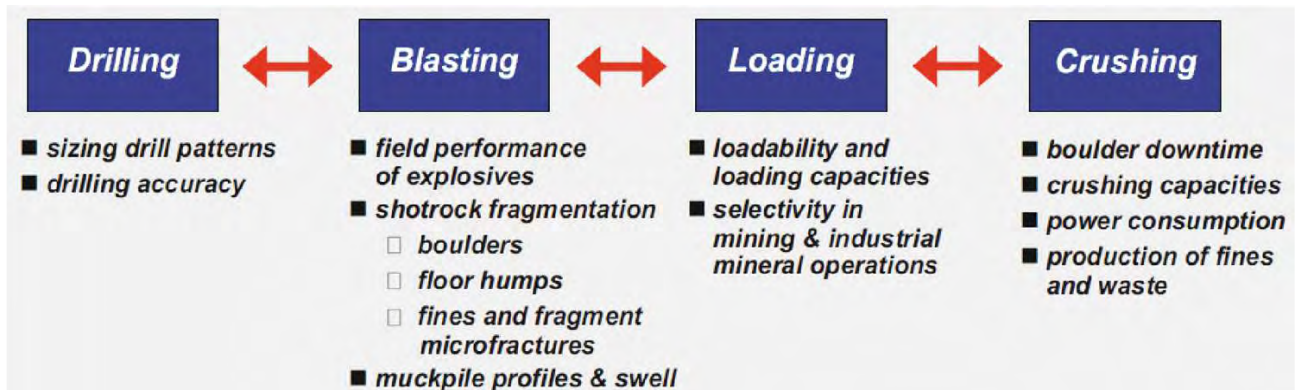
Adding to the technical difficulty is the quick pace of daily job duties, technological progress and product introductions that can make it hard for mine personnel to stay current on best practices for D&B success. In October, Sandvik Mining & Construction convened its first Mining Forum, aimed at bringing participants up to date by focusing on fundamentals as well as recent technological developments in surface-mine drilling and blasting operations. The three-day event, which included 112 participants from 25 mineral producers and mining contractors, was held in Johannesburg, South

Africa, against the backdrop of the African continent's vast mineral potential—and equally immense needs for drilling and blasting equipment, techniques and management strategies to effectively cope with its widely varying mine-site conditions.

## Determining Drillability

In addition to the regional macro-economic trends and political issues, Africa-based mineral producers share mine-site operational challenges that are common throughout the global industry. Among these, the search for improvement in D&B economics may not be paramount in the list of cost-cutting concerns but is definitely rising rapidly in importance. Several of the forum's presentations dwelt on fundamental aspects of identifying and selecting the most appropriate drilling equipment and methods for a given application.

Charles Deacon, Sandvik's vice president of marketing for the Africa region, explained that D&B activities may account for as much as 15% of total production costs, and are actually the most controllable of these costs. Across an entire operation, D&B can affect excavation rates, cost of loading, secondary breakage requirements, ore grade dilution, processing rates, slope stability concerns and mine site safety.



The positive or negative effects of a mine's drilling and blasting methods extend far beyond the blasthole or blast pattern. (All figures courtesy of Sandvik Mining and Construction.)



One of the basic informational needs for determining the best drilling approach for the application, said Deacon, is knowledge of rock mass “drillability”—defined by three factors: drilling rate (penetration), bit wear rate (time elapsed between regrinds), and bit life (distance drilled before reaching end of economic bit life). The most well-known indicator of drillability is the Drilling Rate Index, a relative measure of penetration rates in a given rock type. DRI is determined by two common tests that measure rock toughness and rock surface hardness. In general, the lower the DRI, the lower the drilling rate that can be expected, and vice versa.

Armed with knowledge of local rock characteristics, the customer still faces a long list of factors that must be considered when choosing the proper drilling method. These involve both technical and commercial issues, according to Deacon, and include:

**Technical**

- Hole diameter
- Hole depth/bench height
- Production rate

- Size of operation
- Terrain/mobility/flexibility
- Special techniques required
- Legal requirements – dust, noise, etc.

**Commercial**

- Rock hardness
- Hole angle
- Power availability
- Ownership
- Price
- Fleet size
- Economic life
- Technical support
- Parts supply
- Training
- Operating cost

**Putting Together the Right Rotary String**

For those operators considering rotary drilling methods, Mark Baker, Sandvik’s global product line manager for rotary tools, highlighted the physical limits of the equipment and the importance of using the proper drill string and bit setup. He emphasized that effective control of the feed and rotation applied by a rotary drill rig are essential to productive and

cost effective operation of the drill. Excessive loading by either parameter will significantly reduce consumable life and increase mining costs.

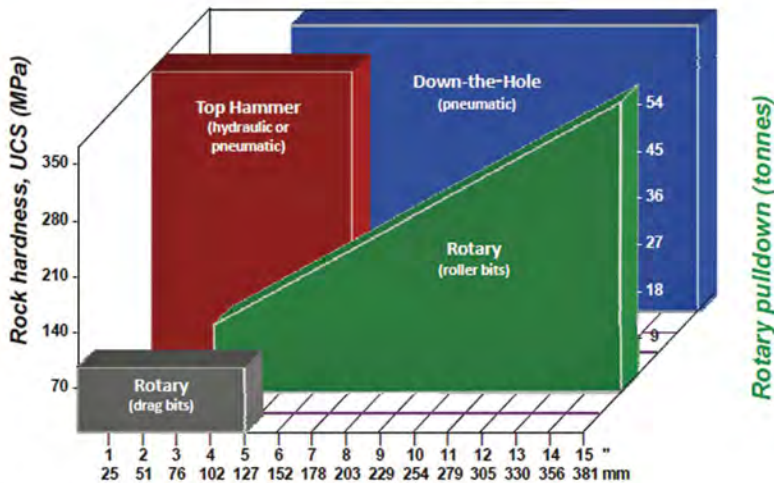
In addition, careful selection of every drill string component is vital to achieve accurate holes, optimal fragmentation and operational efficiency. A complete rotary drill string assembly can include the following:

- Shock sub (optional) – Recommended for use in applications with high levels of axial and lateral vibration (>10g) such as drilling in fractured formations. Benefits include increased drill availability, reduced mast maintenance and less rotary drive head repairs, smoother on-bottom running and improved torque control.
- Top sub – The connection between the drill pipe and rotary motor or shock sub.
- Drill pipe – Based on the outer blasthole diameter, a proper drill string OD should be selected that will provide the necessary column support to reduce flexing, as well as sufficient annular area for cuttings evacuation.
- Deck bushing – Guides the drill string, reduces risk of wobbling, prevents reduction of rotary head torque and supports



Attendees at The Mining Forum, held in mid-October in Johannesburg, South Africa, were offered more than two dozen presentations on drilling and blasting technology and best practices. Inset: During the event, sponsored by Sandvik and supported by AEL and Thunderbird Pacific, a check from forum proceeds for more than \$12,000 was presented to Compass, a South African charity organization focused on care and education of abused women and children.

## Why Rotary?



Recommended effective material and hole-diameter ranges for each major drilling method.

drill string configuration in producing straight holes.

- Bottom sub or stabilizer – Allows for connection of the bit to the pipe. Roller stabilizers are used for improved hole stability in hard and broken formations, where hole caving is prevalent. Blade stabilizers are used in softer formation where the gauging and scraping of the hole wall improves hole quality.
- Rotary bit – Proper drill bit selection is vital for achieving desired results. Pay attention to factors such as ground conditions (rock hardness, abrasiveness, competency and ground water); study product specifications and local availability; determine correct cutting structure, bearing configuration (sealed or air-cooled) and air-nozzle sizing for site conditions.

Baker cited several case studies in which changeover to a properly configured drill string produced significant results, including:

- A copper-gold mine at which average drill pipe life without a shock sub was 25,000–30,000 m with eventual breakdowns usually due to thread failure from vibration. With shock subs in place, drill pipe life increased to 42,000 m, with end failure resulting from eventual surface erosion.
- In another application, drill pipe conversion from 40/20 ft to 33 ft (x2) resulted in less handling, improved ease of rotation and longer service life. Savings amounted to 270,000 per year, primarily from improved efficiency.

### Playing it Straight

No matter what drilling method is selected, overall D&B performance will suffer unless holes are drilled straight and according to plan, from collar to bottom. When an operation “drills holes that look like spaghetti,” according to Arne Lislrud, surface applications manager for Sandvik, it can expect:

- Floor humps, hindering efficient loading due to uneven pit floors;
- Unstable pit walls and difficult first-row drilling;
- Safety concerns from flyrock;
- Stemming material blowouts that generate safety, excessive dust and “bad toe” concerns;
- Poor blast direction, affecting quality of floors and walls;
- Shothole deflagration and/or misfires that produce safety hazards and poor muckpile diggability.

The keys to achieving consistent straight hole drilling, said Lislrud, are simple: Be aware of the numerous issues that lead to drillhole deviation; operate with a technically sound drill rig, drill string and instrumentation; and motivate drillers to strive for best results. Good practice dictates only 2%-3% maximum drillhole deviation in regular production drilling operations.

For collar position error control, Lislrud recommends:

- Using tape, optical squares or alignment lasers for measuring-in collar positions; or
- Using GPS or total stations to measure collar positions;

- Marking collar positions using painted lines, not movable objects such as rocks, etc.;
- Protecting completed drillholes with shothole plugs to prevent holes from caving in (and filling up);
- Using GPS guided collar positioning devices, such as Sandvik’s TIM3D drill rig navigation system. Similarly, to control drill-hole deflection:
- Select bits less influenced by rock-mass discontinuities;
- Reduce drill string deflection by using guide tubes, etc.;
- Reduce drill string bending by using less feed force;
- Reduce feed foot slippage since this will cause a misalignment of the feed and lead to excessive drill string bending;
- Avoid gravitational effects that lead to drill string sag when drilling inclined shotholes (>15°);
- Avoid excessive bench heights.

Choosing the proper bit face design can enhance drill-hole straightness, he also noted. When a percussion bit first starts to penetrate through a rock-joint surface at the hole bottom, for example, the gauge buttons tend to skid off this surface and thus deflect the bit. More aggressively shaped gauge inserts (ballistic / chisel inserts) and bit face gauge profiles (drop center) reduce this skidding effect by enabling the gauge buttons to “cut” through the joint surface quickly, thus resulting in less overall bit deflection.

The right bit-skirt design also helps: As the bit cuts through a joint surface, an uneven bit face loading condition arises; resulting in bit and drill string axial rotation that is proportional to bit impact force imbalance. A rear bit skirt support (retrac type bits) reduces bit and string axial rotation by “centralizing” the bit.

Other deviation countermeasures include using a longer bit body, adding a pilot tube behind the bit, using lower impact energy, or employing a drilling control system that can rapidly react to varying torque, feed and percussion or pull-down demands based on hole conditions.

*Additional information regarding the 2011 Mining Forum can be obtained at [www.theminingforum.com](http://www.theminingforum.com).*



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# OBSERVE IT, MEASURE IT, MANAGE IT

*Effective plant process control needs data—lots of data—and sensor technology has taken big strides toward supplying the required information quickly and accurately*

BY RUSS CARTER, WESTERN FIELD EDITOR

On the scale of risk potential for industrial projects, the design and startup of a processing plant most likely ranks in the upper percentile range. Unlike, say, an auto assembly plant, mine plants can't be cloned from one site to another. Each mineral deposit differs from seemingly similar deposits elsewhere, and it's impossible to pin down and eliminate every variable encountered when trying to process natural materials such as ore, coal or industrial minerals. Plus, unlike construction mistakes that often can be fixed quickly and sometimes even relatively cheaply, a defective flowsheet usually can't be corrected quite so easily.

Apart from design errors, it occasionally happens that once a new plant progresses beyond the commissioning stage—after leaks and other obvious mechanical problems are found and corrected—process failure occurs due to misunderstanding or misapplication of laboratory or pilot plant findings. However, a quick scan of recent mineral processing literature hints that operator miscues also might be a bigger problem than expected as a cause of sub-par process performance. Because of inexperience or unfamiliarity with the technology, plant personnel may not understand or have a complete picture of what's happening inside the plant's process systems.

In addition to improved operator training, another way to solve this problem is through greater reliance on process control systems that make essential data easily accessible to operators, allowing them to make better, faster decisions. At the 'business end' of these advanced systems is a new generation of sampling and sensor technology that has progressed far beyond the warning-and-reaction role these devices originally filled. Today, sophisticated non-intrusive systems can provide operators with real- or near real-time understanding of not just what's gone wrong, but also of what's happening inside a plant's pipes, tanks, columns and thickeners that can be adjusted or corrected to avoid problems

and improve plant performance. The proliferation of wireless technology in industrial applications also provides the opportunity to provide operators with additional data, with less delay, often from points in the plant that previously were unmonitored due to physical or cost restraints. Mobile communications devices and 'apps' add another dimension of data accessibility, allowing plant personnel to keep track of equipment and system status without being chained to the control room chair.

From a broader standpoint, cumulative advances in sampling and sensing technology now allow mineral producers to maintain a digital data stream of information from the exploration and mining stages, through grinding and flotation, and extending to tailings management, environmental monitoring, site safety and security matters as well. Here's a recap of selected recent product developments in this technological sector.

## Before Processing Begins

Colorado, USA-based ASD Inc., a supplier of analytical instrumentation for materials measurement, has introduced two mining industry-specific spectroscopic measurement devices—the TerraSpec Explorer and TerraSpec Examiner—for analysis of minerals in exploration and production.

The TerraSpec Explorer spectrometer is designed for rapid qualitative minerals analysis during exploration and deposit mapping. According to the company, this portable instrument provides immediate mineralogical results and can assist in analyzing a wide variety of deposit types by determining the key alteration minerals. With a spectral range of 350–2500 nm and 6-nm resolution, it has the accuracy needed to help geologists evaluate samples across a broad area, rapidly determine the mineralogy of prospective mining locations, identify alteration patterns and classify ore systems.

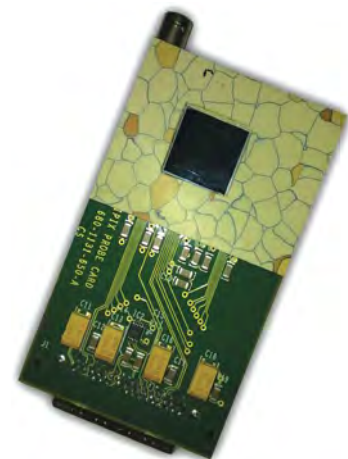
The TerraSpec Examiner, says ASD, is designed for use in the lab or field to perform quantitative materials analysis of ore in production. It offers 10-nm resolution, a

broad spectral range of 350–2500 nm, and can be used for monitoring moisture, acid-consuming gangue minerals, clays and other materials influencing process outcome. When combined with application-specific calibrations from ASD's SummitCAL Solutions, mining operations can build on existing sample analysis to analyze a much larger set of samples in a significantly reduced amount of time. This can result in tighter process control and significant cost savings in a variety of mining processes, including agglomeration, flotation, ore sorting and heap leach.

As this report was being prepared, an article appeared in the October issue of CSIRO's *Process* magazine describing a new, state-of-the-art X-ray imaging detector smaller than a postage stamp as possibly being the key to a powerful new method of characterizing mineral ores.

The photon-counting device, called Medipix, can take high-resolution images of minerals, detailing the materials present in an ore sample. Unlike conventional X-ray films and cameras, the new technique measures the energy of individual incoming X-rays and adds color to traditional black-and-white snapshots.

The author of the CSIRO article, Alexandra Roginski, writes: "While X-rays



The Medipix device adds color to X-ray images.



have long been used to image mineral ores, with shades of grey depicting the density of different components, these images do not easily identify the individual minerals present. It is akin to seeing a foreign object on an X-ray of a human body—knowing it shouldn't be there, but not being able to identify exactly what it is. In the Medipix process, an X-ray tube fires beams through grains of ore. A sensor on the other side measures how X-rays of different energies are attenuated by the objects in the beam.

"Medipix then images the grains of ore in detail, producing pictures in which colors correspond to the elements contained in the sample. The detector collects information at more than 65,000 points simultaneously and multiple images can be obtained and joined together to increase the field of view."

Research scientist Dr. Josef Uher said the new technique could revolutionize micro-imaging, and the mining industry.

"In every single pixel of the detector, you gain information about what the X-ray spectrum looks like. If you analyze it properly, you can determine whether the materials in the sample are nickel, copper, zinc, gold or something else," Uher said.

According to the CSIRO article, Medipix could provide near real-time imaging of ores for plant monitoring and control in the mining industry.

**Fine-tuning Flotation**

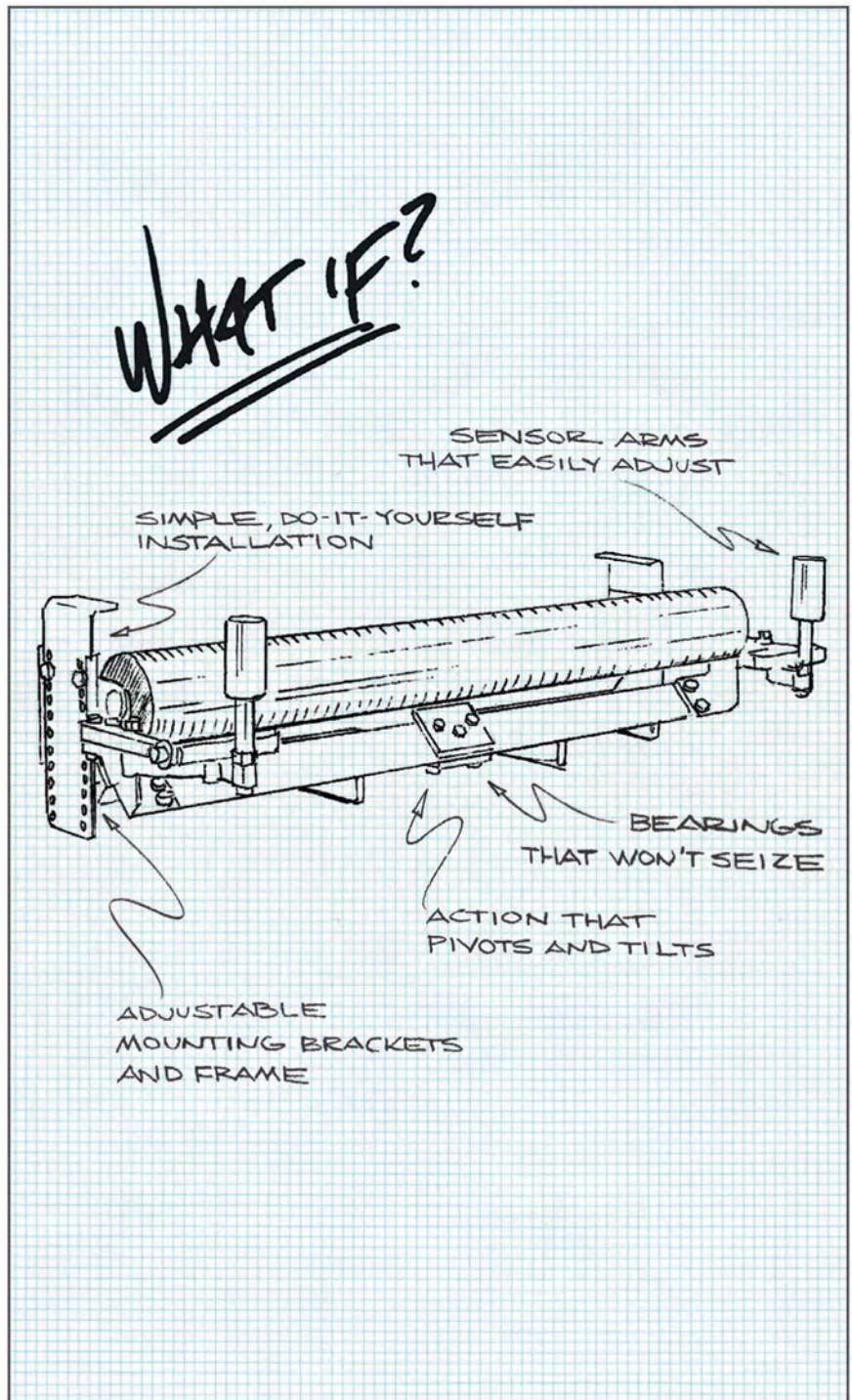
Further downstream in the processing sequence, Numcore Oy's new impedance-tomography imaging technology opens up entirely new possibilities to control flotation processes, said Jukka Hakola, the Finnish company's vice president of sales and marketing. "Problems emerge if froth cannot carry the load of mineral particles or the process otherwise becomes disturbed. The froth bed then disappears, and restarting the process wastes valuable time," Hakola said. "If the solid matter content and bubble size in the froth bed changes, and solid matter starts to gather under the froth, this can cause the froth to become rigid or to collapse. When this situation can be predicted, the problem can be solved by changing the operating parameters."

With Numcore's measurement devices, the size and quantity of air bubbles and the solid matter content of the froth bed can be monitored by means of electric conductivity distribution. Real-time performance is a key functionality in this technology; the system can continuously provide the operator with current data on what is happening in the flotation cells.

"Controlling a mineral concentration process has largely been based on experience-derived know-how. Now that operators can 'look' inside the process, it is possible for them to maintain an optimal mix all the time," said Hakola, who cautioned that measuring, by itself, does not create added value—rather, the results should be used to control the operation. Consequently, Numcore has, in co-operation with key customers, developed

measurement technology to better serve the routine requirements of day-to-day plant operation.

Depending on the diameter of the pipeline or tank, Numcore's measurement devices are configured as either a flow-through sensor or as a probe-type sensor for installation inside large pipelines or tanks. By supplying a weak alternating current to the electrodes of the sensor, it measures conductivity dif-



ferences between the phases—for example, with liquids inside pipelines and tanks, as different substances show different conductivity values. The actual image is created by means of inverse calculation, however, and this is where Numcore's core expertise lies.

"Our CoreApus flow-through sensor lends itself for analyzing material flows inside pipelines of less than 1 m in diameter. Because processing tanks are generally larger than this, we have developed the probe-type CoreHydra sensor which can analyze a larger area of the tank. With several sensors, one can analyze even a large tank or cell," said Hakola.

According to the company, both sensor types can accurately measure interfaces between liquids and solids, but CoreApus is also applicable for imaging rapidly flowing liquids.

"The biggest difference compared to previous systems is that now you can analyze why and how something is happening in the process, and how you can prevent an event if necessary. We focused on making the system easy to use to enable real-time and on-site corrective measures rather than relying on, say, laboratory samples," Hakola said.

Employing a different approach, Melbourne, Australia-based Hawk Measurement Systems, a provider of level, positioning and flow measurement technology, has developed an acoustic device for optimizing flotation cell performance. Hawk's very-low-frequency Acoustic Wave Transmitter is non-intrusive and can penetrate the froth to measure pulp height, according to the company. The sensor is mounted above the froth and pulp level, reducing maintenance or mechanical problems, and the transmitter can be mounted at walkway height for easy serviceability. The transmitter can be supplied ready for connection to a typical two-wire loop power supply used for the displacement float transmitter that it replaces. Remote-mounted transmitters are also an option.



Hawk Measurement's Acoustic Wave Transmitter.



Thermo Fisher Scientific's Nitus gauge allows a non-intrusive look inside large processing vessels and pipes.

### Looking Inside, with Radiometric Help...

Thermo Fisher Scientific designed its new Nitus Gamma Backscatter (GBS) gauge to measure level, density and wall buildup in large mining vessels of any size and pipes 24 in. or larger. Using non-contacting gamma backscatter technology, the sensor measures overflow clarity and flocculants, facilitates control of solids in paste tanks and monitors solids concentration in settling tanks and clarifiers. The sensor on the Nitus gauge features a highly stable, sensitive scintillation detector that allows the system to respond instantly to level or density changes. Additionally, the sensor requires only small amounts of energy, needing only a small gamma source to achieve precise measurements. In many applications, says the company, the amount of gamma energy needed for a typical level or density measurement can be reduced by a factor of 200, without giving up speed of measurement or precision. The small source also lowers capital costs and improves plant safety.

Ronan Engineering claims its X96SI/R radiometric transmitter is ideal for difficult continuous level measurement applications in harsh process environments such as mining. The entire system mounts externally to the vessel or pipe and employs gamma energy to provide reliable and accurate measurement when other measurement techniques are not an option. The X96SI/R, according to the supplier, is the first radiometric transmitter to be fully Ethernet capable, enabling configurations, software updates, and data logging to be completed easily through the user's PC using a standard Web browser. The X96SI/R includes a patented optical coupling that allows the transmitter and detector electronics assembly to be easily mounted to any detector configuration. The transmitter can also be

remotely mounted in the field or control room. The X96SI/R is available in explosion-proof, weather-proof or stainless steel housings. The system is backward-compatible, enabling easy upgrades of existing systems to newer transmitter technology.

According to the company, the complete system can be installed and maintained while the process is running, without downtime, vessel modifications or risk of accidental release.

### ...and Without

Germany-based process measurement instrument specialist Krohne Messtechnik GmbH recently reported its Australia group had successfully applied Krohne's Optimass Coriolis mass flowmeter to a tailings thickener underflow line to provide a non-radiometric density solution.

With annual production of more than 10 million metric tons (mt) of coking coal, the unidentified customer needed reliable thickener underflow density measurements



Ronan Engineering's radiometric transmitter is designed for continuous level measurement in harsh environments.



to enable its preparation plant to optimize tailings disposal schemes to recover water, minimize tailings impoundment areas and comply with regulations over the life of the facility.

According to Krohne, radiometric density measurement has traditionally been employed on thickener underflow lines as they provide a non-contact solution to the high solids, high abrasion environment present in minerals processing. However, the company maintains the high total cost and regulatory requirements of owning radiometric devices is becoming prohibitive. In addition to the initial purchase price, licensing, transportation of nuclear source, documentation and administrative controls, radiometric devices require ongoing training of on-site radiation safety officers who can perform calibration, wipe tests and ensure regulatory compliance. Add to this decommissioning and disposal costs.

Krohne says its straight-tube Optimass 7000 series Coriolis mass flowmeters have been successfully used on abrasive fluids such as ore slurries and sand/water mixtures for more than 15 years. In these applications, a single straight measuring tube provides advantages over other designs with tube geometries that incur erosion and premature failure of flow dividers and bends in the abrasive fluid stream.

Krohne Australia also recently installed the supply flow, level, density, pressure and temperature instrumentation for the carbon-in-leach gold and silver processing plant at the Morobe Mining Joint Venture Hidden Valley mine in Papua New Guinea. The plant treats 4.6 million mt/y of ore and produces an average of more than 250,000 oz/y gold and 4 million oz/y silver.

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Siemens' LR560 microwave radar level detector.

transmitter combines level measuring with high accuracy in tough environments, offering intelligent signal processing for optimum performance. The LR560 has a measurement range of 100 m (328 ft) and emits a narrow 4° beam. In addition to the advantages offered by its narrow beam configuration, its short-wavelength emissions provide excellent signal reflection, even from solids with a steep angle of repose. The lens antenna is highly resistant to

material build-up and a built-in purge system is included for cleaning exceptionally sticky material. The high-frequency operation makes aiming unnecessary, but an optional aiming flange helps direct the beam to an area of specific interest, such as the discharge area of a silo cone. A high-resolution graphical interface guides the user and expedites start-time to less than 1 minute for accurate readings without need of fine-tuning.

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# AUTOMATED BLENDING & STOCKPILE MANAGEMENT

*New power plant uses sophisticated system to manage coal deliveries from many local sources*

During November, Dominion Virginia Power started one of two boilers at its Virginia City Hybrid Energy Center (VCHEC) in Southwest Virginia. It began the testing phase for the \$1.8 billion power station that is on schedule to begin generating electricity this summer.

Work began at VCHEC in June 2008 and construction has entered the final phase. After it begins commercial operations, the power station will burn coal, waste coal and biomass (wood chips) in its two circulating fluidized-bed boilers (CFBs) to produce 585 megawatts of electricity. Located in Wise County, Va., about 40 miles north of Bristol, Tenn., this station is part of Dominion's plan to meet an anticipated growth of nearly 4,600 megawatts in electricity demand in Virginia during the next decade.

Biomass will represent the baseload fuel at a level of 15% with coal and coal waste making up the rest of the fuel mix. During the Coal Handling & Storage seminar, which was held during November, in St. Louis, Randy Shepler, a materials handling senior process specialist for Power Engineers, based in Atlanta, Ga., explained some of the details regarding the new plant's sophisticated stockpile management system. Power Engineers designed the system that will accept the coal, manage the stockpile, blend the coal, and deliver it to the plant. "This new plant faced a lot of scrutiny and it will serve as a model for building more new plants," Shepler said.

When it comes online, the VCHEC will have a maximum burn rate of approximately 10,300 tons per day. The coal yard, which sits in close proximity to a highway, will be 1,200-ft long and 50-ft high and the stockpile configuration will accommodate a 12-day supply of coal. The plant will accept local run-of-mine coal from as many as 35 mines within a 40-mile radius of the plant, Shepler explained.



One of the newest power plants in America, the Virginia City Hybrid Energy Center will co-fire bio-mass with coal.



The coal handling operations consist of a truck dump and a stockpile area with linear luffing stackers and rake reclaimers.



The VCHEC coal inventory system consists of a coal receiving system, which feeds a linear luffing stacker and a rake reclaim system. Unloading 35-ton, end-dump trucks at a rate of 1,440 tons per hour over a 10-hr day, the truck-receiving facility can accept more than 14,000 tons per day. The plant receives coal only five days per week, no weekend receipts. Two luffing stackers will stockpile the coal and two rake reclaimers will place coal on the conveyors. Each is assigned to high- and low-grade pile. Coal is blended using a network of conveyors, conveyor scales and an elemental analyzer. The blended coal is then fed by a tripper conveyor to a set of silos (bunkers). From there, it is fed to a set of cagemill crushers, then posimetric feeders, which feed the CFBs.

"The system will blend from a low- and high-grade source at a 50:50 mixture," Shepler said. "It has to be flexible enough to adjust the blend based on the grades encountered in the pile."

#### Truck Delivery Facility

The truck receiving facility will unload more than 400 trucks per day. That does not include the trucks handling limestone, biomass and ash. "The facility is built to stage those trucks," Shepler said. "Obviously, it will have a lot of truck traffic and a fairly sophisticated four-lane road system surrounds the yard."

A big part of the job is making sure the trucks go to the right location. The coal yard has a set of inbound truck scales with a sampler at each location. The trucks will arrive with a smart card (RFID tag) that identifies the truck and the coal grade. The computer system will direct the truck to its unloading point. "We have designed two unloading stations for high grade coal and two unloading stations for low grade coal," Shepler said. "The facility is designed to unload 720 tph for each grade."

The over-size material is separated in the pit below by grizzlies at the bottom of the hoppers. "Some of the coal will be sized and sorted prior to arrival, but the facility expects to handle material from random sources that could be minus 8 inches and on occasion even as large as minus 12 inches," Shepler said. All of the over-sized material will report to one rotary breaker that separates the rock from the coal. The coal will be reduced to

minus 2 inches and fed back into the low grade stream.

The rock from the rotary breaker reports to a bin. It is then loaded into the empty trucks reporting back to the mine. The weight of the rock is recorded on the smart cards. "The system will know exactly how many tons of coal entered the yard and how much rock has been returned," Shepler said.

The scales will verify inbound coal and outbound rock. A set of check and balances will tell the coal yard operators what they have on site at any given point in time. The coal yard operators know how much they have burned and what they have on hand. They can then contact ABC Coal Co. and ask them to deliver a certain tonnage of a certain grade tomorrow.

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### Blending & Stockpile Management

Belt scales will track the high- and low-grade coals as they enter stockpiling system through the conveyors. “We will know

the tonnage reporting to each pile,” Shepler said. “The pile management system is important because the plant only has 12 days of storage. Getting coal to the

site is not an issue, but managing when the coal arrives and the quality is important.”

The system will stack high-grade coal at 720 tph and low grade at 920 tph. The additional low-grade capacity is needed to account for the over-size material. “The coal is stacked in a chevron pattern, which is a big help in the blending process,” Shepler said. “The trucks will arrive randomly. The coal has to be blended as efficiently as possible.”

A chevron stacking system will better meet the average calorific value specification for the boiler. “With the chevron arrangement, a low-grade range, 5,000 to 9,000 Btu/lb, can be established,” Shepler said. “Everything in the low grade pile is within that range.”

By using this method, the system can use the trucks and stackers to help blend the material as it goes into the yard. A cone-style system would not work as well because it segregates the coal with all of the heavy material falling to the perimeter and the fines gathering on the inside of the pile, Shepler explained. “We have eight stacking zones per grade,” Shepler said. “Seven days a week, the system will reclaim coal from the pile and yet it will always have a spot to put coal on the ground. It will maintain a space between the reclaim area and the stacking area.”

The cross section of the pile amounts to 3,000 sq ft per ft. “At any one time, the pile could have 21 seams from 5,000 to 9,000 Btu/lb,” Shepler said. “On the high-grade side, the calorific value of the pile would range between 9,000-12,500 Btu/lb. The object is to blend to meet a 7,700-7,800 Btu/lb fuel.”

With a reclaiming rate of 1,500 tph, the system should be able to fill the bunkers in less than four hours. The actual capacity of the individual reclaimers is much higher, about 950 tph. “Sometimes one machine will have to dig faster than the other to maintain the mean rate,” Shepler said. “Also if one of these reclaimers goes to down, the other reclaimer can still feed the plant at 950 tph from the high grade pile. That’s a big deal. They are both running on the same set of rails and one machine can cover 80% of the pile.”

The reclaim conveyor uses a 48-inch belt, which runs the full length of the yard up to the crusher building. The blending system uses an elemental analyzer and



The truck dump facility has been designed for 400 trucks per day.



Two linear luffing stackers will stockpile in a chevron pattern.



Rake reclaimers will pull coal from a high- and low-grade area.



two belt scales. The belt scales measure the tonnage from each pile, while the analyzer reports the quality of the mixture. "The online analyzer can describe the chemistry of the coal, but the system is only concerned with the calorific value of the blend," Shepler said. "The computer takes the data from the online analyzer and then adjusts the speed of the reclaimers to control the blend. It has an acceptable band of  $\pm 1,000$  Btu/lb. When it moves 380 Btu/lb up or down, it starts making adjustments in 5% increments. Once it reaches the desired calorific value or better, it maintains that level." A set of cross-belt sweep samplers will be used to calibrate the elemental analyzers and the belts scales.

The system has eight reclaim zones and eight stack zones. "It's important to keep things simple when managing a pile," Shepler said. "The technique needs to be repeatable. The system reclaims from the same pile in a systematic manner, moving the reclaimers and stackers from right to left in a repeatable pattern."

When the reclaimer cuts through the pile, it cuts across 26 seams on either side, Shepler explained. "There is a random blend in the seams. When the rake reclaimer cuts across so many of them, it is blending as it moves vertically and horizontally. The reclaimer blends those coal layers as it pulls the material off the pile, giving the best chance of a homogenous product."

The blended coal is placed in a mass flow surge bin that feed a set of cagemill crushers before a pair of posimetric feeders. The cagemill crushers will blend the fuel mix, which would now include biomass, more thoroughly.

As far as environmental issues, the reclaimers and stackers are designed for minimal dust generation. All of the conveyor chute work has been sealed to eliminate dust. The conveyor feeds a pair of trippers that fill the bunkers from above. There is a dust collection on the trippers and the crusher building. "There is no place for the coal to see the light of day," Shepler said. "The crushers and hoppers are sealed. Coal dust enclosures can act as a bomb unless they are properly ventilation. That's why dust collection systems play such an important role in plant design."

With 12,000 ft of conveyor, maintenance is a concern, but not a major concern. Except for the truck pit, the entire system sits above grade, which improves safety. The system relies on four major machines that need to be maintained. They have health monitoring systems onboard. They also move slowly, at about 30 to 50 fpm. Slower moving machines have less maintenance headaches.

This system is not unique. "We have duplicated similar systems all over the world," Shepler said. "It eliminates the need for people in the yard. In this case, we already have 400 trucks and that's enough. It will be a highly accurate, automated system. There will be a person in the truck dump facility and the crusher house." This system, Shepler explained, is adaptable to any stockpile management system.



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# ARE NEW ROCK DUST STANDARDS CRUSHING YOU?

*MSHA's new regulations once again challenge the status quo*

BY LEE BUCHSBAUM, ASSOCIATE EDITOR & PHOTOGRAPHER

A safety manager at a West Virginia coal mine reported that his operation had been fined \$9,000 by MSHA after the mine's rock dust was found to contain only 78% of incombustible particles, slightly under MSHA's 80% standard. MSHA's latest crackdown is a response to the agency's findings related to the Upper Big Branch (UBB) mine explosion, where rock dust samples indicated there was an insufficient amount of rock dusting and insufficient amounts of incombustible materials in the sampled rock dust. As a result, the agency has begun to issue more rock dust related citations.

Following an October 27 bulletin, MSHA began informing coal operators it would begin enforcing regulations around rock dust samples and content. According to a Program Information Bulletin (PIB) from MSHA, 47% of various rock dust samples taken from underground coal mines did not meet particle size standards. Noncompliant dust was found at 51% of the mines sampled. Rock dust is used by underground coal mines to dilute the atmospheric content of highly combustible coal particles with inert rock such as pulverized limestone, shale, adobe, dolomite, anhydrite or some other inert material.

MSHA now believes the UBB mine explosion was propagated by inadequate rock dusting.

"These two issues indicate a possible lack of product quality control during the manufacturing process of rock dust that is intended for use by mine operators," the PIB bulletin states. "It should be noted that the Low Temperature Ashing procedure used by MSHA to determine the incombustible content of coal dust samples is insensitive to both oversized and caked particles." This means that even though a mine operator may achieve the necessary 80% or greater incombustible content, the "mixture may not prevent a coal dust explosion from propagating." MSHA is recommending coal mine operators test their supplies of rock dust upon receipt and ask for documentation of quality testing from the manufacturer.

MSHA's new "final" rule replaces the Mine Safety and Health Administration's Emergency Temporary Standard (ETS) pursuant to section 101(b) of the Federal Mine Safety and Health Act of 1977. Under the new rule, mine operators must maintain the incombustible content of combined coal

dust, rock dust and other dust to at least 80% in underground areas of bituminous coal mines. The final rule further requires that the incombustible content of such combined dust be increased 0.4% for each 0.1% of methane present in the mine. As is well known, accumulations of coal dust can ignite, resulting in an explosion, or after an explosion, they can intensify flame propagation, increasing the severity of explosions. The latter seems to be part of the underpinning explanation for the severity of the UBB disaster. The final rule, like the ETS, should reduce both the potential for a coal mine explosion and the severity of explosions should they occur.

## What is Rock Dust and How Do I Know?

Rock dust is pulverized stone used to mix with coal dust and render accumulations of it inert. MSHA defines "rock dust" under 30 CFR 75.2 as "pulverized limestone, dolomite, gypsum, anhydrite, shale, adobe or other inert material, preferably light colored, 100% of which will pass through a 20-mesh sieve and 70% or more of which will pass through a 200-mesh sieve; the particles of which when wetted and dried will not cohere to form a cake which will not be dispersed into separate particles by a light blast of air; and which does not contain more than 5% combustible matter or more than a total of 4% free and combined silica (SiO<sub>2</sub>), or, where the Secretary finds that such silica concentrations are not available, which does not contain more than 5% of free and combined silica."

Where rock dust is required to be applied, according to MSHA standards, "it shall be distributed upon the top, floor

**“MSHA is recommending coal mine operators test their supplies of rock dust upon receipt and ask for documentation of quality testing from the manufacturer.”**



and sides of all underground areas of a coal mine and maintained in such quantities that the incombustible content of the combined coal dust, rock dust and other dust shall be not less than 80%. Where methane is present in any ventilating current, the per centum of incombustible content of such combined dust shall be increased 0.4 per centum for each 0.1 per centum of methane present.

Rock dust also acts as a heat sink to absorb and minimize explosions. The active ingredient of the rock dust sucks the heat out of the fire—that is the primary mechanism for rock dust. The fact that rock dust is heavier than coal dust forces the float coal to fall to the floor. The rock dust will then drag the coal dust out of the air to the ground.

On June 21, 2011, under section 101(b) of the Mine Act, MSHA published their final rule revising the existing standard at 30 CFR 75.403, "Maintenance of incombustible content of rock dust" applicable to underground areas of bituminous coal mines.

To clarify MSHA's enforcement under the ETS, the agency, prior to the final rule, issued PIB No. P10-18, "Accumulation of Combustible Materials and Rock Dust," on September 21, 2010 (September 2010 PIB). The PIB emphasized that underground coal mine operators had not been rock dusting in all required areas and were not maintaining the required levels of rock dust applications in compliance with the previous MSHA standard of no less than 65 per centum in intake air-

courses, and no less than 80 per centum in return aircourses under 30 CFR 75.403.Sh.

On October 14, 2010, MSHA issued Procedure Instruction Letter No. 10-V-16, "Accumulation of Combustible Materials and Rock Dust" (October 2010 PIL). The October 2010 PIL provided instruction for MSHA enforcement personnel regarding accumulation of combustible materials and rock dust. In the 2010 PIL, MSHA emphasized each mine operator's responsibility to comply with the ETS by October 7, 2010, for newly mined areas; and November 22, 2010, for all other areas of the mine. MSHA provided instruction to agency personnel for enforcing the ETS and for taking spot rock dust samples at applicable mines.

All underground areas of a coal mine, except those areas in which the dust is too wet or too high in incombustible content to propagate an explosion, shall be rock dusted to within 40 ft of all working faces, unless such areas are inaccessible or unsafe to enter or unless the Secretary or his authorized representative permits an exception upon his finding that such exception will not pose a hazard to the miners. All crosscuts that are less than 40 ft from a working face shall also be rock dusted.

The September 2010 PIB provided guidance to operators on existing § 75.402 and ETS § 75.403. It suggested that they use bulk dusters, trickle dusters or high-pressure rock dusting machines to blow the rock dust into inaccessible areas to maintain the 80% TIC in remote areas.

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MSHA thoroughly believes that as little as 0.005 inch (the thickness of a sheet of paper) of coal and float coal dust on top of rock dusted surfaces is capable of propagating an explosion. Therefore, removal of coal dust, including float coal dust, loose coal, other combustible materials, and the application and re-application, where necessary, of rock dust are essential to effectively protect miners from the potential of a coal dust explosion; or if one occurs, to reduce its severity and prevent loss of life.

Application of rock dust by hand is not prohibited under the final rule, as long as the 80% incombustible content of the combined coal dust, rock dust and other dust is maintained. Based on MSHA experience, mine operators are capable of maintaining the requirements of the final rule through application of rock dust by hand.

To ensure that coal mines are using rock dust that is within MSHA specifications, the agency started conducting blind testing of various rock dusts. It found that a large majority of them were not meeting the proper spec on sizing. The agency's recent PIB states that each mine needs to ensure that not only is the rock dust being used making the spec, but that there is documentation that it does and will continue to do so. According to one company representative, the new standard hasn't resulted in an increase of in the usage of rock dust, but in making sure there are more checks and balances. "MSHA is asking producers of rock dust to provide evidence that we are providing what we say we are providing," said the

**“MSHA has not issued any rules on how to test the rock dust; suppliers are beginning to provide a certificate of regulatory compliance.”**

representative. Though to date MSHA has not issued any rules on how to test the rock dust, suppliers are beginning to provide a certificate of regulatory compliance.

Anecdotally, MSHA field inspectors are doing a much more thorough job testing rock dust. "More than in the past, these inspectors are being very vigilant in terms of making sure that you have enough rock dust," said another insider. Inspectors are taking grab samples or doing on-sight sieve analysis. So far, for someone to get fined, it has to be pretty bad. And if they are down 20% from what they needed, then they have a problem," he said.

### Is There a Shortage of Rock Dust Available?

Historically, limestone has always been a stable, low cost product. Following the UBB disaster, several major suppliers have put in new capacity and installed larger equipment to ensure that as rock dust production increases, quality

remains steady and reliable as well. "There is plenty of capacity to cover the increase demand for rock dust. No one is being shorted materials today. Every coal mine that needs it, gets it. There are no shortages where people can't get rock dust today," said David Berg, market manager, industrial milled limestone, Carmeuse Lime & Stone. While statistics and figures are hard to come by, Berg estimates that North America's underground coal mines use about 1.5 million tons of rock dust per year. "Looking over production statistics, I estimate that for every 250 tons of coal produced you need 1 ton of rock dust," Berg said.

Following the UBB disaster, Berg said there was a brief bump in demand of rock dust. That has since abated. Today, the most important issue for rock dust providers is to sell rock dust that meets MSHA's standards. One of the problems with the rock dust sector is that, up until this latest MSHA ruling, any aggregate quarry or ready-mix concrete plant could legally supply rock dust. "But as MSHA ratchets up field inspections, these mom and pop quarries will have to meet the MSHA rock dust spec. So if someone is using a small quarry a mile from the mine, unless that plant can produce to the new standards, then they'll have to start buying from a larger, compliant rock dust producer," said Berg. Some of these smaller producers have been selling their "quarry fines" as rock dust. This product might not meet the new rock dust spec, however.

Though many quarries supply rock dust, several coal producers also mine or quarry rock dust for internal use as well. These vertically integrated companies will most likely weather this storm with little incident. More challenged, however, will be the third party brokers who sell rock dust as well. Many of these outfits are a combination of trucking companies, coal brokers and distributors that also sell or distribute rock dust. Some will buy existing rock dust and put a different label on it. However, if they adulterate the rock dust, they could find themselves in MSHA's cross-hairs, especially if that dust is found to be problematic.

In fact, to ensure quality, some rock dust producers like Carmeuse are developing certificates to further underscore a strict adherence to quality. "When these new rules came out, most of our customers didn't push the panic button—they just needed documentation from us that says what they purchased meets the spec. We will guarantee that our product meets legal specifications as it leaves our facility. However, if we sell it to a third party, then we have no quality control. But for anything we ship directly from our facilities, we'll prove that our materials meet the spec. That should be the end of the discussion. Now it's up to the coal producer to make sure they are living up to their ends, that they are using enough, that it doesn't cake, and that they stay within engineering best practices and standards. Keeping the mine safe is our number one priority. We want to make sure that our product and all rock dust being used gives coal operators the assurance that rock dust is part of the solution to safety, not the problem," said Berg.



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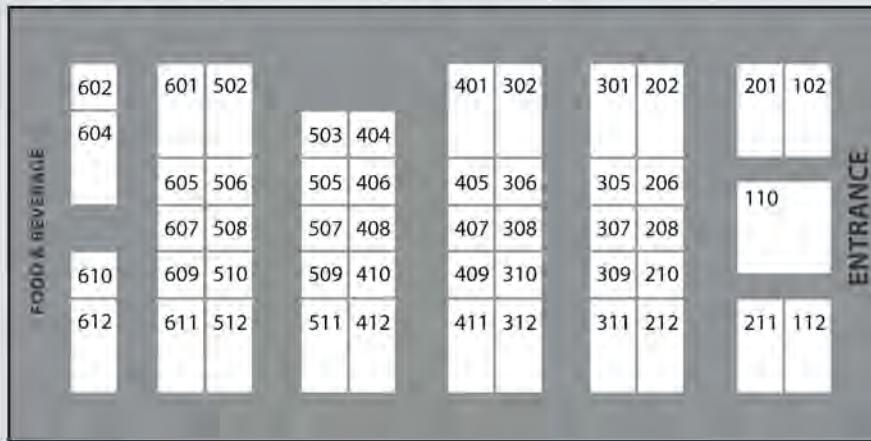
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# UNDERGROUND COAL MINE SAFETY PERFORMANCE

*A decade of challenges and improvements*

BY LARRY GRAYSON AND HARISHA KINILAKODI

For mine safety, the decade 1991-2000 was outstanding for underground coal mining in many ways. Although the number of mines diminished from 1,484 to 716, a 51.8% reduction, the number of employees fell from 62,427 to 34,131 (45.3% reduction), and coal production decreased from 403 million tons to 373 million (7.5% reduction), on the positive side, the productivity increased by 60.4% from 3.31 tons per employee hour to 5.31. The decade began with 39 fatalities and ended with a record low 16—amazing at the time. Significantly, the NFDL IR steadily decreased from 12.96 to 8.81, a 32% reduction. However, the Fatal IR remained flat (0.06 to 0.05), and the single mine disaster at Southmountain mine No. 3 in 1992 caused eight miners to die.

Certainly, the decade 2001-2010 was a mixed bag of good and bad, with many challenges along the way. The impacts of mine disasters had a profound effect on safety, enforcement, production, employment and productivity. A steady decline in safety statistics was marred in four of 10 years, with the following multiple-fatality major-hazard events, with impacts noted in some detail:

- 2001: JWR No. 5 explosion (13 fatalities); the usual high-impact visibility was overshadowed by the media coverage of the aftermath of 9-11, and thus no new mine safety legislation was initiated.
- 2006: Sago mine (12 fatalities), Aracoma Alma No. 1 mine (two fatalities), and Darby No. 1 mine (five fatalities); Congress passed the Mine Improvement and New Emergency Response (MINER) Act, fines increased dramatically, new technology was implemented, new training was mandated, other provisions took hold, and it took until the end of 2008 for enforcement impacts to be fully realized.
- 2007: Crandall Canyon (nine fatalities); this event heightened the already high scrutiny on underground coal mines and prolonged the transition time on stabilization.
- 2010: Upper Big Branch mine-South (29 fatalities); Congress pursued new legislation, but with multiple investigations pending, none was passed. However, because of Congressional and media scrutiny of the worst disaster in 40 years, MSHA took action by implementing impact inspections, a new potential pattern of violations (PPOV) process, POV rulemaking, and the Rules to Live By initiative.

The number of mines again declined from 717 to 497, by 30.7%, but the number of employees increased from 38,538 to 43,867, by 13.8%; however, the low point occurred in 2003 with 34,580 employ-

ees (See Table 1). Total production declined by 42.6 million tons, and productivity decreased dramatically from 4.72 in 2001 to 3.36 in 2010, a 28.8% reduction, while the average number of hours worked per year per employee increased from 2,088 to 2286, a 9.5% increase. During this period, a large transition in the workforce began in earnest, with baby boomers retiring and taking their experience with them. Now approximately 50% of the workforce has five or fewer years' experience. This is, however, only partially the answer for the dramatic decrease in productivity.

Overall statistics on accidents are given in Table 2, but with separate statistics presented on fatalities and disabilities (F-D, including partial disabilities) and serious injuries (SI, defined as lost or restricted days of 20 or more). These statistics are used to calculate normalized safety measures.

**Table 2—Accident Data**

Year	Fatality	NDL	NFDL	Days Lost	FD-Days	SI-Days
2001	31	2812	3080	425,442	260,128	151,725
2002	12	2523	2930	281,205	121,915	147,712
2003	13	2401	2545	287,700	125,810	152,194
2004	15	2552	2443	293,309	139,750	142,981
2005	14	2583	2407	290,311	145,092	134,964
2006	36	2695	2383	413,329	278,506	123,898
2007	20	2859	2317	298,535	165,918	118,280
2008	12	2697	2256	222,669	99,963	110,222
2009	6	2201	2085	244,808	114,269	120,722
2010	41	2336	1951	405,967	288,348	106,179

Table 3 reveals a steady and dramatic decline in the NFDL IR (49.2% reduction), the NDL IR (33.3%) and the SI-SM (43.8%). The Fatal IR reached a record low of 0.013 in 2009, with a record low six fatalities, but was marred greatly by very high IRs in 2001, 2006, 2007 and 2010. The elimination of disasters remains the underground coal sector's greatest challenge, and unfortunately, the events impact all sectors of the mining industry.

## Policymakers React

Another major impact from disasters comes from Congressional and media scrutiny, as the rescue and recovery operation unfolds, some-

**Table 1—Data on Mines, Employees, Production and Productivity**

Year	Mines	Miners	Man-hours (millions)	Production (millions)	Hours/Miner	Tons/Hour
2001	717	38,538	80,463,014	379,933,950	2088	4.72
2002	655	37,015	75,809,652	357,106,504	2048	4.71
2003	579	34,580	73,946,735	352,487,486	2138	4.77
2004	583	35,812	78,504,123	366,510,326	2192	4.67
2005	606	39,029	86,144,899	368,611,500	2207	4.28
2006	654	41,067	91,098,700	358,985,414	2218	3.94
2007	563	40,325	89,874,950	351,789,934	2229	3.91
2008	583	42,972	97,622,797	357,645,482	2272	3.66
2009	540	43,827	95,932,679	332,055,422	2189	3.46
2010	497	43,867	100,271,309	337,348,524	2286	3.36

**Table 3—Normalized Accident Measures**

Year	Mines	Fatal IR	NDL IR	NFDL IR	SM	FD-SM	SI-SM
2001	717	0.077	6.99	7.66	1057.48	646.58	377.13
2002	655	0.032	6.66	7.73	741.87	321.63	389.69
2003	579	0.035	6.49	6.88	778.13	340.27	411.63
2004	583	0.038	6.50	6.22	747.24	356.03	364.26
2005	606	0.033	6.00	5.59	674.01	336.86	313.34
2006	654	0.079	5.92	5.23	907.43	611.44	272.01
2007	563	0.045	6.36	5.16	664.33	369.22	263.21
2008	583	0.025	5.53	4.62	456.18	204.79	225.81
2009	540	0.013	4.59	4.35	510.37	238.23	251.68
2010	497	0.082	4.66	3.89	809.74	575.14	211.78



times over many days. The public senses the isolation of desperate miners, the agony of the families, and the pressure of a timeline after which no recovery may be possible. The disaster scenes ultimately lead to warranted public outrage and intense pressure on Congress and MSHA to do something to prevent another disaster. A major consequence of the scrutiny is legislation and/or rulemaking, followed by changed enforcement. Unlike the aftermath of the Jim Walter Resources disaster in 2001, the Sago mine rescue and recovery operation carried on for four long days, and ended with one miner left alive among the 13 who found shelter. In all rescue and recovery operations, mistakes are made, but in this operation, an ill-fated cell-phone call caused more grief and another outrage by Congress. Quickly, the MINER Act was passed with bi-partisan support, and with it came intense scrutiny from MSHA and Congress, elevated fines and more frequent enforcement action.

**Table 4—Citation and Penalty Data**

Year	Citation	S&S	Order	INSP_HRS	Pro_Penalty	SS-Penalty	O-Penalty
2001	47671	18592	904	347,448	\$10,125,736	\$7,989,423	\$1,828,780
2002	39270	14101	772	326,154	\$9,657,185	\$7,712,808	\$2,585,534
2003	39825	14614	790	313,238	\$9,966,665	\$8,003,386	\$2,554,289
2004	45734	18038	1047	315,196	\$11,944,915	\$9,515,625	\$2,886,938
2005	50407	18608	1007	312,674	\$13,775,385	\$11,093,766	\$3,079,779
2006	58832	22170	1753	302,801	\$25,213,423	\$20,827,106	\$8,135,836
2007	63072	20540	1708	326,275	\$78,752,974	\$60,137,356	\$26,687,941
2008	82748	25308	1699	433,152	\$87,766,875	\$65,774,937	\$22,454,615
2009	79036	23204	1688	452,738	\$79,316,287	\$58,126,166	\$16,825,190
2010	77748	25470	2272	478,259	\$95,727,892	\$79,440,320	\$29,881,861

Table 4 shows the statistics, which highlight the heightened enforcement. Beginning in 2006, and extending through 2008, the number of citations, S&S-designated citations, and orders grew dramatically, by 64.2%, 36% and 68.7%, respectively, over 2005 levels. The number of inspection hours increased by 53% and the total proposed penalty assessments rose by 637% over 2005. Similarly, the proposed penalty assessments for S&S-designated citations and orders rose by 49.3% and 62.9%, respectively. Table 4 also reveals that 2009 enforcement actions and penalties dropped significantly from 2008, but because of the Upper Big Branch mine-South disaster in 2010, S&S-designated citations and orders rose dramatically, even beyond the highest levels realized in 2008. All is not bad news though.

In spite of the dramatic increases in total citations and inspection hours as well as numbers of citations, Table 5 shows that the citations per 100 inspection hours (C/100 IH), S&S-designated citations per 100 inspection hours (SS/100 IH) and orders per 100 inspections hours peaked in 2006. The rates decreased significantly through 2009, by 16.3% (through 2010), 29.9% (through 2009) and 36.2% for C/100 IH, SS/100 IH, and O/100 IH, respectively. Because of the Upper Big Branch mine-South disaster, the SS/100 IH and O/100 IH rates increased in 2010. It is useful to note the percent S&S citations and percent orders also decreased similarly through 2009, and increased in 2010. This indicates

**Table 5—Normalized Citation Measures, % S&S and % Orders**

Year	Mines	C/100 IH	SS/100 IH	O/100 IH	%SS	%Ord
2001	717	13.72	5.35	0.26	39.00%	1.90%
2002	655	12.04	4.32	0.24	35.91%	1.97%
2003	579	12.71	4.67	0.25	36.70%	1.98%
2004	583	14.51	5.72	0.33	39.44%	2.29%
2005	606	16.12	5.95	0.32	36.92%	2.00%
2006	654	19.43	7.32	0.58	37.68%	2.98%
2007	563	19.33	6.30	0.52	32.57%	2.71%
2008	583	19.10	5.84	0.39	30.58%	2.05%
2009	540	17.46	5.13	0.37	29.36%	2.14%
2010	497	16.26	5.33	0.48	32.76%	2.92%

there is a strong correlation between the occurrence of a disaster in a particular year and the level of enforcement in reaction to it; however, as demonstrated in the period following 2006, these enforcement levels tend to moderate as industry addresses the additional scrutiny, apparently through greater diligence in maintaining compliance with major hazard-related regulations, which tend to get more elevated citations. This is good news, and hopefully is indicative of a growing movement by many mining companies to change the safety culture in their workforces to one of diligence and prevention.

For completeness, Table 6 shows the normalized fiscal impact of efforts to reduce enforcement actions. The average proposed penalty assessments on citations and elevated citations also diminished significantly from 2007 through 2009, by 19.6%, 14.4%, 36.2% and 27.4%, respectively, for average proposed penalty per citation (PP/C), average proposed penalty per S&S-designated citation (PP/SS), average proposed penalty per order (PP/O) and average proposed penalties per 100 inspection hours (PP/100 IH). Following the UBB disaster, the trend was reversed, as would be expected.

**Table 6—Normalized Proposed Penalty Measures**

Year	PP/Cit	PP/100 IH	PP/SS	PP/O
2001	\$212	\$2,914	\$430	\$2,023
2002	\$246	\$2,961	\$547	\$3,349
2003	\$250	\$3,182	\$548	\$3,233
2004	\$261	\$3,790	\$528	\$2,757
2005	\$273	\$4,406	\$596	\$3,058
2006	\$429	\$8,327	\$939	\$4,641
2007	\$1,249	\$24,137	\$2,928	\$15,625
2008	\$1,061	\$20,262	\$2,599	\$13,216
2009	\$1,004	\$17,519	\$2,505	\$9,968
2010	\$1,231	\$20,016	\$3,119	\$13,152

**Productivity Declines**

Getting back to productivity, after a flat record during 2001-2004, with 2004 seeing a modest decrease, productivity began a dramatic, steady decline thereafter. There was a relatively large increase in the number of employees from 2004 to 2005 and there was a distinct increase in the citation and S&S-designated citation rates. Of course in 2006, these rates and the order rate increased even more dramatically, as did the proposed penalty assessments. Thus the more intense level of enforcement, coupled with large changes in mines to implement new provisions of the MINER Act, could have had a significant impact on productivity. Although the intensity of enforcement action rates subsided during 2008 and 2009, after reaching a peak in 2007, productivity continues to decline as the workforce transition continues. We now await realization of the next round of legislative action and finalization of several rules in various stages of rulemaking.

The record year in 2009 for all of the incident rates was excellent. The normalized citation measures similarly decreased. The underground coal industry is in large part responsible for building the safety cultures across their mines that can sustain that level of performance, and MSHA must maintain the scrutiny over mines to ensure that 'bad players' don't disrupt this trend again. At this point, the industry and MSHA are focused on the same outcomes, which are driven by the goals of zero fatalities and zero lost-time accidents. In 2009, the goal of zero fatalities was so close. Hopefully, 2012 will be the year. Nonetheless, we are all hopeful that all of the aforementioned normalized measures continue dramatically downward, and we can be proud of our joint accomplishments.

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# SERVICE IMPROVEMENTS FOR COAL CRUSHERS

BY STEVE FISCOR, EDITOR-IN-CHIEF

The companies that build and design crushers freely admit that not a lot has changed with coal crushing systems. They are, however, making improvements that extend the wear life for the rolls (or rotors in the case of sizers) that allow miners to better maintain the equipment themselves.

Applications are site specific and conditions vary throughout the coal business. Large western U.S. surface mines, such as those operating in the Powder River Basin (PRB) are looking at high volume applications, processing a friable subbituminous coal with little rock. At the other end of the spectrum, coal operators in the eastern U.S. are processing coals that are much harder and often-times accompanied with a significant amount of rock.

One prominent roll crusher provider, McLanahan Corp., has invested quite a bit of time into extending the wear elements on its roll crushers and the research is now beginning to pay nice dividends for its customers. Working with Kennametal, the company developed weld-on carbide teeth for its crusher segments. “The new carbide teeth have been a very hot product for us,” said Bruce Daskivich, general manager-mineral division, McLanahan. “In the PRB, we have increased the capacities for crusher segments by more than twice what they were getting with regular cast segments. In this application, the segments would normally average 18 to 20 million tons. We have now increased that to 50 million tons at some operations.” The new teeth also reduce the change-out times for the mines.

The mines stock the weld-on teeth on site. If a piece of tramp steel passes through the crusher and breaks off teeth, they grab replacement teeth from the warehouse shelf, weld them on and are



McLanahan's new weld-on carbide teeth allow miners to make repairs rather than replacing the roll segment.

quickly back in operation without replacing the complete segment. “This extends the life of the segment saving time and money,” Daskivich said. “They are getting a lot of value out of this product.”

The mines do not normally replace the primary and secondary rolls at the same time. The secondary rolls, the ones with the smaller teeth, see the most wear. For some of the larger triple roll machines, they can change a set of roll segments in about 16 to 24 hours, Daskivich explained. “To reduce segment changeout from annually to every two to three years, again, saves money and prevents downtime,” Daskivich said.

The engineers at McLanahan had been working on these improvements for a while. Initially, they designed cast roll teeth to include a piece of carbide as a

tooth cap. The tooth was cast with a step and then the carbide cap was welded into the face of the tooth. “That was our first attempt at improving wear life with carbide and it worked well,” Daskivich said. “However, we found through field trial that when the weld wore away or the tooth cap broke, the cast parent-tooth would wear rather quickly, leaving a void in the segment. Operators were left without much recourse for in-place repair and therefore had to replace the entire segment.”

That thinking led the company to pursue a replacement tooth that, if it was worn or broken, the mine could weld the tooth back in place. “We worked with Kennametal to develop a replaceable tooth with carbide granules impregnated into the base metal of the tooth itself on the



leading face on the top edge,” Daskivich said. “These teeth maintain their profile much longer resulting in a tremendous amount of wear life and the replaceable design means a longer lasting base segment. We are providing similar technology for other brands of roll crushers. We have an agreement with Kennametal on the tooth. If mine operators want these teeth, they have to work with McLanahan.”

McLanahan has started to use the same technology in more eastern U.S. applications with more rock. “We have introduced it slowly in the East and we are experiencing similar success,” Daskivich said. “The teeth are holding up fairly well calming our initial fears that we would be breaking teeth left and right with some of the harder sandstones that these mines encounter. That has not been the case.”

When Lee Doyer, vice president, sales and marketing, Pennsylvania Crusher, considers some of the more recent trends for coal crushers, he talks about a shift from roll crushers to sizers, particularly for coal operators based in the Illinois Basin and Appalachia. That should make

for lively internal dialogue for the K-Tron Size Reduction Group, a subsidiary of Hillenbrand Inc., which acquired Pennsylvania Crusher and Gundlach. Gundlach builds some fairly large roll crushers.

Pennsylvania Crusher has also been looking at ways to extend wear life for its sizers. “Initially, we provided primary sizers with Kennametal mining bits,” Doyer said. “More recently, we have started to provide rotors with a specially-developed hardfacing to improve wear. For primary crushing applications, we have started supplying rotors with segmented tooth castings. From a maintenance perspective, it’s a lot easier to change these teeth. Occasionally with the really strong teeth, the bit block would get knocked off and the maintenance technicians in field are not normally equipped to properly replace those blocks.” The bit blocks require special procedures with preheat and post-heat welding specifications.

Pennsylvania Crusher is now stocking parts at its Ohio plant and the company

has embarked on a warehouse in West Virginia, which also carries supplies for Gundlach’s machines.

Every piece of equipment has its own application, explained Phil Schaefer, regional sales manager-Western USA & Canada, Gundlach Equipment. “If a mine can manage with a roll crusher and a v-belt drive, they can save quite a bit of money over buying an expensive sizer,” Schaefer said. Gundlach has been supplying the 8030 carriage mounted units or the 5000 series double stage machines for high-volume PRB applications. Some of those mines are crushing as much as 6,000 to 7,000 tons of coal per hour.

The two major environmental concerns associated with crushing coal are dust and noise. “We have been looking for more ways to better seal the equipment for fugitive dust,” Schaefer said. “We have been looking at a better seal arrangement to control dust inside the crusher housing. We are always looking at how to improve roll configuration and roll design to give the mines a better product yield for their facility.”

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## CATERPILLAR TO SUPPLY AUTOMATED LONGWALL PLOW SYSTEM TO CHINA



Representatives of Caterpillar and the Chinese customers participate in a contract signing ceremony. Seated at the table are Norbert Dobberstein, technical sales support – longwall, Caterpillar Global Mining (left); Sun Hongfeng, general manager, Lvliang Dongyi Gasification (Group) Co., Ltd. (center); and Dai Qiuliang, general manager, China Coal Overseas Development Co. Ltd. (right).

Caterpillar recently signed another contract to deliver an automated longwall plow system to a Chinese company, Gasification Co., Ltd. of Lvliang Dongyi Group. The system marks the 11<sup>th</sup> plow system from DBT/Bucyrus/Caterpillar destined for Chinese mines. The system will be delivered in the first quarter of 2013 and will go to work in the Xinyan mine in Shanxi province.

The system will mine a metallurgical coal seam with height of 1 to 1.2 m (39 to 47 inches), and the face length will be 240 m (787 ft). The Cat GH800 plow will be paired with a Cat armored face conveyor using PF3 line pans, and the Cat PMC-R roof support control system will manage roof support advance. Automation enhances safety—there is no need for an operator to be at the coal face during operation.

In China, automated plow longwall faces from the Caterpillar predecessors, DBT and Bucyrus, hold all of the production records for seams less than 2 m (79 inches) thickness. Tiefsa Coal Mining Group, with a 50% share in the joint venture project with Dongyi, owns four such systems already and has publicly indicated that the plow systems enable them to profitably mine thin seam reserves that otherwise would be uneconomic.

There was a time when the application of plows for longwall mining was limited by the type of coal to be cut. With Cat systems, this is no longer the case. Advancements in drive, control and transmission systems—with more powerful motors, stronger plow chain,

increased plow speeds, higher advancing force provided by the roof supports, precise control of the cutting depth, and plow bit design improvements—all combine to allow Cat plows to be used for any coal hardness and with higher efficiency than other longwall extraction methods in low and medium seam heights.

As an example of the robust design and power of Cat plow systems, the gliding plow guide is welded to the face side of the armored face conveyor. Plow chains up to 42 mm can be used, allowing power installations up to 2 x 800 kW (2 x 1,080 hp). On older-style systems, the cutting depth was typically controlled by adjusting the shield advancing ram pressure. As a result, cutting depths varied with coal hardness. A modern Cat plow system can cut a precisely defined depth, regardless of coal hardness and seam structure.

### Embry to Distribute L-3 Accolade System

L-3 Global Security & Engineering Solutions signed an agreement with Embry Enterprises, Inc. to become a new distribution partner for the L-3 Accolade wireless mesh communications system. “Embry Enterprises is a recognized and established provider of engineering services and custom design solutions for automation systems for the coal mining industry, with the resources necessary to meet the needs of our current and future customers,” said William Berry, senior vice president and general manager of L-3’s Integrated Solutions unit. “We are

pleased to add Embry to our nationwide Accolade distributor network and look forward to our continued partnership.”

“We feel the experience we have gained by installing the system for L-3 has given us the insight required to serve the continued needs of the coal mining industry,” said Rick Embry, president, Embry Enterprises. “The safety and reliability offered by the Accolade system will undoubtedly prove to be beneficial for years to come.”

Embry will provide marketing, sales and distribution channels for L-3 Accolade system customers in the Midwest and the southern Appalachian coalfields, as well as installation support.

The L-3 Accolade system provides a self-healing, redundant, and survivable voice and data network, allowing communication among miners underground (peer-to-peer) and communication between below- and above-ground personnel. The system also provides a real-time situational awareness capability and can be tailored for mines of all sizes.

The system is approved for use by the Mine Safety and Health Administration, the State of West Virginia and the Commonwealth of Pennsylvania, and has been deployed to mining companies throughout the United States.

### McLanahan Acquires Universal Engineering

McLanahan Corp. has acquired Universal Engineering Corp. of Cedar Rapids, Iowa. Universal Engineering manufactures crushing and screening equipment for the aggregate and mining industries. founded in 1906 in Cedar Rapids.

“It is our hope to grow the sales of Universal equipment around the world,” said George Sidney, president and COO, McLanahan. “We are excited to have Universal’s high quality, respected machines in our line-up, but we are more excited to have a professional, highly-trained group of people join our team.”

For more than a century, McLanahan has been involved in crushing materials, with a focus on crushing soft minerals using roll crushers, feeder breakers and rotary breakers to process minerals such as coal, salt and trona. Now, the Universal acquisition brings



hard rock crushing and apron, pan and wobbler feeders to the table. Universal products complement McLanahan's existing lines and add a new dimension to the dynamics of the company.

### CoalTek Receives First Sino-U.S. Clean Coal Joint Venture Approval

CoalTek Inc., a Massachusetts-based clean energy company that uses proprietary technology to upgrade brown coal, announced its clean coal processing facility in Inner Mongolia has received final approval from all requisite regulatory and governmental authorities in the People's Republic of China (PRC).

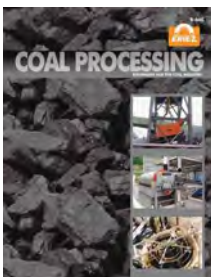
CoalTek's approval marks the first successful completion of the rigorous PRC environmental review and engineering examination by a clean coal technology company. Total investment in the joint venture project is expected to exceed RMB 2.4 billion—more than \$350 million. The facility will initially produce 10 million metric tons (mt) of processed high quality fuel per year, transforming low-grade brown coal into high-thermal value coal that burns more efficiently and produces lower emissions. In anticipation of future demand, the facility has been designed with infrastructure that will allow for seamless expansion beyond the currently planned scale.

CoalTek will own the facility in a 50:50 joint venture with Yijian Group Co., Ltd., a Chinese corporation with wide ranging energy and asset holdings.

The CoalTek-Yijian joint venture represents the first fully licensed Sino/U.S. commercial partnership since the 2009 signing of a bilateral Strategic Partnership agreement by Chinese President Hu Jintao and U.S. President Barack Obama.

### Coal Processing Brochure Now Available from Eriez

A broad assortment of Eriez equipment for the coal industry is featured in "Coal Processing: Equipment for the Coal Industry," a six-page brochure offered by Eriez. The brochure is available from Eriez in both printed and PDF format.



Equipment highlighted in the literature includes, suspended electromagnets, Bin vibrators, mechanical feeders, conveyors and Screeners, wet drum magnetic separators, heavy duty vibratory feeders, conveyors and screeners, metal detectors, Crossflow teeter bed separators, CoalPro column flotation cells and electric rotary vibrators.

To download the brochure in PDF format, go to [www.eriez.com/Products/CoalProcessing/](http://www.eriez.com/Products/CoalProcessing/).

### Schmidt, Kranz Group Acquires Majority Stake in allmineral

The Schmidt, Kranz Group, a mechanical engineering firm based in Velbert, Germany, recently acquired 75% of the shares in allmineral GmbH. "The Schmidt, Kranz Group's involvement is a further expression of our consistent, internationally-oriented market strategy," said allmineral Managing Director Dr. Ing. Heribert Breuer. "The international market for ore and coal processing, which is our core business, has grown considerably over the last years. Now that an established company with a strong global presence like Schmidt, Kranz Group has joined us, we will be able to offer our clients even more qualified expertise and to enter into new markets."

The Schmidt, Kranz Group has various subsidiaries around the world and manufactures and sells crushers, mining vehicles, tunnel boring machines and high pressure hydraulics as well as other products. The acquisition was made possible by the previous shareholders, Klösters und Ackermans, who transferred their shares to the company.

Particularly in India, the companies aim toward taking joint action in the near future. allmineral Asia wants to greatly expand its activities there with those of Hazemag India. Since 2009, allmineral Asia Pvt Ltd. is responsible for marketing, project management and service for allmineral's complete solutions in the field of mineral processing in India and Southeast Asia. Hazemag India Pvt Ltd. is part of Hazemag & EPR GmbH, another subsidiary of the Schmidt, Kranz Group. Hazemag & EPR manufacture and distribute machines and plants for processing and crushing above ground and underground, as well as machines for underground mining.

allmineral is one of the global leaders for custom processing plants in the raw materials industry. The Duisburg-based company has achieved a world class reputation as a specialist for processing and separation technologies for coal, ore, slag, gravel, crushed stone, sand and various recycling materials.

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The shop doors seal the opening and they are made from translucent fabric giving the facility more light.

Megadoor recently placed six doors on a new workshop building at the Moolarben coal mine, which is part of YanCoal Australia Pty Ltd. The new workshop building was completed in 2010 and was designed with the possibility of adding doors at a later date. The workshop building is in an elevated position and the prevailing winds blow directly into the shop. The mine is a world class coal asset located 40 km east of Mudgee in the Upper Hunter Valley, New South Wales, Australia. Production is expected to reach around 12 million metric tons per year.

The mine needed a solution to enhance the working environment with the ability to seal up the openings when the weather turns for the worse. The Megadoor system was able to fulfill the customer requirements as it provides the best sealing properties on the market and keeps air infiltration to a minimum. The system has been proven to offer reliability with minimal maintenance requirements and 100% safe operation, giving its customers peace of mind. The order included four series S1000 and two series S800, with sizes ranging from 6- x 5-m up to 12- x 11-m. All doors were supplied with translucent fabric that maximizes the amount of natural light into the building for a pleasant and energy-efficient working environment.

The order was placed in May 2011 and the installation was completed in September 2011. The system was manufactured in Skellefteå, Sweden. [www.megadoor.com](http://www.megadoor.com)

## Fenner Acquires Allison Custom Fabrication

Fenner Dunlop, a global leader in conveyor belting for mining, recently acquired Allison Custom Fabrication (ACF), based in

Allison, Pa. ACF specializes in design, engineering, machining and metal fabrication of made to order belt conveyor drive systems for the underground coal mining industry. The acquisition, when fully integrated, will position Fenner Dunlop to its customers as a single-source solution providing world-class conveyor system engineering and conveyor products.

“This significant expansion of Fenner Dunlop to add conveyor system design and manufacturing capabilities to our well-respected conveyor belting products will be a win-win for both the company and our customers,” said Cassandra Pan, president, Fenner Dunlop. “The acquisition of ACF also demonstrates Fenner Dunlop’s commitment to being the supplier of choice in conveying solutions and will relay the benefits of our continual growth to both Fenner Dunlop and ACF customers.”

In the months to come, this acquisition will provide customers with conveyor solutions that improve the reliability of their entire material handling infrastructure, elevate the overall safety of their conveyor systems and help them better predict and manage costs associated with their conveyor systems. The acquisition also strengthens Fenner Dunlop’s future-forward strategy of providing customers with increased risk minimization, product usage compliance, conveyor up time and cost stability while increasing productivity and safety.

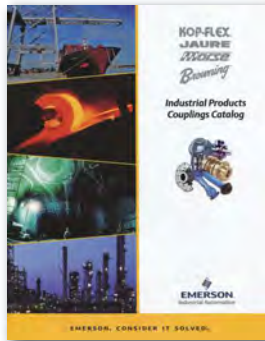
“Combining Fenner Dunlop and ACF’s offerings will allow our customers to benefit from integrated solution packages from a single source that include system design, system install, after-market



components and ongoing service,” said Scott Croftcheck, Vice President, ACF. [www.fennerdunlopconveyorservices.com](http://www.fennerdunlopconveyorservices.com)

### Industrial Coupling Catalog

Power Transmission Solutions, a business unit of Emerson Industrial Automation, has introduced its new consolidated 300-page industrial coupling catalog covering Kop-Flex, Jaure, Morse and Browning products in bore sizes up to 43.5 in., and torque ratings up to 329,000,000 lb-in. Styles include the simplest rigid and sleeve units to multiple types of disc, gear, chain, elastomeric, barrel, U-joint, shear-pin and tapered grid couplings.



An interactive page-flip version of the catalog is online at [www.emersononlinecatalog.com](http://www.emersononlinecatalog.com). Printed copies can be ordered at [www.emerson-ept.com](http://www.emerson-ept.com).

### Synthetic Gear Oils

The Mobil SHC 600 Series lubricants, high-performance synthetic gear, circulating and bearing oils, have been formulated to help mining companies increase productivity, reduce costs and lower energy consumption. In laboratory and in-service testing, SHC 600 series lubricants exhibited energy savings of up to 3.6% compared with conventional oils. The advanced oils can deliver a service life up to six times longer than competitive mineral oil based gear and bearing lubricants. They also deliver a number of other significant benefits including low temperature fluidity to enable start up and operation at low temperatures, and resistance to rusting and corrosion for equipment protection. A multi-purpose potential allows companies to reduce their overall lubricant inventory, delivering additional cost-savings and storage benefits.



[www.mobil.com](http://www.mobil.com)

### Mole-Master Installs Training Silo

Mole-Master Services has installed a 36-ft bulk storage silo at its Marietta headquarters in an expansion of its existing training capabilities. With a 12-ft outside diameter, the addition gives the Ohio-based silo cleaning specialist the ability to provide further hands-on training for its employees on site. The silo offers the opportunity for employees to train on all aspects of silo and bin cleaning including all required OSHA and MSHA standards.

“An added benefit is that the silo allows Mole-Master to offer training facilities for a wide range of community members,” said Dave Laing, general manager, Mole-Master. “Anyone needing training to meet OSHA and other safety

requirements will find the new training silo useful. We will lease the facility to companies and/or municipalities who may wish to use it to train firefighters, HAZMAT team members or others who may require safety training for their job.”

[www.molemaster.com](http://www.molemaster.com)



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### Dust Suppression Ring for Conveyor Discharge Points

A new dust suppression device has been introduced specifically for use at conveyor discharge points, designed to create a virtual curtain around the material flow for outstanding particle containment. The DustBoss DB-R Ring from Dust Control Technology is built with a high-quality stainless steel ring outfitted with a network of atomizing nozzles that deliver millions of 50- to 200-micron droplets per minute. By surrounding the discharge flow on all sides, it provides simple, focused dust management that's well suited to continuous duty, such as radial stackers.

This design was developed specifically for a coal application. "The momentum created while discharging dry coal was propelling large amounts of dust into the air, and the coal company was looking for a way to specifically address the material as it came off the conveyor," said DCT CEO Edwin Peterson.

The DustBoss DB-R is available in five standard sizes, from 17 in. (43.2 cm) to 100 in. (254 cm) in diameter. All five can be customized with DCT's Variable Particle Sizing technology, allowing customers to specify different droplet size ranges to match specific materials.

Designed without any moving parts, the intrinsically safe DB-R is intended for elevated mounting. It requires no electrical power or compressed air. The water supply hose is connected directly to male pipe threads on the ring: 3/4-inch NPT for the 17-inch model, and 1-in. NPT for the three intermediate sizes: 22.5 in. (57.2 cm), 25.5 in. (64.8 cm) and 42 in. (106.7 cm). For large applications, the company also offers the 100-in. diameter model, which is supplied by a 1.5-in. NPT hose.

Available options for the DB-R include a booster pump to elevate low water pressures, a variety of nozzle sizes and configurations, and a water filter. Customers can also order the units with a two-way valve and/or hose included.



The number and size of the spray nozzles vary by model. The smallest model features 30 brass nozzles that produce 3.25 gallons per minute (gpm) of water flow. The 22.5-in. unit is designed with 18 medium-flow nozzles, with a water usage of 11.34 gpm. The 22.5- and 42-in. models feature 30 high-flow nozzles that deliver 18.9 gpm, and the 100 in. size employs 84 nozzles for a whopping 52.9 gpm of water delivery.

[www.dustboss.com](http://www.dustboss.com)

### Rugged Wall-Mount Cabinets

The PROTEK Series enclosures are designed to provide protection, support, thermal management and easy access to rack-mounted, 19-inch panel and other sensitive electronics. Available in a wide selection of sizes, materials and configurations, these versatile enclosures provide solutions for the emerging trend toward intermediate distribution frame networks and point-of-operation industrial component applications. The enclosures deliver solutions for applications where space constraints or aesthetics demand wall mounting to solve the application requirements.

[www.hoffmanonline.com](http://www.hoffmanonline.com)



### Toughpad Tablets

Panasonic unveiled the Toughpad family of professional-grade Android-powered tablets, which includes a 10- and 7-inch device. The devices—targeting mission-critical and highly mobile workers—will be supported by an eco-system that includes an enterprise focused app store, peripherals, developer tools, deployment support and more. The 10-inch Toughpad A1, available first, is ideal for highly mobile outdoor workers,





where exposure to extreme environments is a constant challenge and the consequence of a failure is significant. The device can also be used as a tool to optimize business processes as a cost effective pen/paper replacement. The 7-inch Toughpad B1 targets similar markets, but in applications where screen real estate is not as critical and where device mobility and portability are critical. [www.PanasonicToughpad.com](http://www.PanasonicToughpad.com)

**Multi-Purpose Sludge Pumps**

Xylem has one of the most extensive portfolios of dewatering pumps on the market with the addition of three new sludge pumps to its flagship Flygt 2600 drainage range. The company, which was spun off from ITT Corp. during October 2011, specifically designed these versatile pumps (models 2620.280, 2630.280, and 2640.280) to meet customer demands for multi-purpose drainage pumps for mining markets. These wear-resistant pumps handle solids up to 80 mm (3.2 in.) and sand concentrations of approximately 20% by weight, due to a larger inlet and pump volute, Hard-Iron™ (60 HRC) vortex impeller, polyurethane-lined pump housing and side discharge design.

[www.xyleminc.com](http://www.xyleminc.com)

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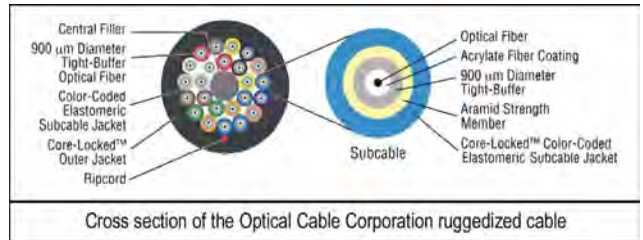
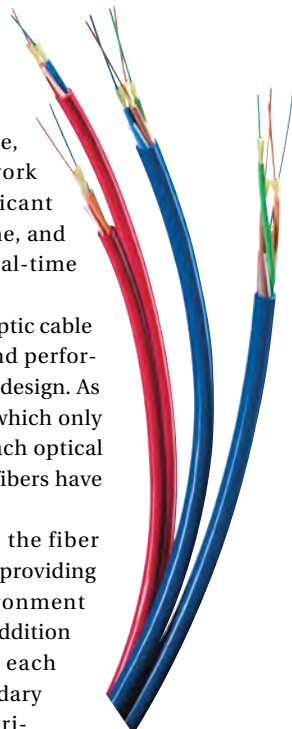
Optical Cable Corp.'s MSHA-certified tight-buffered breakout cable is designed to extend high speed communications deep underground, while withstanding thermal extremes, physical hazards, and even falling debris in mining operations. This extremely rugged fiber optic cable enables mining personnel to access a corporate network and even its ERP system from thousands of feet below ground for critical tasks such as real-time maintenance tracking, ordering parts, review of electronic files or schematics, access to monitoring data, and more.

Once they enter the shaft or the portal, it can take several hours for personnel to travel to active mining areas.

With up to several hundred workers below ground at any one time, immediate and localized network access translates into a significant time-savings on travel time alone, and contributes to more of a true real-time operating environment.

Rugged, tight-buffered fiber optic cable derives much of its reliability and performance advantages from its basic design. As opposed to loose-tube designs, which only have one coating surrounding each optical fiber, ruggedized tight-buffered fibers have two.

In loose tube cable designs, the fiber coating is only 62 microns thick, providing minimal mechanical and environment protection to the glass fiber. In addition to the primary fiber coating, each tight-buffered fiber has a secondary buffer that, together with the pri-



Cross section of the Optical Cable Corporation ruggedized cable

mary coating, reaches "heavyweight" proportions such as 387 microns.

In the breakout cable design, there is yet another layer of protection. Each tight-buffered fiber is surrounded by aramid yarns and a tight bound elastomeric jacket. Even at this sub-cable level, the sub units are very crush resistant, rugged and able to withstand environmental extremes.

In the case of OCC, the sub cables are helically stranded and surrounded by a special formulation, pressure extruded outer jacket. This Core-Locked outer jacket locks all the sub elements of the cable in place. The cable structure therefore acts as a unit, much like a rope. This enhances crush resistance, jacket tear resistance and overall survivability in harsh environments.

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# EVERYTHING OLD IS NEW AGAIN—THE RETURN OF PRE-ASSESSMENT INFORMAL CONFERENCES

BY MARCI FULTON



A long time ago, in a regulatory environment far, far away, operators and MSHA personnel would meet shortly after citations/orders were issued to informally discuss the merits of the enforcement action. These conferences took place before a penalty was assessed, did not require Federal Mine Safety and Health Review Commission approval, and often resulted in a mutually agreeable outcome requiring no further action by the operator. Then everything changed.

In 2008, MSHA issued a Procedure Instruction Letter (PIL) emphasizing the “broad discretion” of the district manager to limit the number and scope of conferences granted. The PIL effectively restricted informal conferences to citations/orders alleging unwarrantable failure or high negligence. District managers embraced the directive and began denying conferences for any citation or order that fell outside these parameters. Without the ability to challenge the least serious violations informally, operators have only two options—invoke the formal contest proceedings afforded them under the Mine Act or accept poorly written, factually inaccurate, and/or unjustified citations.

In 2009, MSHA urged the postponement of conferences until after penalties were proposed and contested. Under this procedure, operators still had to request an informal conference within 10 days of receipt of the citation. Following a conference request, MSHA informed operators it would not schedule a conference until after it issued a proposed assessment and if the proposed penalty was not timely contested, no conference would take place. This change in course drastically undercut the efficacy and usefulness of informal conferences.

Under this post-assessment regime, operators had to submit a contest (initiating formal contest proceedings) in order to preserve their right to an informal conference. Under Section 110(k) of the Mine Act, once a proposed penalty is contested, it cannot be “compromised, mitigated, or settled” without approval of the commission. Accordingly, the commission must approve compromises reached as part of a post-assessment informal conference—a process that can take months. Recently, operators and MSHA have seen an increasing demand from commission Administrative Law Judges to provide more information before a settlement will be approved, a process that results in further delay.

In an effort to reduce the backlog of cases before the commission, MSHA Assistant Secretary Joseph Main proposed a return to pre-assessment conferencing procedures. In August 2010, MSHA initiated a pilot program in select districts aimed at “early resolution of concerns to prevent the need to contest citations and orders that would add to the backlog; and, to increase accuracy and consistency in citation and order writing by creating a feedback loop so that all parties could learn from the process.” Following an analysis of the pilot programs, MSHA announced its intention to “begin implementing pre-assessment conferencing procedures” starting in January 2012.

So, what does that mean for operators? Depending on what district they are in, maybe not much. The announcement explains,

“[e]ach MSHA district must determine when to implement the procedures based on available resources. Implementation may occur slowly or not at all in some districts...” Operators wishing to take advantage of pre-assessment procedures need to determine how and whether pre-assessment conferencing will occur in their district.

There are important considerations to keep in mind for informal conference success.

- District managers have broad discretion to deny conferences. Operators that do not comply with the minimal requirements for requesting an informal conference make it easy for MSHA to deny requests out of hand.
- Pre-assessment conferences are usually conducted by Conference and Litigation Representatives (CLRs) or Field Office Supervisors (FOSs). Neither CLRs nor FOSs are attorneys and they are directed not to entertain legal arguments as part of an informal conference. Operators that have strong, fact-based arguments have the best chance for success in an informal conference. Those arguments should be set out in the informal conference request.
- In preparing their conference requests, operators need to strike a careful balance between presenting a detailed, compelling argument and not making admissions that could later be harmful if the citation or order proceeds to a hearing.
- Operators are relatively successful in informal conferences. The pilot program analysis revealed that conferences resulted in 35% of the conferenced citations/orders being vacated or modified. The fact that MSHA was willing to revise its inspectors’ initial findings in nearly one third of the cases shows some level of recognition that citations contain errors. Operators that display a thorough understanding of the facts and can point to errors contained in citations hold the key to a successful conference.

While one certainly hopes that MSHA is committed to making the “new” pre-assessment conference process a success, several indicators point to this as MSHA’s latest failed initiative. Pre-assessment conferences were supposed to lend consistency to the process. However, allowing individual districts to implement pre-assessment conferences on their own schedules, if at all, cannot possibly achieve consistency.

Additionally, a return to pre-assessment conferences does not get to the root of the backlog problem. If all citations and orders written were factually accurate and made appropriate findings regarding gravity and negligence, there would be very little for operators to challenge—informally or otherwise. However, this is not the case. There is a fundamental lack of accountability on the part of inspectors writing bad paper that is not being addressed. There is seemingly no mechanism by which inspectors are held accountable for mistakes that are made as part of their inspection and then corrected through informal conferences (or through formal litigation) at the considerable expense and effort of the operator. Until consistency and accountability are injected into the process, there will continue to be a backlog.

*Fulton is an associate with Patton Boggs LLP. She can be reached at 303-894-6121 or at mfulton@pattonboggs.com.*



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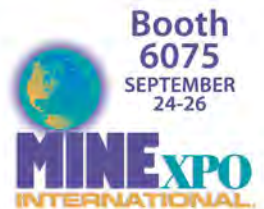
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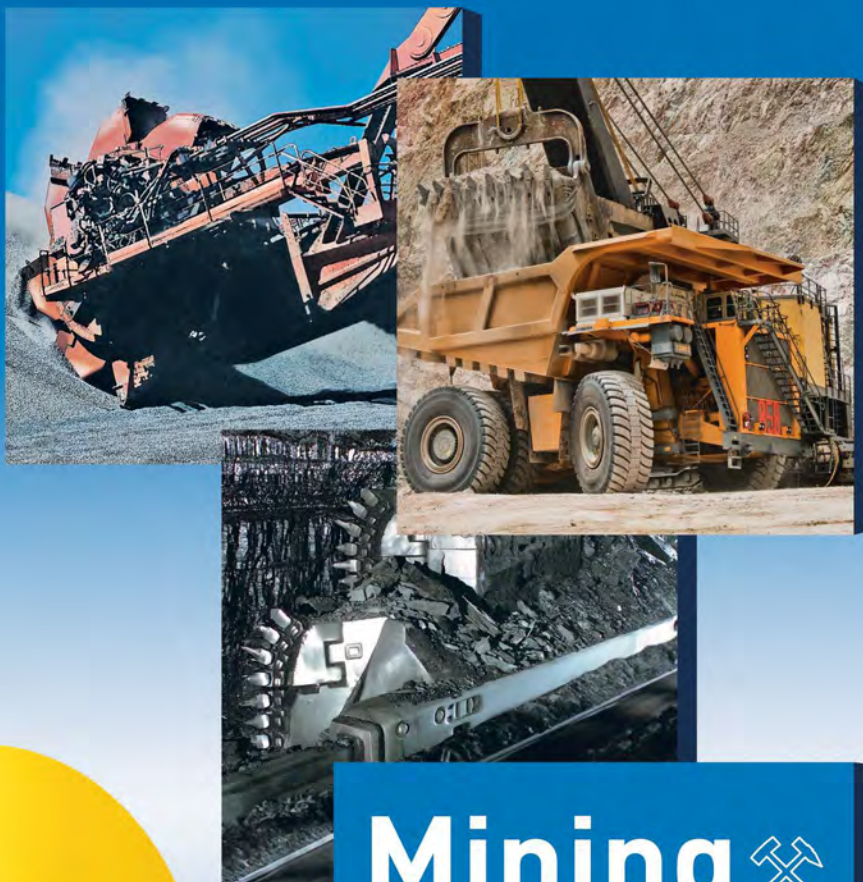




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# FOREWORD:



As we move into 2012, there is widespread growing demand for energy and steel, especially in emerging markets such as China, India, Brazil and Russia. Germany's mining-equipment manufacturers are ready to respond to the new surge in demand for high technology—combined with better safety standards—as the key to higher production and greater efficiency.

Germany leads the world in engineering expertise, especially in mining equipment and technology. German technology has a long tradition, having been designed to handle the difficult geological conditions found in the hard-coal mines in the Ruhr area, the Saarland and at Ibbenbüren. Over time, this technology has been developed further, so as to satisfy the requirements of a worldwide market.

Today, almost 90% of German mining-equipment sales are generated in countries other than Germany. While China, Russia and the United States are currently the main export destinations, other parts of the world such as Southeast Asia, Latin America and Australia are growing markets for Germany's mining equipment manufacturers. German mining technology has been field-proven in both underground and surface mines in each of these markets, firmly founded on the strength of its technical design, safety measures and environmental features.

The VDMA-Mining Equipment Association welcomes all readers of the 2012 Mining Supplement, with its emphasis on how today's German mining technology is designed with the emphasis on operational and personal safety. We hope you will enjoy this publication.

Glückauf!

**Dr. Paul Rheinländer**  
President of the VDMA-Mining Equipment Association

VDMA, the German Engineering Federation, Mining Equipment Association  
Lyoner Strasse 18  
D-60528 Frankfurt  
Germany



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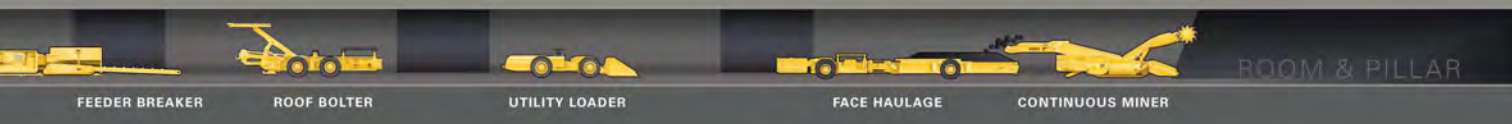
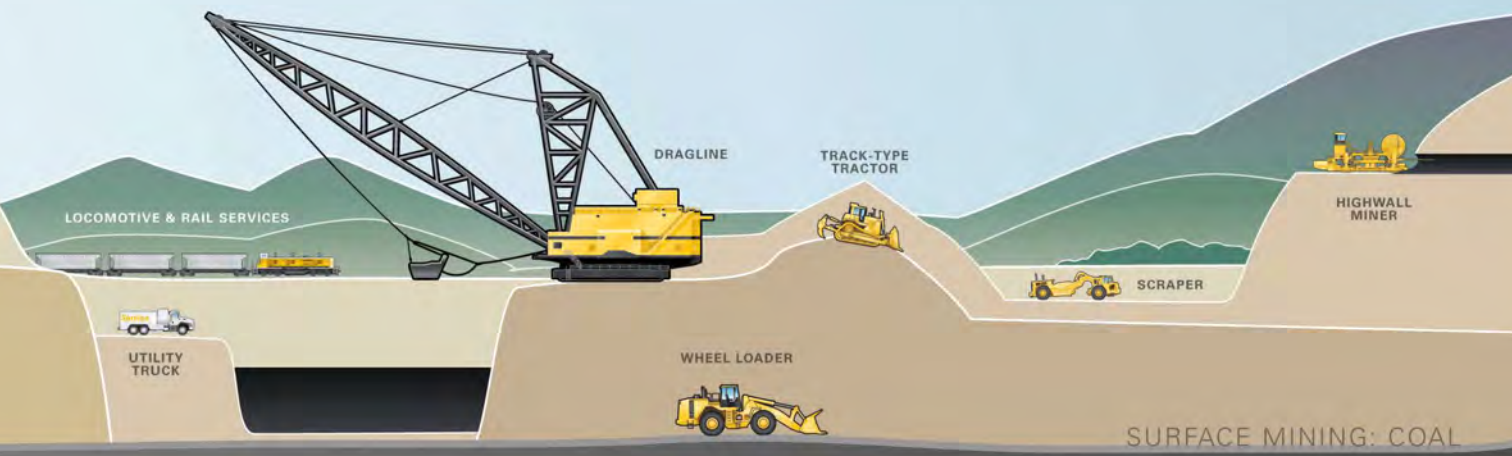


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# GERMAN EQUIPMENT SALES GO FROM STRENGTH TO STRENGTH WITH RECORD EXPORT DEMAND

With the world showing a gradual recovery from the worst of the economic crisis, Germany's mining-equipment manufacturers reported a modest increase in sales during 2010. Although sales during the first part of the year had been slow, demand fortunately began to grow during the final few months of 2010, with the upturn then accelerating to form a spring-board for a bumper 2011.

This was the message given to VDMA member companies at the mining branch's annual meeting in Essen in late November. Speaking at the meeting, branch president Dr. Paul Rheinländer was able to predict that Germany's mining-equipment suppliers were expecting to achieve total sales of just over €5 billion during 2011, representing not only a 32% increase over 2010, but also a new annual record.

Not only is this a significant achievement in its own right, Dr. Rheinländer said, but the fact that the mining-machinery sector had managed to increase its sales for the past three consecutive years meant it was one of the few in Germany that had shown uninterrupted growth throughout the period of economic crisis.

Dr. Rheinländer cited the strength of demand around the world for raw material commodities as being the driving force behind this success, not only from industrialized countries but also increasingly from emerging markets. "For example in India, we expect revenues from equipment sales will be up by almost 50% this year," he said.

The world's main commodity exporters have been taking advantage of the continuing strength in demand to both expand existing mines and bring new ones on stream. "In addition, rising commodity prices have increased the attractiveness of new mining projects, even in Germany, with the opening of a barite mine at Wismut and plans for the development of a big new copper mine in the Lausitz region of eastern Germany," he said.

"Germany's potash producer, Kali & Salz, is also thinking seriously about either re-opening two old mines or developing two new ones. While mining-machinery manufacturers are watching with interest plans being developed by RAG to use old hard-coal mine shafts and infrastructure as a new generation of environmentally friendly pumped-storage power stations," Dr. Rheinländer said. With sales of some €480 million anticipated for 2011, Germany remains the sector's largest single market, although the scheduled wind-down of the hard coal industry by 2018 will inevitably reduce its importance as time goes by.

Responding to a question at the meeting's press conference, Dr. Rheinländer noted that while the sector's domestic market was bound to shrink in the future, some companies are already being

proactive in their approach. Citing his own company, coal mining equipment manufacturer Eickhoff, he said that it will be taking its R&D operations to one of its main markets—Australia—in order to be closer to its customers there, while continuing to rely on the expertise of its skilled workforce in Germany to produce its equipment to the high standards expected of it.

## Exports Underpin Record Sales

With sales worth around €4.66 billion expected from export markets in 2011, Germany's mining-machinery manufacturers had a bumper year. China continued to be the largest individual export destination, with sales totalling some €400 million, up from €323 million in 2010. And, said Dr. Rheinländer, it was not only orders from the country's coal industry that were important; China is developing its mineral resources across the board, providing export opportunities for the whole range of mining equipment.

Second in importance as an export destination, Russia also produced an upturn in equipment orders during the year, with sales rising from €264 million in 2010 to €299 million in 2011. As Dr. Rheinländer pointed out, liquidity in the Russian economy has improved, with better opportunities for financing new equipment purchases. In addition, he said, coal is increasingly replacing natural gas as a fuel in Russia, given the country's need to maximize gas export earnings, with more coal being mined for export as well.

German equipment exports to the U.S. market also rebounded strongly in 2011, to stand at around €197 million, while exports to Australia reached a new value high of €76 million. This, Dr. Rheinländer told *Best of Germany 2012*, was excellent news, with sales volumes in both major markets having returned to—or surpassed—levels achieved before the economic crisis broke.

And, while much of the equipment sold into these markets was orientated toward the coal industry, most of the sales made to operations in South America have been into hard-rock mining, illustrating just how versatile Germany's manufacturers really are. With the value of exports rising by more than 25% to an estimated €91 million as metal-mining companies expanded their operations, and brought new mines on stream, this was a major achievement, Dr. Rheinländer said.

"Germany's mining-equipment sector is very stable, and this is due in no small measure to the very wide spread of the technologies covered by VDMA member companies. It's a good position to be in, and so far as we can tell, companies have strong order books well into 2012. Orders are coming in on a very regular basis, and we are predicting that the sector will increase its turnover by between 8% and 10% next year," he said.

"There is great potential to develop bigger markets in South America, and in countries such as Indonesia and Mongolia," he said, noting the organization hosted a visit by a delegation from Colombia's mining industry during 2011, with preparations for a similar group from Peru already under way.

His enthusiasm for creating stronger links with the rapidly developing mining industry in Mongolia were echoed by the country's ambassador to Germany, Baldorj Davaadorj, in a presentation to the Essen meeting. Making mention of work that German companies have

### VDMA Participation at Mining Exhibitions During 2012

DATE	SHOW	LOCATION
9-13 April	Expomin	Santiago, Chile
24-26 April	Mining World Russia	Moscow, Russia
2-5 May	Conbuild Indonesia	Jakarta, Indonesia
16-19 May	Future Mongolia	Ulan Bataar, Mongolia
10-14 September	electra mining africa	Johannesburg, South Africa
16-18 September	CIEI	Taiyuan, China
24-26 September	MINExpo International	Las Vegas, USA
5-8 December	IMME	Kolkata, India



already done, for example, in the fields of coal-to-liquids projects and supplying mineral-processing equipment, Davaadorj also pointed to the visit that Germany's Chancellor, Angela Merkel, made to Mongolia in October 2011. Positive results from Merkel's trip included the signing of a commodity partnership agreement that provides for increased bilateral mineral and equipment trade.

"We have the raw materials while Germany has the latest technology and the know-how," Mongolia's Prime Minister, Sukhbaatar Batbold, was reported as saying during the visit, while Merkel said: "I am convinced that we have laid the foundations for a long-term partnership in the energy and extractive sectors that will benefit both countries."

### **Mining for the Future**

Over the past three years, the VDMA has been at the forefront of moves to involve Germany's mining industry, its equipment suppliers and its mining universities in understanding what the next generation of miners will need in terms of technology. Having already run workshops at Aachen and Clausthal technical universities, the third Future Mining workshop was held in July 2011 at the Bergakademie Technische Universität Freiberg, which was founded in 1765 and is the oldest mining faculty of the world.

The questions posed at the workshop were: "what equipment will be required?" and "what is needed for Germany to remain a world leader in terms of technology?" To generate discussion and to help workshop participants gain knowledge from the open forum, the event focused on questions such as: "how can we create new ideas?" while challenging people to change their points of view. Helping them to do this, the workshop also included an introduction to the most appropriate ways of getting new and different viewpoints.

Having held three events that provided engineers with the inspiration to find different ways to innovate, the VDMA is now challenging manufacturers to create new ideas and new R&D projects. During 2012, its mining equipment branch will be organizing workshops with universities and companies to discuss proposals for the new technologies and procedures that have been outlined in the previous events. The aim, it says, is to decide the best way of taking these ideas forward to the next stage, as development projects.

### **Promoting German Equipment Worldwide**

One of the VDMA's key functions is to support its member companies in international markets, in a sales environment that is becoming increasingly competitive. Publications such as *Best of Germany* play an important role here, and are readily available at all of the international exhibitions that the VDMA attends.

During 2012, for instance, the VDMA will be at no fewer than eight major mining sector exhibitions around the world, as shown in the adjoining table. The truly international effort it places on marketing activities for its members is clear to see, with its presence at trade shows in Asia, the United States, South America, Africa and Europe aimed at promoting the high quality and technical expertise of German equipment to new markets.

Looking ahead even further, 2013 will bring the return of *bauma*, with the VDMA's mining and construction equipment branches being among the principal sponsors. Running from April 15 to 21 at the main Munich fairground, *bauma* 2013 aims to build on the success of the last show in 2010 when, despite the volcanic disruption to Europe's transport links, over 420,000 people attended from more than 200 countries. Since 2004, *bauma* has included a specific mining component that in 2010 had 605 exhibitors, with a promise for 2013 of a dedicated hall for mining-sector suppliers.

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# UNDERGROUND MINING TECHNOLOGY: SAFER WORKING CONDITIONS AND HIGHER PRODUCTIVITY

German companies have been at the forefront of underground mining technology for well over a century, and even during the gradual run-down of the country's hard coal mining industry, they are still showing just how innovative they can be in supplying state-of-the-art equipment to export markets around the world. German underground mining technology is not, of course, focused exclusively on the coal industry, with its suppliers continuing to win an increasing share on world markets with machines for hard-rock and evaporite mining.

For instance, **Hauhinco** has been supplying equipment to the mining industry for over 100 years, having become one of the world's leading suppliers of water hydraulic systems, with an extensive range of valves, pumps and electronics. Hauhinco supplies individual and tailor-made high-pressure and spray systems for longwall installations. As well as single-face systems, the company says, it can design and install centralised networks that can supply up to four faces within a single mine, with its infrastructure covering distances of up to 5 km.

From its headquarters in Dortmund, the **Deilmann-Haniel International** group encompasses specialist shaft-sinking contract services and underground mining equipment from its German subsidiaries, with shaft-sinking and mine construction services being supplied through its Redpath and Frontier-Kemper companies in North America.

**Deilmann-Haniel Shaft Sinking GmbH** claims to be one of the world's most experienced shaft-sinking contractors, having undertaken more than 500 shafts. As well as sinking new shafts, the company provides rehabilitation services for old mine accesses, together with raiseboring, ground-freezing and mine-closure services. An example of its raiseboring skill comes from a ventilation shaft at Deutsche Steinkohle's West mine, where it achieved an accuracy of 300 mm over a 600 m pilot hole length, the company reports.

Underground transport systems are **SMT Scharf's** speciality, with the Hamm-based company offering suspended monorail systems, floor-mounted rail systems, chair-lift transport for man-riding, road-headers and conveyors. Orders reported by the company during 2011

included a 7 km-long chair-lift system for a coal mine in Mexico. A challenge here was to keep the system separate from an existing monorail network, for personnel safety reasons, the company said.

Scharf also reports having been successful in transferring its monorail technology from the coal industry to hard-rock mining, with several systems delivered to mines in South Africa. The company claims that independent reports have shown that mining companies can cut both their costs and cycle times for handling materials underground by using monorails, with savings coming from lower ventilation requirements and the use of smaller-diameter headings for their transport infrastructure.

## *Caterpillar: Bringing Germany's Coal Mining Heritage Up-to-date*

As predicted in the 2011 edition of **Best of Germany**, there is a new name within the German mining-equipment sector: Caterpillar. Today, **Bucyrus Europe GmbH** is part of the Caterpillar Global Mining Division, which offers what the company claims to be an unparalleled range of mining and support equipment and technologies for all types of underground mining.

As most people within the mining industry will recall, the former DBT company brought together a huge pool of German expertise in mining equipment design and manufacture, with the subsequent acquisition of DBT by Bucyrus merely adding to the company's already strong international reputation. Now, as part of Caterpillar, Bucyrus Europe remains a committed member company of the VDMA, with its production facilities founded in their traditional heartland.

For underground coal and soft-rock mining, Caterpillar offers the full range of longwall equipment—roof supports, armoured face conveyors, shearers and plows—together with room-and-pillar mining equipment, including continuous miners and haulers. For underground hard-rock mining, Cat equipment now encompasses loaders, trucks and drills.

Since completing its Bucyrus acquisition, Caterpillar has been focusing strongly on its underground coal equipment range, and in October 2011 was a first-time exhibitor at the China Coal & Mining Expo in Beijing—the largest underground mining exhibition in the world. Designed under the 'Wherever there's mining' theme, Caterpillar's stand featured as its centerpiece its recently rebranded EL3000 shearer, which was developed for medium-to-high coal seams in the 2.5-5.5 m (98-217 in.) range. With 2,295 kW (3,078 hp) of installed power, the EL3000 is designed for production rates of up to 5,000 metric tons per hour (mt/h). Industry-leading automation can be configured to meet individual control needs, Caterpillar says, from basic monitoring and protection to advanced automation and data transmission. In addition, an automation package allows improved utilization of manpower in a safe environment, with increased yields from any given seam section, faster haulage speeds, improved face management, and increased equipment life.

Cat's coal sector equipment that is produced at its Lünen factory includes the company's longwall face-support, armoured face conveyor and plow ranges, as well as its haulage conveyors and CST (Controlled Start Transmission) drive units. Built to meet individual



Caterpillar participated in the China Coal & Mining Expo for the first time in 2011, where the company displayed its EL3000 shearer.





site requirements, face supports are available to cover seam heights of 800 mm to 7.5 m (22-295 in.), and are capable of providing support loads of up to 1,750 mt (1,930 ton). Support units are also made in various widths from 1.5 to 2.05 m, with special units for systems such as longwall caving also available.

For seams less than 1,800 mm (71 in.) thick, Caterpillar offers plow systems that can produce up to 3,500 mt/h. With 2x800 kW installed, these are the most powerful plow systems available, the company says, capable of out-performing shearers, with features such as horizon control and overload protection that make this a future-orientated solution for hard-coal mining.

### **BASF Products for Underground Safety**

**BASF's** Construction Chemicals division is a leading supplier of chemical systems and formulations for the mining and construction industries. Its admixture-systems business unit specifically helps customers involved in concreting and shotcreting, while Switzerland-based MEYCO supplies the equipment needed for shotcrete and polymer-film application.

Looking specifically at the safety aspects of shotcreting, BASF believes there is an increasing need for high-quality, durable sprayed concrete that poses negligible health risks and fewer negative impacts to the environment. Worldwide, the company says, there has been an important shift from dry- to wet-mix application, a change that—together with the latest technology in equipment and alkali-free accelerators that give low dust and rebound levels—has significantly improved the working environment and reduced health risks.

In late 2010, BASF won MSHA approval for its TSL 865 thin spray-on liner, a one-component polymer powder for spray-application onto soil and rock for supplementary support and protection against weathering. The MSHA approval expanded the acceptable use of TSL 865 to the complete range of applications in underground coal mines, the company said at the time.

TSL 865 is used to seal and strengthen the rib and roof, seal leaky stoppings and overcasts, build maintenance-free block stoppings, and improve the quality of any ventilation control in the mine. The product is mixed with water in the spraying nozzle, impacts the substrate as a paste and sets within five to 10 minutes, before continuing to gain tensile and bond strength over a period of weeks. According to BASF, TSL 865 is one of the fastest and simplest products of its type now available. It can be applied quickly, is dust free, and only needs a 6 mm (0.25 in.) coating to perform effectively, the company adds.

Through MEYCO, BASF offers the mining sector a total-system approach to ground support, including admixtures, accelerators, stabilizers, water reducers, fibers and curing systems. Its equipment includes sprayed-concrete pumps and robotic manipulators, such as the MEYCO Cobra, as well as grout pumps.

Other products include thin spray-on liners, backfill materials, rock- and cable-bolt grouting products, cementitious foaming grouts, water-control systems, and corrosion- and abrasion-control systems.

### **Mining Equipment Rebuild Specialists**

Established just four years ago, Wesel-based **DAT Bergbautechnik GmbH** is already making a name for itself in international mining markets. The company has two strings to its bow: renovating and supplying used longwall face equipment, and developing specialized safety systems that help protect personnel if they get too close to moving or hazardous machinery.

Despite being a small company, DAT has big ambitions, managing partner Jörg Menningen told *Best of Germany*. It won its first major

project in 2010 with the supply of 120 roof supports to a coal mine in Ukraine, and followed this up in 2011 by supplying a full face-equipment set to the Russian coal company, Vorkutaugol. For this contract, DAT's specialist staff rebuilt and strengthened the shield bodies, he explained, as well as fitting new cylinders and hydraulic systems, with the supports then being matched to a Russian-sourced armored face conveyor. Getting the whole consignment, which weighed around 4,500 mt, from western Germany to Vorkutaugol's operations in Russia's remote north presented some challenges, he added, but DAT completed the whole project within its five-month delivery schedule.

Meanwhile, tests on DAT's new personnel proximity-detection system, which it has developed in conjunction with Rostock University, began in August 2010, with the company planning on taking the system underground in 2012 and having it ready for the market the following year. Weighing just 100 g, the belt-worn transponder is powered by a battery with a 40-day life. Radio-based, the system currently has a positional accuracy of around 500 mm, allowing equipment to be deactivated if the wearer strays too close to it.

Other DAT products include a new-generation hydraulic pump station which, it claims, is virtually vibration-free, and it also has an interest in the electronics company, **Wölke Industrietechnik**, which produces gas sensors for underground use. The company has already achieved export success in Russia, Ukraine, Kazakhstan and Turkey with this equipment.

### **Making LHDs for Nearly 50 Years**

A member of the Schmidt, Kranz group since 1999, **GHH Fahrzeuge GmbH** produced its first LHD in 1964, and since then has sold several thousand worldwide. Following its move to a new production facility at Gelsenkirchen in 2007, GHH put several prototype machines on trial, including the SLP-12 ultra-low-profile LHD that it had developed on request from a German potash mine. Only 1.65 m high but with a 12 t loading and carrying capacity, the SLP-12 represented a completely new design in terms of size, shape and technology, the company said.

More recently, it has introduced its LF-1011 LHD, which it describes as being an 11-mt LHD in the shape of a 10-mt machine, and which is equipped with the Efficient Drive System (EDS) pioneered on the SLP-12. Combining all of the advantages from both hydraulic and mechanical drive systems, EDS gives its customers significant savings in terms of fuel consumption and maintenance, the company claims.

Today, GHH Fahrzeuge has a six-model diesel-powered LHD range, with a further five electric-drive machines. Payload capacities range from three to 20 mt, with haulage support provided by the company's five-model range of rear-dump trucks, offering capacities of 15 to 50 mt. Specialist machines, such as scalers, are available to order, as are conversions on its standard LHDs to give full remote-control operation.



GHH Fahrzeuge's LF-1011 uses the company's Efficient Drive System technology.



## Putzmeister Underground

Putzmeister's Underground Solutions division, based in Spain, has designed and built concrete-spraying equipment for more than 30 years, with its systems being used in mining and tunnelling projects all over the world. Its spraying systems apply shotcrete at output rates of up to 30 m<sup>3</sup>/h and spraying reaches of up to 17 m, the company says.

The Sika-PM 4210 is Putzmeister's latest model of shotcrete equipment for lower-height mine sections, and includes a version with dual diesel and electric operation to facilitate its use independently from a power source. Another version with a rotor pump will soon be available, the company adds, giving the opportunity for concrete spraying using both wet and dry processes. This means the machine can also be used when a job site's logistics do not allow the use of ready mixed wet shotcrete, Putzmeister says.

The company reports that the first of these new machines was sold during 2011 to Germany's Sachtleben Bergbau for use at its Clara barite-fluorite mine near Oberwolfach in the Black Forest, and that more machines will soon be commissioned at mines in South America.

At Clara, the Sika-PM 4210 is used for structural support in roadway headings as well as for special operations in critical situations. Challenges include the frequently changing rock conditions there, Putzmeister explains, which vary significantly in composition, strength and stability. Because of this, the machine operator needs to be flexible during the shotcreting process as far as the concrete output and additive dosage are concerned, depending on the early-strength and drying-time requirements for each specific situation.

The proportional remote-control of the Sika-PM 4210, which works using either cable or wireless, responds to the mine's needs, the company says, as it allows full control of the concrete output as well as fine adjustments to the preset additive dosage. All other functions on the machine are also available via remote control, Putzmeister adds, including automation of the start of the spraying sequence.

The vertical reach of the machine's new spraying arm has been increased to 10 m, while its maneuverability is also better with a 25% increase in the spraying speed at the arm tip. The hydraulic cylinders on all of the arm extensions are covered for protection, but are still easily accessible for maintenance. In addition, new high-intensity xenon working lights have been incorporated onto the spraying arm, while other improvements to the new machine include the use of heavy-duty axles with mining tires and a manually released, multi-point automatic fire extinguishing system. The equipment includes the latest software, optimizing the operation as well as the synchronization of the concrete and additive flows, Putzmeister adds.



The latest addition to Putzmeister's shotcreting portfolio: the Sika-PM 4210.

## Sophisticated Shearers, and Much More

Part of the Eickhoff group, Bochum-based **Eickhoff Bergbautechnik GmbH** develops, builds and supplies high-performance machinery to the underground mining industry. The company's product line ranges from shearer loaders for longwall mining, via continuous miners for heading and room-and-pillar mining, to roadheaders for mining and tunnelling. All of its development activities on these machines are focused on achieving the optimum benefit for the customer, the company says, with maximum availability and reliability, ease of maintenance and long service life being features of its products. The highest possible installed powers assure high productivity at low machine-specific mining cost, Eickhoff adds.

Eickhoff's shearer range encompasses four models: the SL 300, SL 750, SL 900 and SL 1000. When the SL 300 was introduced in 1994, the company points out, it was equipped with two 220 kW cutter motors and two 35 kW DC haulage motors. Today, an SL 300 comes with two 480 kW cutter motors and two 90 kW AC haulage motors, giving increased cutting and travel capabilities while producing up to 600,000 mt/month at operations in Australia and the U.S.

The SL 750, introduced in 2006, built on the success of the SL 300 and former SL 500 machines, being only slightly larger than the SL 300 but with significantly higher cutting power. The shearer is designed for seam heights of 1.8-4.5 m, with 1.9 MW of installed power.

While this machine grew from its smaller relations in the range, the SL 900 combines the compact dimensions of the SL 750 with the power of the larger SL 1000, and although it is of similar size to the SL 750, it weighs in at around 25 mt heavier—a consequence of its higher machine body stiffness and rigidity, Eickhoff says. Installed power of 2.35 MW means that the SL 900 can produce in seams from 2.1 to 5.5 m high.

With what it claims is the world's most powerful shearer loader, Eickhoff commissioned the first SL 1000 at a Shenhua mine in China in 2007. The machine is designed to achieve peak performance in seams more than 7.1 m thick, although it can be modified to work at seam heights down to 3 m.

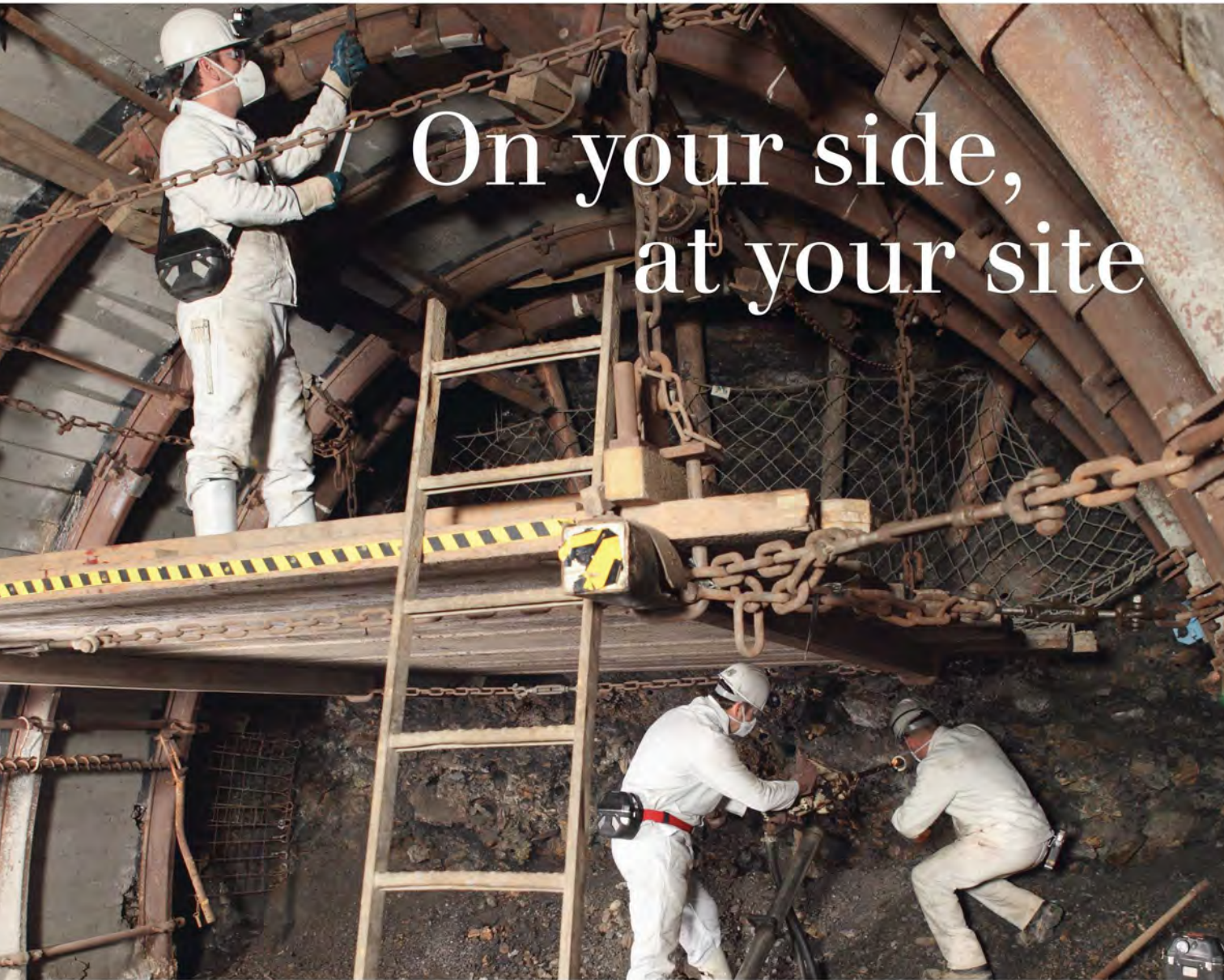
Turning to continuous miners, Eickhoff offers two versions of its CM 2, one with hydraulic drive for better traction in wet or muddy conditions, and the other with electric traction drive. Both provide low ground pressure and high tramping speeds, the company says. A 1.2 m-diameter cutting drum is fitted as standard, with 360 kW of installed power.



Eickhoff offers two versions of its CM 2 continuous miner. It recently received orders for a further four machines.



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Speaking to *Best of Germany*, the company's CEO, Dr. Paul Rheinländer, said Eickhoff's continuous miner fleet recently increased by another four machines, with orders received from China, Russia and Belarus. "Although they have only been on the market for a short time, these machines are already getting a good reputation," he said.

### **Simple Designs; Productive Machines**

**Schopf Maschinenbau GmbH** designs, manufactures and sells products for the underground mining and tunnelling markets, together with aviation ground-support equipment. Built at its factory at Ostfildern, near Stuttgart, the company's range of mining vehicles comprises underground loaders from 6- to 18-mt payload suitable for all materials and volumes, together with dump trucks and utility vehicles supplied in collaboration with an international partner.

Building on its long track record in designing and building special vehicles for the mining and tunneling industry, Schopf recently introduced its latest LHDs into the market. The company says its KISS (Keep It Strictly Simple) design system is one reason for its success, explaining that decision makers who have taken a close look at its designs have appreciated the good serviceability and straight-forward technology of its loaders. Separate cooling circuits for the brakes, radiator and hydraulic functions keeps the hydraulic temperature down and so guarantee a long component life, it adds, resulting in low total life-cycle costs compared to other loaders. All of its machines feature an ergonomic, comfortable operator's position, while built-in components comply with the latest environmental and safety requirements.

Today, Schopf's loader fleet includes the SFL 60XLP, SFL 60FLP, SFL 65, SFL 100, SFL 120, SFL 140, SFL 150 and SFL 180. The company describes the flameproofed SFL 60FLP as being 'the ultimate workhorse for low-seam coal mines, with a 6-mt payload. Only 1.38 m high, it is designed for the heaviest of transport, loading and haulage tasks in underground mines, the company says, thanks to its installed tractive effort, big ejector bucket and Z-linkage design. This, combined with utmost simplicity in its electric and hydraulic circuits, operational comfort and safety, makes it an exceptional choice in this special type of equipment, Schopf states.

The SFL 65 provides  $4\frac{1}{2}$  yd<sup>3</sup> capacity in the shape of a  $3\frac{1}{2}$  yd<sup>3</sup> LHD, the company reports. With a standard bucket volume of 3.5 m<sup>3</sup> ( $4\frac{1}{2}$  yd<sup>3</sup>) (6,500 kg payload) in this popular LHD class, the SFL 65 offers 2.5 m tipping height in its 'HiLift' version, answering the demand for a team-mate for the increasing use of 25-mt payload, narrow-width dump trucks with higher box heights.

The SFL 100 is a 10-mt class Loader with a 6.5 yd<sup>3</sup> standard bucket, and is matched to 30- to 40-mt capacity dump trucks, while



Schopf's SFL 140 LHD, designed to work with 40- to 50-mt capacity trucks, has a 250 kW Tier 4A (Stage III B) engine.

the SFL 120 is a compact 12-mt class machine that provides 7- to 8-yd<sup>3</sup> capacity in the same compact size as a 6 yd<sup>3</sup> unit. Schopf says its 227 kW Tier 3 engine, Z-linkage and heavy-duty drivetrain components make it a highly productive loader, especially for uphill haulage.

Finally, the 14-mt SFL 140 is designed to work with 40- to 50-mt dumpers, while the SFL 150 and SFL 180 offer 15- and 18-mt tramming capacities and mark the top of the company's underground-loader range.



Thiele's Big-T mining chain, launched in 2010, includes optimized curvature of the vertical link.

### **Chains for Mining and More**

The **Thiele** company was founded in 1935 and is now one of the world's foremost chain manufacturers. Its product line includes a full range of mining chains and accessories, and lifting chains and accessories, as well as bushed conveyor chains and forged-link chains. Thiele says its know-how has been built up over many years of designing and producing complete chain systems, and its highly skilled workforce and modern, high-performance production facilities stand for products of the finest quality.

The company specializes in chain systems for conveying and lifting. Its engineers provide an on-site consulting service and work alongside their clients to analyze the technical requirements before planning and sizing up the moving chain assembly. Customized solutions are then worked out in-house in Thiele's own design department.

All of the company's chains and components are manufactured in-house. Its production facilities include equipment for welding, laser-, plasma- and gas-cutting, solid forming, heat treatment and mechanical processing using the latest CNC lathes and multi-spindle milling machines.

Thiele says that high-integrity production methods are used to ensure that all products leaving its factory are of the finest quality, as confirmed by continuous monitoring in its laboratory and testing house. It adds that it was one of the world's first chain-producing companies to meet the DIN EN ISO 9001 quality management standard.

One of its most recent developments, its Big-T chain, made its first appearance at the *bauma* exhibition in 2010, and represents a breakthrough in the development of high-performance mining chains, Thiele claims. The Big-T chain features a number of improvements, the company adds, including an optimized curvature of the vertical link, a greater sprocket contact area, a narrow leg for the round link, a very low overall height, and the inclusion of an anti-kink bar.

### **Safety First with the New Paus Scaler**

"The market needs companies like us to come up with solutions to individual conditions," Franz-Josef Paus, managing director of **Hermann Paus Maschinenfabrik GmbH** told *Best of Germany*. "We love engineering, and we try to offer machines that are as specialized as possible. Within each of our ranges, there are good opportunities for customization."



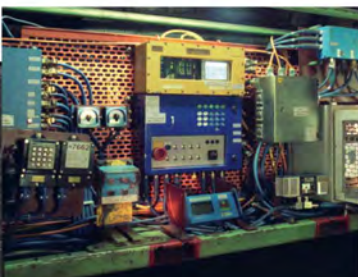


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The IntelliScale control system, which links machine functions on Paus' 853 S8 scaler to give additional safety features.

Paus went on to note that the mechanization of scaling, and protection against rockfalls in general, is growing in importance in the mining and tunnelling sectors world-wide. As a result, he said, the company has analyzed the issue in detail and hopes to contribute to the improvement of roof and impact safety by the use of its redeveloped scaler. "The keyword here is 'safety first!,'" he said.

According to Paus, scaling equipment in use at the moment is often too large or too inflexible, and is hard to move quickly from one site to another, especially where mines have small cross-sections. Operators also quickly lose their 'feel' for the rock with longer reaches or comparatively heavy hydraulic hammers.

Having been in production for more than 15 years, the company's scaler has now been completely redesigned, with a number of new features and functions—and a change of name, from TSL 852 to Scaler 853 S8. With articulated steering and a compact design, a radius of just 2.8 m is all that is needed to make a 90° turn. The telescopic boom can extend to a reach of 8 m and, with a pivot angle of  $\pm 45^\circ$ , a heading width of up to 9 m can be covered from one set-up. Paus uses NPK hammers as standard since, as Paus pointed out, "we know that they will work pointing upward."

Maximum safety during scaling is assured by the operator sitting up to 8 m from the scaling point, depending on the pivot angle and the actual length of the telescopic boom. Deflectors on the boom prevent broken rock from sliding onto the cabin and, during scaling, the operator has a clear view of the cutting point because of the way that the boom and hammer pivot.

The new machine has a ROPS/FOPS cab with large windows and a glass roof that give the operator a good view of what is happening during scaling; additional protection comes from a grill over the front and roof glazing. The turret is now significantly lower on the new model than before, without any loss of reach, giving significantly better forward visibility, Paus said.

The scaler can be equipped with an optional 'IntelliScale' machine-control system—a Canbus-based network of the key mechanical components with the hammer, enabling various parameters like the engine speed and hammer frequency to be coordinated automatically. Defined operating statuses can also be called up, thereby preventing the possibility of accidental or incorrect operation: the functions are blocked since, as the company points out, hazardous situations underground are often the result of operator error.

A unique safety feature is the vehicle's reverse fleeing mode. In the event of imminent danger, such as falling rock, the operator presses a button on the control joystick, the hammer and boom are stopped and retracted, and the machine moves backward automatically.





### marco: Innovative Longwall Technology

In 2012, the longwall control-system supplier, **marco Systemanalyse und Entwicklung GmbH**, will launch a new PC unit incorporating a 22 in. graphic screen. Weighing just 46 kg, these units serve as underground main computers for controlling longwall applications, or as a means of displaying information graphics for the complete longwall. marco collects and collates data from peripheral systems such as pumps, power stations, energy suppliers, actuators, shearers, couplings and belt conveyors, and also transmits the data to the mine's main surface control stations.

The company reports that its longwall application product line has been enhanced with the development of a low-sized hydraulic main block for use in thin-seam roof supports. This type of system is currently used in Ukraine, Russia and Poland, and is likely to be used in thin-seam mines in Australia, China and the U.S. in the future. The automation concept is based on an ultrasound displacement transducer that is now widely accepted, marco says, replacing the ram transducers that were mounted inside the support advance cylinders.

In addition to the electrohydraulic control package, marco has introduced a warning device combined with an LED colored-light system to be mounted under the support canopies. The pm32 controller starts warning sequences by changing the color of the LED lights from green to orange and red when automatic functions occur. Warning sounds are also generated. These LEDs provide easily visible indication of safe longwall areas, and also of dangerous areas where machines may start to move and operate, depending on the shearer or plough position. Equipped with a battery back-up, the LED light system can be software controlled, and is only lit where people are moving along the longwall.

A further application of the marco ultrasound displacement sensor is as a barrier to detect miners walking through the supports. A miner will be detected when crossing the ultrasound beams that mea-

sure the distance between the shield leg and the conveyor. The system can even determine the direction in which a person is moving, by comparing the broken-beam reports from the transducers with the roof-support numbers, while the individual miner can be identified from radio signals transmitted from a helmet-mounted source to the ultrasound multi-sensor receiver.

As a safety feature, marco's system can then block the electrohydraulic automatic support functions for these specific shields, with the company stating it will work with its individual customers to develop the appropriate software details when a system is being put into operation.

The range of services offered by Dachau-based marco includes expertise in planning and implementing equipment for specific geological conditions, best practice in planning and implementing electrohydraulic control systems for longwall equipment from any manufacturer, and analysis of the longwall mining process and situation-specific requirements such as operating shields on inclined faces. marco also offers control automation concepts for cutting machines and roof supports, as well as developing dedicated electro-hydraulic modular components and valves to meet specific roof-support requirements.

The company said its manufacturing, testing and commissioning capabilities have recently been extended with a bi-di controller, designed on the basis of its solenoid valve controller. Used with its electrohydraulic main blocks, this replaces standard manual pilot control systems on roof supports, doing away with the need for multi-hose connections by replacing them with an easy-to-maintain four-wire electric cable.

### Safe Electrical Systems for Underground Mining

Founded in 1975 at Bad Mergentheim, **Bartec GmbH** supplies explosion-protected electrical equipment. The company operates 10 production facilities in Germany, Switzerland, the UK, Norway, Slovenia

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and China, and markets its products world-wide. During the 1990s, it acquired the underground mining products operations of both AEG and Siemens, as well as continuing to research and develop its own product portfolio from its Menden production facility. The company said customization of its products forms the main part of its business.

Its current product range includes transformers, power-distribution units, switchgear and control systems, mining frequency converters and motors for speed-controlled gears, and automation systems. Bartec reports it has recently received some large orders from customers in both Russia and China for its mining frequency converters.

Other mining products include switching relays, three-phase motors, controller units, and terminal and junction boxes. The company's most recent introduction is its power distribution center. Examples of where Bartec has supplied power-distribution equipment to OEMs include all of the main mining-equipment suppliers in Germany and Austria.

Since 2007, the company has exported its mining motors to customers in Russia, Austria, Poland, the Czech Republic and the UK, as well as supplying the German mining industry.

### High-pressure Longwall Pumps

Established in 1974 as the European subsidiary of a large American pump manufacturer, today **Kamat-Pumpen GmbH & Co. KG** is one of the world's leading manufacturers in the field of high-pressure water technology. Its extensive product range is sold through an international distributor network and experienced specialists in more than 40 countries.

Based in Witten, the company now offers a product range that covers high-pressure pumps, pump systems and accessories for pumping various kinds of fluids, and suitable for working pressures up to 3,500 bar. Besides supplying its products to users such as industrial cleaning contractors and to heavy industry, Kamat claims to be the world's leading manufacturer of pumps developed specifically

for longwalling and dust suppression in the mining industry, with both a standard range of pumps and tailor-made products and systems designed to meet customers' special needs.

Kamat reports its pumps are compact and robust, have a long service life and are simple to maintain. Designed and manufactured to provide smooth, trouble-free operation under a continuous duty cycle, its high-pressure plunger pumps provide a reliable solution to the provision of hydraulic power on longwall installations.

Its product range covers high-pressure plunger and piston pumps, as well as complete pressure systems, for a power input range up to 1,100 kW, and includes accessories for all kinds of applications. Single pumps offer flow rates of up to 2,400 liter/minute at 95 bar, handling fresh water, demineralized water, emulsions, light oils and other similar fluids, while pressure capabilities range up to 3,500 bar at 58 liter/minute. Special pumps are available for mining and for reverse-osmosis salt-water desalination plants.

In October 2011, Kamat introduced a new family of pumps suitable for power inputs of 100-160 kW. Offering low-vibration, low-noise operation, these pumps are optimized for use with VSD-driven motors and with diesel engines, the company says, allowing variable speeds in the range 10%-100% of their nominal speed. In addition, there is a high level of parts commonality between the new pumps and the existing K10000, K13000 and K16000 ranges. Kamat is following this in early 2012 with the introduction of its 3G pump series, used with 350-400 kW drives.

In the international market, to date Kamat has sold more than 75 pumps into Australian mines. It reports that the Australian company, Longwall Hydraulics, is installing a pump system that includes its new gearbox K35000-3G pumps. The system, being supplied to one of the BHP Billiton Mitsubishi Alliance (BMA) mines, consists of three pump sets, with each set housing a K35055-3G (439 liter/minute at 350 bar) and a K9030M (84 liter/minute at 415 bar) pump, driven by

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a Morley 400 kW emulsion cooler motor. The pump station itself is a crawler-driven platform, 8.5 m long by 3.5 m wide and 2.6 m tall, with an 14,000 liter emulsion tank and a boosted suction system. The company also notes that this contract represents a great success as BMA had previously been using pumps from another supplier.

### Becker Mining Systems: Mine-wide Communications, Transport and Automation

With its headquarters in Friedrichsthal, **Becker Mining Systems** provides complete mine-wide solutions for underground mining in the fields of energy distribution, automation, communications, transportation and roof support. The company has followed a policy of becoming more influential in the global market in recent years, and is now located in all of the world's major mining regions. Its principal customer base is in the coal, gold and platinum industries, the company says, providing a foundation for its activities in Poland, Russia, China, South Africa, Australia, the U.S., Canada and South America, among other areas of the world.

In a recent project, Becker has been working with the Polish hard-coal mining company, Jastrzębska Spółka Węglowa (JSW), to modernize the logistics chain at the Zofiówka mine in Upper Silesia with high-output conveyors and an integrated control and communications system. JSW operates five underground mines that deliver about 13 mt/y of bituminous coal, of which about 70% is high-quality coking coal. Over the past few years, the mine has been extensively modernizing its underground materials-transport systems.

The aim has been to improve the movement of materials from the shaft stations to the working areas by means of continuous trapped-rail or suspended monorail transport systems. This has involved the introduction of both systems with increased drive output and hill-climbing ability, specially designed for heavy-duty transport that

complies with safety regulations that were introduced in 2006 by the European Machinery Directive.


The project also involved the optimization of the logistics system through the tracking of vehicle locations, with the possibility of using remote control from a transport control room on surface. In addition, it incorporated a bi-directional voice link to the vehicle operators using WLAN and fiber-optic VoIP technology.

During the course of the modernization programme, diesel-powered monorail locomotives made by the company's Polish subsidiary, Becker-Warkop, were installed in 2007. Supplying positive tensile force transmission to the rails, these were followed in 2010 by five type-KPZS 148 rack-and-pinion units, which have a motor output of 148 kW, a maximum tensile force of 100 kN per drive, and can be used on inclines of up to 30°. Together with six type-KPCS 148 diesel-powered friction-wheel monorail locomotives, these are now in operation along an 8.5 km-long haulage route.

The logistics system for materials in the mine are supported by a WLAN network along its main transport axis, using Becker's newly developed, intrinsically safe access points (WRAP 200) with connected leaky-feeder transmission cables that act as transmission/receiving antennas and complete the wireless connection between the locomotives and the mine-wide fiber-optic network. This is then used to transmit voice, machine data and information on the location of vehicles to the surface control room, via ethernet.

Meanwhile, the monorail locomotives are equipped with a Mining Master Smart intrinsically safe mini-computer that acts as a subscriber to the WLAN network and communicates with the access points through a machine-side gateway. In addition, the locomotive operator can establish connections to the telephone exchange using a mobile VoIP telephone, enabling current information to be exchanged with the control room and new tasks to be allocated.

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# SURFACE MINING TECHNOLOGY: SAFETY AND PRODUCTIVITY GOING HAND-IN-HAND

With its history of large-scale surface mining that goes back to the 19<sup>th</sup> century, Germany has built up a strong presence in the world market for equipment that does the job efficiently, cost-effectively and—as is ever more important these days—as safely and with as little environmental impact as possible. Orders for massive machines for lignite mining may be few and far between, but the machines that are out there in the field need upgrading from time to time, making them more energy-efficient and productive.

German expertise has led the world in the design of hydraulic mining excavators, with three of the major suppliers located in Western Europe. Where engines are concerned, manufacturers have risen to the challenges set by national and international regulators, thereby ensuring that earthmoving equipment of all types and capacities meets the evolving environmental emission standards. Control systems have become increasingly sophisticated, squeezing the last pennies of productivity out of a machine's performance; yet Germany's equipment companies continue to come up with new solutions that give the surface mining community even more for their money.

## ***A Long-time Heavyweight in Hydraulic Excavator Design***

With its headquarters in Düsseldorf, **Komatsu Mining Germany GmbH (KMG)** is part of the international mining and construction equipment supplier, Komatsu Ltd. of Japan. Within the group, KMG is responsible for the development, production and marketing of super-large hydraulic excavators for open-pit mining world-wide. The company says the KMG brand is recognized around the world as a synonym for high quality that is achieved through continuous product development and innovation, combined with long-term reliability.

The company's history goes back to the early 20<sup>th</sup> century. In 1907, Carlshütte AG built its first electric-driven rope shovels for the Lizenz open-pit, which was controlled by Demag (Deutsche

Maschinenbau AG). In 1925, Demag took over Carlshütte and relocated the company to Duisburg. The Düsseldorf plant, where production is centered today, was built in 1939.

Over the years, KMG notes, Demag again and again set milestones in the mining sector worldwide. In 1949, the BL 335 rope shovel was the biggest such unit in the world, and in 1954 Demag caused a sensation at the Hannover industrial fair when it introduced the first fully hydraulic, diesel-driven excavator in the world. The company followed that in 1972 when it developed the first hydraulic excavator with a total machine weight of more than 100 metric tons (mt).

In 1978, Demag was integrated into the global Mannesmann group, and was renamed Mannesmann Baumaschinen GmbH. However, it maintained its pioneering role in world mining, with the introduction and commissioning of what was then the world's largest hydraulic excavator, with a machine weight of more than 500 mt. Another important milestone came in 1999 with the company's acquisition by Komatsu Ltd., and its renaming as KMG.

Today, the company claims around a 30% share of the substantial world market for mining excavators, and is continuing to expand and strengthen its position as a manufacturer of extra-large excavators for open-pit mining. Its Düsseldorf plant produces four different types of excavator, with weights of 250 to 760 mt for its flagship machine, the PC 8000. Depending on the model, bucket sizes vary from 16 to 42 m<sup>3</sup>. In addition to standard configurations, KMG offers machines that are tailor-made to customer requirements, with users able to choose between diesel or electric drives as well as between backhoe and front shovel equipment.

KMG says its machines are now at work all over the world, operating day and night under very tough conditions. One example of this is the environment in the Department of Cesar in Colombia, with humidity close to 75%, daytime temperatures ranging up to 50°C and high dust concentrations. Moreover, another big advantage Komatsu claims is working in high-alti-



The team of mechanics responsible for looking after two Komatsu PC 4000s and a fleet of 730E haulers at Vale's Bayóvar phosphate mine in Peru. Weighing in at 390 mt (430 ton), these PC 4000s carry a 29 m<sup>3</sup> bucket because of the low density of the rock.





tude operations, which are tough on excavators. At Barrick Gold's Pascua Lama project on the border between Chile and Argentina, three PC 8000s will work at an altitude of 5,200-5,800 m, in one of the highest surface-mining operations in the world.

KMG reports the PC 8000 is the best-selling excavator in this class, with more than 90 units supplied worldwide. In addition, it claims market leadership in supplying electric-driven excavators, and to be the only OEM able to supply this power source in the plus-700 mt heavyweight excavator class. It also says its design philosophies are guided by safety regulations together with the requirements of the EMERST (Earth Moving Safety Round Table) group, and that in October 2011 it became the first hydraulic mining shovel OEM to offer a specific OMAT training course.

### **An Update from Tenova Takraf**

**Tenova Takraf GmbH** supplies systems for the complete process chain in open-pit mines, from overburden removal and raw materials extraction, to processing, homogenizing, storage and further transport or shipment. Headquartered in Leipzig, the company has branches in Australia, Brazil, Bulgaria, Canada, Chile, China, India, Italy, South Africa, Thailand and the United States, as well as representative offices in Kazakhstan, Romania, Russia and Uzbekistan. It has intensified its business in South America, the CIS countries, China and India, and rolled out in the Southeast Asian region by establishing a subsidiary in Bangkok during 2011.

The company reports it has recently completed some interesting projects, and has acquired new jobs that will be undertaken in the near future. In mid-2011, for instance, it commissioned an SRs (H) 1050 compact bucket wheel excavator in the Brod Gneotino brown-coal mine in Macedonia. Geological conditions at the mine, such as dipping seams and interburden within the coal, meant the machine had to be specially adapted to work on a slope of up to 11° while selectively mining the coal and waste.

Another project in 2011 involved Tenova Takraf commissioning a SRs 2000 bucket wheel excavator at Drmno in Serbia. The machine had actually been designed, and the parts shipped to site, 15 years ago. The company was able to resurrect the project, then erected and commissioned the excavator, while equipping it with state-of-the-art technology to ensure high-capacity operation, low noise levels and reduced energy consumption.

Meanwhile, the company is currently building a SRs (K) 2000 excavator for the Zhanahoer mine in Inner Mongolia in China. With a capacity of 6,600 m<sup>3</sup>/h, the machine is designed to operate in a climate where temperatures range from 40° to -40°C, and has a 12.2 m-diameter wheel with a 1.25 MW drive. The excavator is scheduled for commissioning in 2013, while in November 2011, Tenova Takraf received an order for a 7,900 m<sup>3</sup>/h-capacity spreader system for Zhanahoer.

The company also reports success in hard-rock mining applications as well as in coal, and is currently working on a waste-rock spreader system for Goldcorp's Peñasquito mine in Mexico. Being undertaken by Takraf USA, Inc., the system consists of a 13,000 t/h crawler-mounted tripper car and spreader that is fed by conveyors.

In Chile, meanwhile, Minera Escondida recently awarded Tenova Takraf a contract to modify its in-pit crushing and conveying system, and in Mauritania the company is designing two stacking bridge systems for the state iron ore producer, SNIM, using technology it had developed previously for use on heap leach projects.

### **Cat's German Excavators – A New Era is Under Way**

Long-established as one of the world leaders for hydraulic mining shovels, the former O&K factory in Dortmund is now a design and production facility for Cat mining shovels. Today, this encompasses six models, from the 113-mt 6015 to the 565-mt 6060. All six machines can be supplied in either front shovel or backhoe configuration.

Only six weeks after Caterpillar finalized its acquisition of Bucyrus, a 6030 shovel, painted in full Caterpillar yellow, shipped from the Dortmund factory, destined for Yara International's phosphate mine near Siilinjärvi in Finland. Commissioned there in early October, the 290 mt (319 ton) shovel was the first Cat-branded product from the former Bucyrus line to start operation at a mine. The machine, known as an RH120E under the O&K/Terex/Bucyrus banners, also made history as being the first shovel from the Dortmund plant to be sold to a customer in Finland.

Although the original purchase agreement for the shovel, signed in January 2011, stipulated the machine would be delivered in Bucyrus trade dress, the mining contractor at Siilinjärvi, E Hartikainen Oy, was subsequently given the option to change to Cat colors. Hartikainen did just that—citing a long and favorable working relationship with the Cat dealer as a primary factor in the decision, Caterpillar reports.

Configured as a backhoe, the new Cat 6030 was delivered together with three 785D mining trucks, a 993K wheel loader and a 16M motor grader. Powered by two Cat C27 diesel engines, which produce a total of 1,140 kW (1,530 hp), the 6030 has a 30 mt (34 ton) payload and is matched with the mine's fleet of Cat 777 and new 785D trucks.

Yara International's mine in Finland is currently the only producer of phosphate ore in Western Europe. In addition to the mine, the Siilinjärvi site also hosts plants used for the production of fertilizers, phosphoric acid and other industrial chemicals.



Double first: the first Dortmund-built Cat 6030 excavator to be delivered in Caterpillar yellow, and the first working at Yara International's phosphate mine in Finland.



## **Wirtgen: Made-to-measure Solutions**

Since mining and processing minerals imposes high demands on man and machine, powerful and durable equipment is essential. According to **Wirtgen**, many years of experience in the field of mineral technologies have given the company innovative and practicable technologies designed for use in the most extreme conditions. From mining to processing the material, these robust machines offer high reliability and efficiency, Wirtgen says,

The Wirtgen group comprises four well-known brands: Wirtgen, Vögele, Hamm and Kleemann. With surface miners from Wirtgen and crushing and screening plants from Kleemann, the group's mineral technologies division supplies a carefully matched range of products for mining and processing mineral commodities.

Now well-established, Wirtgen's surface-miner technology provides an alternative to conventional drilling, blasting or primary crushing. Surface miners use a special cutting drum to mill and break up the rock being cut, with the cut material then being loaded by conveyor into dump trucks or deposited alongside or behind the miner. Wirtgen's 2200 SM, 2500 SM and 4200 SM surface miners have cutting widths ranging from 2.20 m to 4.20 m and cutting depths from 200 to 830 mm in rock up to a UCS of 120 MPa. Special-purpose machines can even cut hard granite up to 260 Mpa, and the company claims to be the only manufacturer to cover a performance range from 100 to 3,000 mt/h.

Surface miners are used to win minerals such as coal, limestone, gypsum, bauxite, phosphate or iron ore, all of which can be selectively mined to produce a high-purity product. Wirtgen also points out that the range of uses is expanding all the time, with its machines now being used for special applications such as mining salt, granite, kimberlite or oil shale. More than two dozen cutting drum versions are available as standard, the company says, with additional versions available for specific applications.



Covering both ends of the mining chain, Wirtgen surface miners and Kleemann crushing and screening plants.

Extending the range of materials that can be handled, Kleemann offers a wide selection of jaw, impact and gyratory crushers, as well as screening plants. Having been involved in rock processing for more than 150 years, Kleemann has developed products that can handle the most difficult minerals and materials within the mining industry. The company can provide guidance to its customers on which machines are best suited to cope with their specific requirements.

Kleemann's mobile jaw crusher units offer capacities from 100 to 1,500 mt/h, with quarrying operations often relying on these machines for primary crushing at feed rates of 450 to 1,000 mt/h. Secondary crushing units, such as tracked mobile impact and gyratory crushers, are electrically interlocked to operate in combination with primary crushers and screens, while its 100- to 1,000-mt/h stationary plants handle the other processes required in addition to crushing and screening.

Wirtgen states the combination of its surface miners with Kleemann's crushing and screening plants means the group can supply modern, extremely robust special-purpose machines for mining and mineral treatment. Its wide range of products and decades of practical experience in applications technology means customers worldwide receive made-to-measure solutions from a single source, the company adds, with its products available through more than 55 group-owned sales and service companies, as well as over 100 selected local dealers.

## **Specialized Applications for Big Breakers**

Based in Essen, **Atlas Copco's** heavy-duty hydraulic breaker division now has a 14-model range, covering the 2,000 kg HB 2000 to the 10 t-operating weight HB 10000. Recent upgrades to the product range have given an improved power-to-weight ratio, the company says, so that the same performance can be achieved with a smaller attachment and carrier unit—leading to reduced investment and maintenance costs.

Two applications that spring to mind for big hydraulic hammers are the secondary breaking of oversized rocks and clearing blockages on scalping grizzlies and in crusher throats. However, the quarrying industry is also a major user of this type of technology, as Atlas Copco reports in a recent example from the U.S.

Based in Stafford, Virginia, Chesapeake Materials specializes in producing stone for marine applications, specifically the rip-rap and armor stone commonly used to stabilize and protect shorelines, dikes and breakwaters from the force of waves.



Chesapeake Materials' crew, specialists in producing rip-rap and armor stone, using Atlas Copco hydraulic breakers.



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Although the company has no quarries of its own, it operates from New Jersey to Florida through partnerships with quarrying companies, adding value from the quarry to the end-user.

Chesapeake produces high-quality products for its customers, Atlas Copco says, and its way of working means that quarries do not have to tie up capital by buying additional equipment that Chesapeake already owns, uses and maintains on a daily basis. It often assists quarry companies by cleaning up their operations, turning what would be waste rock or large obstacles to a quarry's other operations into profitable products. In addition, some quarries do not have the techniques to produce rip-rap and armor stone that meets the durability needs of this specialized application.

Atlas Copco explains that while armor stone is generally made to order by weight, this is not the only specification. In one example, a rock density of nearly 2.65 t/m<sup>3</sup> (165 lb/ft<sup>3</sup>) was required with individual boulders containing few fracture planes. For more than 10 years, Chesapeake has used Atlas Copco hammers as its principal production tools, with a fleet of three HB 4200s and a number of HB 3000s which, it reports, offer greater flexibility in terms of maneuverability and ease of transport between work sites. Until recently, they were also more compatible with the size of carrier that Chesapeake uses, mainly Link-Belt and Volvo machines.

Throughout the industry, Atlas Copco says, increasing demand for smaller, more mobile carriers has emphasized the gap between the 3000 and 4200-sized breakers; hence its decision to introduce the HB 3600 machine. Having bought one, Chesapeake subsequently reported that it produced higher impact performance and was able to run on any excavator in the company's fleet. According to its operators, the HB 3600 hits harder and gets more work done than an HB 3000, and can do as much work as an HB 4200 because of its higher impact frequency.

### **Supplying the Big Tools for Mining**

From small beginnings in 1949, the decentralized Liebherr Group of companies has grown to offer hundreds of products and services worldwide. With more than 32,000 employees in over 100

countries, the group states it is recognized by customers throughout the world for its top quality, user-orientated products and services in a wide range of technological fields.

The range of loading equipment manufactured by Liebherr at Colmar, France, currently covers seven different sizes of mining excavators, with electric and diesel drives of up to 3,000 kW and operating weights more than 800 mt. This broad range of types provides the right equipment for every application, the company suggests, while offering a selection of mining buckets specially matching the properties of the material. Liebherr's most recent additions in this product category, the R 9100, R 9400 and the R 9800, have extended the lower, middle and upper ends of the range.

The smallest mining excavator, the R 9100, which was first introduced in 2010, weighs between 110 and 114 t. It is powered by a new Liebherr V12 diesel engine that develops 565 kW (757 hp), complies with USA/EPA Tier 2 emission limits, and makes highly efficient, economical use of fuel, the company claims. The Liebherr bucket of the R 9100, with a nominal volume of 6.8 m<sup>3</sup>, has an optimized pattern for mining work, designed for improved penetration and a high fill factor. The R 9100 incorporates proven systems and components that Liebherr itself has developed; together with the revised single-line lubrication circuit and the fuel and oil filter systems, they are part of the key to the machine's reliability and performance potential, Liebherr says. Cost-effectiveness is enhanced by the reduced volume of maintenance work. A wide catwalk makes it easy to reach the individual assemblies for rapid and reliable servicing, while all maintenance points are accessible at a practical height from one side of the machine.

The upper end of the Liebherr range is marked by the R 9800, introduced in 2008. With up to 810 t operating weight and powered by two 1,492 kW (2,000 hp) diesel engines in Tier 2 configuration, the R 9800 is the largest backhoe excavator in the world. The machine is fitted with a nominal 42 m<sup>3</sup>-capacity bucket as a backhoe and 42.7 m<sup>3</sup> as a face shovel, with breakout and digging forces being optimized for the best possible penetration.

Other mining excavators from Liebherr include the R 984 C (120-125 mt; 504 kW/685 hp); R 9250 (250-253 mt; 960 kW/1,287 hp); R 9350 (302-310 mt; 1,102 kW/1,500 hp); R 9400 (345-353 mt; 1,250 kW/1,675 hp), R 995 (441-450 mt; 1,600 kW/2,140 hp); and R 996 B (672-676 mt; 2,240 kW/3,000 hp). The R 9400 will be officially launched at the 2012 MINExpo in Las Vegas, the company says, although it already has eight machines working on site, while the R 9250 and R 9350 can be supplied with Tier 2-compliant engines for the U.S. market.

Key safety features on new Liebherr excavators include a redesigned operator's cab, which is positioned further forward than in the past, to give better visibility.

Meanwhile, the company's other contribution to surface mining technology is its T 282 C mining truck, produced in its plant in Newport News in the U.S. Liebherr reports its trucks are now in operation in coal, copper, iron-ore, oil-sand and gold mines in the U.S., Canada, South America, South Africa, Australia and Indonesia.

The T 282 C can carry a payload of up to 363 mt (400 ton) at speeds of up to 64 km/h (40 mph). Available with a 2,800 kW MTU engine or a 2,610 kW Cummins, the truck is engineered to be strong, durable and light-weight, Liebherr says, while claiming that it also offers the highest payload-to-empty vehicle weight ratio in its class.



Liebherr's flagship truck, the 363-mt capacity T 282 C.



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# MATERIALS-HANDLING TECHNOLOGY: KEEPING MINERALS MOVING AROUND THE WORLD

Moving minerals from mine to plant; moving overburden; crushing, stacking and reclaiming; German companies are at the forefront of materials-handling technology. And, of course, that is not really surprising, given the country's background in the large-scale opencast lignite mining that has kept its power stations fueled for decades.

German materials-handling systems think big, and can move millions of cubic meters of material safely and economically while minimizing their impact on the environment. Reliability is a key feature, with no room for complacency when it comes to keeping the belts running, the screens clean and the rock flowing.

One of the world's leading suppliers of plants and systems for mining, processing and handling raw materials and minerals, **ThyssenKrupp Fördertechnik's** equipment is used in open-pit mines, stockyards, port terminals, power plants and quarries throughout the world. Innovative concepts, decades of expertise and a global presence enable it to provide expert advice, planning, engineering, design, construction, delivery, installation, commissioning and after-sales service, the company says.

With its mining business unit, ThyssenKrupp Fördertechnik has acquired a global reputation for high-quality open-pit mining systems and equipment. It has also played a major role in the development of cost-efficient in-pit crushing systems, and is today one of the most experienced manufacturers of mobile and semi-mobile crushing systems.

German expertise in the field of materials handling covers far more than the physical hardware, however. For example, **Mato Maschinen und Metallwarenfabrik Curt Matthaer GmbH & Co. KG** is one of the main manufacturers worldwide of mechanical jointing systems for belt conveyors. Its product range includes high-performance lacing systems for use in coal- and ore-mining, and in quarrying and the cement and steel industries. Other Mato products include belt cleaners, with scraper blades made from materials that can be used in underground coal mining, or where the materials being conveyed are particularly aggressive, the company says.

**Rema Tip Top Industrie's** product range focuses on wear- and corrosion-protection and noise reduction, right through the mining and mineral-processing cycle. Examples include lining and repair systems for extending the service life of excavator buckets, truck bodies and tires, and anti-caking coatings to reduce material build-up and wear in excavator buckets.

For conveyors, the company's product range includes pulley covers, belt covers, splicing systems, belt cleaners and skirting systems, and wear-resistant rubber and ceramic liners for chutes and slide areas. It also offers anti-abrasion linings for crushers and screens, and rubber linings for ball mills, together with corrosion-protection liners for tanks and pipework in processing plants.

## ***Aumund: Always Onward and Upward...***

With its headquarters in Rheinberg, the **Aumund** group has established a strong reputation for state-of-the-art materials-handling systems in continuous process industries such as mining, cement, steel, power and general industrial process plants. The group provides an umbrella for its manufacturing companies, Aumund Fördertechnik GmbH, Schade Lagertechnik GmbH and B&W Mechanical Handling Ltd. The

group also has eight subsidiary companies in Asia, Europe, and North and South America, plus an extensive network of agents that cover four continents. The company says its project list includes a variety of applications for its extensive range of vertical elevators which, in the largest installations, can handle up to 1,830 m<sup>3</sup>/h of materials at temperatures of up to 130°C through a vertical lift of some 175 m.

While the cement industry represents the largest market for high-performance elevators, it is by no means the only market, with Aumund being active in other sectors such as mining and fertilizer production. As an example, an important new order from MBAC Fertilizer Corp. for its Arraias project in Brazil includes four units of Aumund's BWZ-S gravity-discharge elevators, along with TKF drag chains with a maximum handling rate of 420 t/h.

Staying in Brazil, the iron ore market is hugely important, and Aumund is directly involved through recent contracts from Samarco Mineração SA (jointly owned by BHP Billiton and Vale). Aumund is supplying four of its 'Block'-type rotary-discharge machines to Samarco's Ouro Preto operation, with each unit able to recover iron ore from storage at a rate of 1,800 mt/h. By using several identical units, ore can be recovered simultaneously from different sections of the stockyard, allowing effective blending. Automated control using individual variable-frequency drives allows the level of blending to be adjusted to suit the process demands, Aumund points out.

Staying with iron ore but moving continents, in Mauritania SNIM (Société Nationale Industrielle et Minière)—the world's seventh-largest iron ore exporter—is currently upgrading its preparation plant and the handling systems at the port of Nouadhibou to achieve an export capacity of 14 million mt/y loaded on to Capesize vessels. Aumund is supplying a pair of heavy apron feeders to extract material from a buffer hopper, located between the stockyard and the shiploader, at rate of 2x6,000 mt/h.

In Liberia, B&W is currently commissioning a new mobile shiploader for ArcelorMittal, designed to handle 2,000 mt/h of iron ore from a simple stockpile close to the loading berth. Aumund said that by using an independent mobile unit with an integral feeder, powered travel and gen-set, almost any berth can be converted into a bulk export facility without additional permanent port infrastructure.



A BPB-type apron feeder from Aumund, designed to handle moist or sticky materials.





Moving on to colder climates, Aumund is delivering a combination of a Samson surface feeder and a BWZ-type central chain vertical bucket elevator to Eurocement in Russia for its Maltsovsky portland cement plant at Briansk, handling imported clinker. Combining a Samson surface feeder with a vertical elevator offers a compact plant footprint with the minimum of excavation and associated civil works, Aumund said.

### **Belt-maintenance Specialization**

**Nilos GmbH & Co. KG** has been active in the field of conveyor belt equipment since 1926. The company belongs to the Ziller holding group, with its headquarters in Hilden, near Düsseldorf. A global player, it has a network of branch offices and subsidiaries in Brazil, Chile, India, United Arab Emirates, Greece, Czech Republic, Iran, China and for the Asian market in Singapore.

With the help of modern technologies, its conveyor belt equipment division has made Nilos a well-recognized brand name worldwide and, for parts of its product range, a world market leader, according to the company. Its portfolio encompasses rubber products, vulcanizing presses and belt units, as well as accessories for working with conveyor belts.

The first Nilos product was a detachable mechanical belt connector, invented by Dr. Hans Joachim Ziller. Today, the company offers a much wider range of products. Its rubber range includes hot and cold repair materials, splicing kits, lagging, lining, scraper rubber, impact aprons, cleats and sidewalls. For splicing belts, it has a range of engineered products, including equipment such as vulcanizing presses, repair vulcanizers, belt end clamps, cable winches, tools, belt-repair workshops and special machines.

Its range of belt conveyors and accessories includes belt conveyors, conveyor belts, belt rip-detection system, conveyor accessories, scraper systems and mechanical connectors. The company also offers installation and service facilities, both at its factory and on site, together with technical service and training for its customers' personnel. In addition, it undertakes the planning, construction and commissioning of entire conveyor belt repair workshops for its customers.

Nilos also specializes in producing wear-protection products made of rubber or plastics for scrapers, pulley laggings and screen decks for use in high-stress areas.

The company recently published a revised version of the well-known technical handbook, "*Fördergurte in der Praxis—Know-how and Know-why*," which was first compiled and edited by Herbert Westpahl. Nilos says an English-language version of the book (*Conveyor Belts in Practice*), which builds on the company's practical experience in conveyor-belt technology, is scheduled for publication in March 2012 and can be obtained from Nilos.

### **Vibration Expertise for the World Market**

Headquartered in Dülmen, **Jöst GmbH & Co. KG** specializes in applying vibration technology to handling and processing a wide variety of bulk materials for primary industries and also for other end-users such as the foundry, steel, environmental, recycling, chemicals and food industries. With more than 90 years' experience, the company manufactures sophisticated machines and systems mainly based on vibration technology, together with solutions for thermal processes.

Looking specifically at Jöst's vibration technology for the handling of bulk materials in primary industries, it has a wide product range that includes the Extrovib system, grizzly screens and feeders, scalping screens, banana screens, classifying screens, dewatering screens, vibrating feeders and drying systems. Its special screens include its Grecco screens, Trampolin flip-flow screens, fine screens



Heavy-duty vibrating screens is one area of Jöst's specialization.

and non-blinding screens among others, while it also has expertise in the design and supply of electric control and regulation for machines and complete systems.

The company says that screening technology is the centerpiece of its product range for the primary industries, handling materials as diverse as coal and diamonds as well as industrial minerals such as limestone, hard rock and mineral sands. Aside from its main plant in Germany, Jöst manufactures its machines and systems in Australia, China, France, India, South Africa and the U.S., with the Australian, Chinese and South African activities being mainly focused on the production of heavy-duty vibration screens and vibrating feeders.

During 2011, Jöst won a major order for seven large feeders and screens for Rio Tinto's iron ore operations in the Pilbara region of Western Australia. The screens will be used at the Cape Lambert Port B facility to sort lump ore and fines ahead of ship-loading. The new port facility will add 50 million mt/y of iron-ore capacity in phase 1, with a second phase proposed to duplicate capacity to 100 million mt/y.

Each double-deck screen, fully assembled and tested at Jöst Australia's Welshpool facility, has a vibrating mass of 37.9 mt mounted on an isolation frame weighing 19.2 mt. Measuring 4.27 m wide, the screens will be fed using diverging feeders to spread the ore over the full width of the screen, thereby using the maximum available surface area. The screen design was developed 'in-house,' Jöst says, using finite element models that were checked against factory test results using strain-gauge recordings for verification. Fully modal analysis was also undertaken to ensure a full understanding of the frequency responses of the screens.

In another application, Jöst recently delivered a high-capacity screening system for a new port complex that serves as a central distribution point for coal supplies to a certain country's power plants and steel mills. The installation comprised two high-capacity screens together with discharge and distribution feeders.

Two linear oscillators, constructed as vibratory banana-type screens, are used for the screening function. The screens have a screening area of 4.0x8.3 m (33.2 m<sup>2</sup>) each. The special slotted grid system used gives high throughput rates and can be quickly replaced because of its segment-shaped design. The company explains that different conveying rates on the screen are achieved because of the various screen-deck angles, so the product layer remains thin and bridging resulting from material pressure is avoided.

### **Specialized Screens and Pelletizing Systems**

Mineral processing specialist the Haver Screening Group consists of **Haver & Boecker Machinery Division** in Münster, Haver & Boecker



A Haver & Boecker-designed, exciter-equipped linear screen.

Latinoamericana in Brazil and WS Tyler in Canada. The company focuses its expertise on screening, washing and pelletizing processes, with a product portfolio that includes vibrating screens, washing equipment, pelletizing discs, screening media and the provision of parts and service.

Haver & Boecker says that some of the largest mining companies in the world trust it to deliver high-capacity vibrating screens. One particular customer, it explains, required two high-capacity vibrating screens that measure 4 m wide by 11 m long. These were designed to work in temperatures of -47°C in winter, when the largest pieces of product to be screened are rock-hard from the cold, while at the same time performing in summer conditions when the product becomes a sticky paste. Each screen weighs 115 mt. In tandem as one unit, these screens process 15,000 mt/h of material.

The company also notes that it enjoys international recognition in providing pelletizing discs, with more than 20 years of experience in Brazil alone. To date, it has supplied more than 50 high-capacity discs to customers such as Vale, Samarco, Gerdau, Nomos, AcelorMittal, Andritz, Anglo American, Posco and Harzmetall, across South America, Southern Africa, Asia and Europe.

In late 2009, Haver and **Eirich** delivered an agglomeration plant with a capacity of 200 mt/h to South Korea. Haver supplied two GR 7500 pelletizing discs with a diameter of 7,500 mm. By using the resulting agglomerates (so-called micro pellets) made of steelworks residues, coal, additives and pellet-feed fines, the productivity of the plant has increased significantly, the company adds, pointing out that the recycling of the residues is a huge step toward a zero-waste technology, and leads to an excellent life-cycle assessment.

### **Bending Belts for Environmental Protection**

Based in Beckum, **Beumer Maschinenfabrik GmbH & Co. KG** offers its materials-handling capabilities right across the mining and minerals sector. The company states it is an international leader in the manufacture of intralogistics for conveying, loading, palletizing, packaging, sorting and distribution technology. Together with Crisplant a/s and Enexo Technologies India Ltd, the Beumer group employs about 3,000 people and has an annual turnover of about €450 million.

Having been in business for 75 years, Beumer began developing curved belt conveying systems some 50 years ago, claiming to have originated the theoretical dimensioning fundamentals for these types of installation. Since then, the company says, it has continued to

develop the technology, both for open troughed belts and for closed, tubular belt conveyors.

The company has been involved with various aspects of conveyor design since its formation with its founder, Bernard Beumer, having invented and patented a conveyor idler that featured a labyrinth seal. From that starting point, successive generations of the Beumer family have built the company to be a significant player in the international market.

Under a recent contract, the company is supplying a troughed belt conveyor, capable of negotiating horizontal curves, to Nordkalk, one of Europe's major manufacturers of lime products. A key feature of Nordkalk's requirements was for the limestone-transport system to be environmentally friendly, Beumer explains, with the 8.7-km long conveyor being installed in the north of the island of Gotland in the Baltic Sea. This, the company adds, is the largest limestone-production operation in Scandinavia, supplying limestone to customers around the Baltic Sea, with part of the quarry's output being processed into quicklime by Nordkalk's subsidiary, KPAB.

Every hour, 1,500 mt of limestone will be transported from a new quarry at Bunge to the plant in Storungs, where it will be graded and stockpiled. "The Beumer troughed belt conveyor was a clear favorite of ours compared to other transport options," said Mikael Lindberg, plant manager for Nordkalk. "It uses little energy, is quiet and environmentally friendly."

Beumer notes it was crucial for Nordkalk to preserve the island's countryside during transport. This goal was achieved, it says, because the troughed belt conveyor can navigate particularly tight horizontal curves. This allows for flexible, continuous routing, and the opportunity to bypass sensitive areas or to negotiate obstacles such as rivers, streets, railways and so on, while preserving the existing terrain.



Beumer specializes in designing and building curved belt conveyors.



# Separation Technologies



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# COAL AND MINERAL PROCESSING: GETTING OUT THE MOST, SAFELY AND ECONOMICALLY

Covering construction materials, industrial minerals, fuels and ores, German companies provide the technology to upgrade, concentrate and recover valuable commodities, not only from newly mined raw materials but through recycling as well. Today, mineral-processing technology supplied from Germany can be found world-wide, with German innovation at the forefront of new concepts and developments.

Not surprisingly, the growth of Germany's coal industry in the 18<sup>th</sup> and 19<sup>th</sup> centuries provided an early stimulus for the development of processing systems on a much larger scale than had been seen before. However, it is also important to remember that central Europe has an even longer history of ore mining, with mineral-separation and metal-smelting processes forming an essential part of this. And, resourced from massive resources of bedded deposits like rock salt and potash, as well as coal, Germany's chemicals companies were among the world leaders in the development of the reagents that today are essential in the mineral recovery process.

In this chapter of *Best of Germany 2012*, we look at a cross-section of the German companies that are currently offering mineral treatment and processing expertise worldwide. The depth of this expertise is substantial, as each of the sections below clearly shows. Using state-of-the-art technology to help cut energy costs is one major focus from all of the companies involved here, as is enhanced safety in all aspects of mineral-processing operations.

## **Tower Mills Take Center Stage**

Mixing, granulating, fine grinding and drying: all these technologies fall within the expertise of the **Maschinenfabrik Gustav Eirich** group. Specific areas where the company's equipment can be found include the production of blast-furnace or direct-reduction iron ore pellets, sinter feed, agglomeration using binders, and the recycling of plant residues, either wet or dry.

Among the company's fine-grinding products, its tower mill concept has applications in a wide range of materials, including copper and zinc ores and concentrates, iron ore, slags and petcoke. Eirich exhibited its tower mill at the Metec exhibition in Düsseldorf in June 2011, describing it as "an efficient and highly reliable machine for wet grinding at today's state-of-the-art ore-processing plants." Based on 40 years of experience in industrial grinding systems, the company has designed the mill to handle a wide range of materials and grinding operations, with capacities extending from 500 kg/h to more than 400 metric tons per hour (mt/h). Input power starts at 3.5 kW, with the largest machines rated at 1.1 MW.

In the tower mill, a vertically mounted agitator in the grinding container sets several thousand steel balls in motion, which efficiently break down the material due to the different relative speeds and friction contact. The spiral-shaped agitator and an external recirculation pump create uplift in the grinding container, minimizing residence time and avoiding over-grinding. Eirich says that as a result, this mill consumes 25%-45% less energy compared to conventional horizontal ball mills, while ball wear is reduced by roughly 35%. The machine also takes up less space, the company adds, while foundation costs are lower. When used downstream

from a horizontal ball mill, the vertical mill optimizes the fine grinding process.

Eirich also introduced its new R28 intensive mixer at Metec 2011. This offers usable volumes of up to 5,500 liters, and delivers a throughput rate of up to 650 mt/h in applications such as iron ore preparation in pelletizing systems. The design is based on the 1,400 mt/h DW40 mixer, which Eirich introduced in 2007, since when it has delivered 16 units to the iron ore industry. The company also announced the planned introduction of the 8,000-liter R33 mixer in 2012, as a replacement for its existing DW31 series machines.

The company says that as well as single machines for mixing and fine grinding, it also offers complete one-stop solutions—ranging from process engineering and machine/plant construction through process control engineering right up to aftersales service with reliable supplies of replacement parts—based at six production sites worldwide.

## **CMP: Custom-designed Processing Plants**

Operating out of brand-new headquarters near the eastern German city of Dessau, **Cement and Mineral Processing AG (CMP)** is an engineering company that focuses on providing processing expertise to the cement and mineral industries. To date, its order-book for new cement plants has come from places such as Pakistan, Iran, the United Arab Emirates and countries in north Africa, while in Europe it has carried out upgrading projects on plants in Switzerland, Germany and Belgium. And, as project manager Hans-Joachim Kühne explains, while the company has its own designs for major plant items, it often delivers these to its clients for local manufacture while supplying components such as critical parts and instrumentation. "We aim to include European equipment from well-respected companies in our packages," the head of the company's process department, Thorsten Haase, added, "which makes our designs highly competitive in world markets."

Cement is only one of the commodities that CMP handles, however; its current project list includes alumina and iron ore plants for customers in Iran. Using wet-process technology, the iron ore concentrator flowsheet includes grinding, gravity separation, low- and high-intensity magnetic separation, flotation and filtration to handle hematite and magnetite ores as well as to reprocess old tailings for additional iron recovery.

At the alumina project—which uses nepheline syenite as its raw material—CMP's input covers the complete plant from crushing to sinter grinding. According to Dr. Haase, this is the first time this process has been carried out in a preheater-short kiln system, instead of a long wet kiln. This, he said, is the same logical step as happened in the cement industry, and will save energy.

CMP is not just a design and engineering firm, though. In 2009, its engineers developed a new type of grinding mill—the Beta-Mill—which it claims can cut energy demand for grinding by up to 5%. The first full-scale machine, installed in a cement plant in Dubai, went on stream during 2011.

The Beta-Mill works on the pressure-grinding principle, in which both the force applied and the rotational speed of the rollers can be





varied. The concept works best on hard, brittle materials such as cement clinker, blast-furnace slag and some ores. Materials with a moisture content of up to 8% can be ground, with various models available than can handle throughputs of between 90 and 360 mt/h.

### **Hazemag: Doing Well in China and Asia-Pacific**

With its headquarters and main factory in Dülmen, **Hazemag & EPR GmbH** specializes in sizing equipment for the minerals industry, with its machines designed to handle materials such as cement-plant feedstocks, coal, oil shale, salt and, according to the company's mining-division manager, Sven Heuer, increasingly into harder minerals such as manganese and copper ores.

Nonetheless, he told *Best of Germany*, coal and overburden remain the company's 'bread-and-butter' in the mining area at the moment, with Hazemag having been very successful in supplying sizers into China's coal industry over the past two years. "Our focus remains on Asia-Pacific, especially where there is a need for higher-capacity in-pit crushing and conveying of both coal and overburden in the region's huge surface mines."

And, while the company has developed sizers that can handle up to 10,000 mt/h of soft overburden, its most recent achievement has been the supply of two 3,000 mt/h SB 1525 R impact roll crushers to the Chinese coal company, Datang International. The machines, Heuer explained, can handle material that is too hard for a traditional feeder-breaker. Another unit has been equipped with an integral roller screen to reduce fines production—the first time that this technology has been applied to coal.

These roller screens were originally developed for use on aggregates, he added, with the company now transferring the technology to coal applications. In fact, Hazemag can now supply coal crushing equipment that can reduce power-station fuel to minus-2 mm.

Other areas of the world where the company has been successful include India, where it has sold 24 feeder-breakers over the past four years. In Germany, it has supplied feeder-breakers, sizers and crushers to the potash producer Kali & Salz and, as Heuer noted, Hazemag is looking to build on previous equipment sales into the potash industry in both Russia and Belarus, as well as developing new business in the emerging tier of potash companies around the world. Elsewhere, it is looking at opportunities in countries such as Vietnam, Mongolia, Mozambique, the U.S. and Australia, he added.

For this edition of *Best of Germany*, Hazemag has focused on its HCS center sizer and HSS side sizer. These, the company says, are designed for use as primary, secondary or tertiary crushers for

soft to medium-hard raw materials, together with cohesive materials with a high moisture content.

In this type of machine, the comminution of the feed material is generally achieved by compression and shearing induced by two fixed crushing rolls at low speed with high torque. For the center sizer, the crushing takes place between two inward-rotating crushing rolls, while in the side sizer, crushing takes place between the two outward-rotating crushing rolls and the wall of the crushing chamber. The company currently has a four-model HCS range, with power requirements of up to 2x200 kW, while offering two HSS models, which have 2x45 kW or 2x75 kW installed power.

However, Hazemag is not just about crushing and sizing: it also specializes in underground mining equipment such as dinting, drilling and loading machines, which account for more than a quarter of the company's total sales. The main markets recently have been in China and the CIS countries where, Heuer explained, the company has been successful in selling against local competition. And not all of its customers are easy to supply, as in the case of several dinters that recently went to Vorkutaugol in northernmost Russia, or some loading units for use in the coal sector in Argentina.

### **Building Big Jigs**

Headquartered in Cologne, **MBE Coal & Minerals Technology GmbH** (MBE-CMT), is one of the world's leading suppliers of plants and equipment for mineral and coal preparation. The former Humboldt Wedag Coal & Minerals Technology GmbH was acquired by the Indian company, McNally Bharat Engineering Ltd., in October 2009.

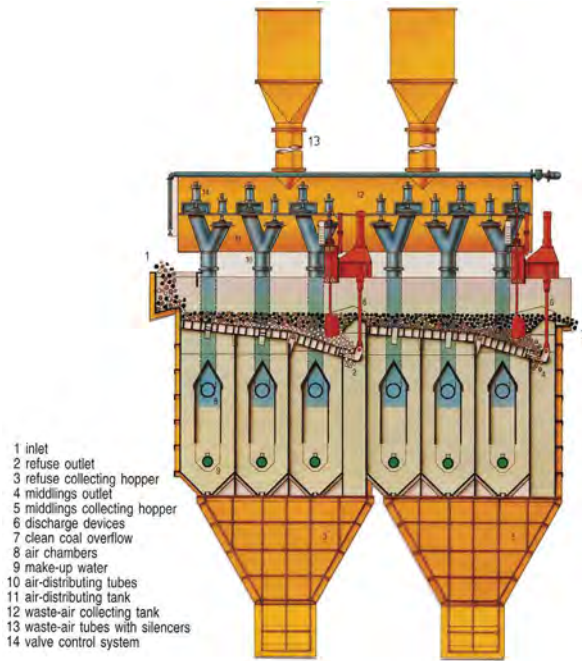
MBE-CMT's history goes back more than 150 years, with the company offering basic and detail engineering, components for complete plants and plant sections including modernization and capacity increase measures, as well as process control equipment. The scope of services also includes feasibility studies, raw-material testing, financing concepts, erection and commissioning, personnel training, and pre- and after-sales service.

The company notes that its main markets for coal and minerals projects are in Asia, Africa, South America and Russia. It has subsidiaries in China, India, Russia, South Africa, Brazil and Indonesia, as well as agents in Vietnam, South Korea, Australia, Venezuela, Colombia, Chile, Peru and Mongolia.

During 2011, MBE-CMT was awarded a contract to supply the largest Batac jig that has ever been built. The client is the Russian coal company, SUEK, and the machine will be installed in the Kirowa coal preparation plant at Lenin Kuznetsk in the Kusbass coalfield of western Siberia.



Ready to roll – one of the SB 1525 R roll crushers that Hazemag supplied to Datang arrived on site in China in late 2011.



A schematic of one of MBE-CMT's Batac jigs.

MBE-CMT says the machine separates minus-100 mm raw coal with a nominal feed rate of 800 mt/h into rejects, middlings and clean coal. Built at the workshops of Cologne Engineering, part of the MBE group, the jig will form the heart of the washing plant for power-station coal. Commissioning is scheduled for spring 2012.

MBE-CMT claims market leadership in the supply of high-capacity jigs. It has supplied various 7 m-wide Batac jigs to coal-washing plants around the world, with one of them delivered to the Listwajshnaja washery, which is only 20 km from Kirowa.

### Loesche's Fine-grinding Mill Technology

Founded in 1906, **Loesche GmbH** specializes in the design, manufacture and installation of grinding equipment for the cement, mining and industrial minerals industries. The company designs vertical roller mills, and can deliver grinding, preparation and drying systems that range in size and complexity from individual units to complete turn-key plants. Its product range also includes feeders and classifiers, together with hot-gas production units. As well as its main facility in Düsseldorf, Loesche has associated companies in Spain, the U.S., the UK, Russia, South Africa, India and China, as well as representatives and agents worldwide.

For processing ferrous and non-ferrous ores, and base and precious metals, the company can supply grinding mills with capacities of up to 2,000 mt/h, capable of reducing minus-150 mm feed to 20  $\mu\text{m}$  ( $p_{80}$ ). For industrial minerals, its dry-grinding plants can be used on materials such as barite, bentonite, chalk, dolomite, gypsum, graphite, manganese ore, phosphate, titanium slag and titanium dioxide, among others, while the technology is also applicable to grinding hard coal, petcoke and lignite for the cement, power, and iron and steel industries.

In May 2011, Loesche was awarded a third order by Guangxi Jinchuan Non-Ferrous Metals Co. Ltd. for a LM 31.3 copper matte mill. Destined for installation at Jinchuan's copper plant at Fangchenggang City in China, this built on the experience gained with the successful introduction of this technology at the company's YangGu project in September 2009 and at its Tongling project in July 2010. Up to now, Loesche says, it has been successful in winning all of the orders for copper matte grinding equipment for use with flash-smelting technology which, it adds, has been widely accepted by the Chinese copper industry.

Loesche's first order for Jinchuan, consisting of an LM 31.3 copper matte mill and a LOMA LF 25 hot gas generator, was commissioned at YangGu in Shangdong province at the beginning of 2011. The capacity of the most recent mill unit to be ordered will be



According to Loesche, its new containerized coal-grinding plant can help save energy costs.



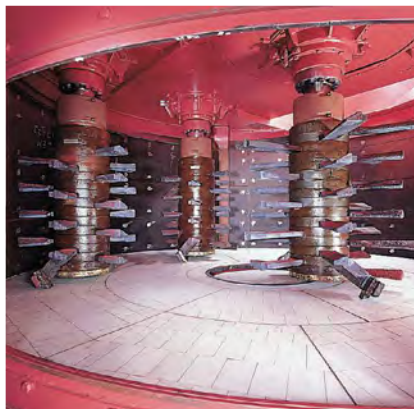
## Material Preparation Technologies for Metallurgy



Eirich intensive mixer type DW40 with an effective capacity of 12,000 liters.

Eirich supplies machines and turnkey plants for the preparation of materials for the metallurgical industry and of metal production/working residues to be recycled or dumped. Field proven solutions are available for the material preparation in the range of ores, powder metallurgy, auxiliaries, and environmental protection/recycling. With locations in Germany, France, Spain, the United States, Brazil, Japan, China, India, South Africa, as well as agencies in over 60 other countries, we are always close to hand with our know-how accumulated from countless projects worldwide. The production range covers an extensive selection of highly reliable machines, components and complete systems for continuous and batch operations.

- Consulting and engineering for green-field and revamping projects
- Application technology
- Process optimization in our own test centers



Mixer type DW31/7 - Capacity up to 700 t/h – Wear protection inside a mixer for iron ore (This configuration can process more than 10 million tons without showing any noticeable wear).

- Mixing and cooling technology for batch-wise and continuous operation
- Intensive mixers with effective capacities from 1 to 12,000 liters
- Agglomerating mixers for the disposal of sludges and dusts
- Batching and weighing technology
- Conveying technology and plant engineering
- Control and process data technology CAQ/TQM/ISO 9000
- Maintenance and spare parts service worldwide

### Metallurgy

Machines and plants for the preparation of raw materials and additives (e.g., ores, sinter mixes, sponge iron) by crushing, grinding, mixing, pelletizing, etc.

### Recycling/disposal

Plants for the conditioning of ashes and sludges for optimum recycling processes and precise product properties required for safe dumping.

### Maschinenfabrik Gustav

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Internet: www.eirich.com



100 mt/h of finished product at 85% passing 200 mesh, giving an annual capacity of 400,000 mt/y.

Loesche reports that in the past few years it has sold three LM 31.3 units, one LM 31.2 and two LOMA LF 25s to handle this type of copper-containing material. The first unit, installed in 1995 at Kennecott Utah Copper in the U.S. has given excellent performance, the company adds.

In October 2011, Loesche unveiled a new concept in coal grinding: the world's first containerized coal-grinding plant which, the company says, is aimed at helping its customers reduce their operating costs by substituting coal instead of oil or gas in various thermal applications. Housed in standard-sized sea-freight containers, the plant is fully automated and ready for operation.

Loesche explains that it has packed more than 100 years of experience in coal grinding technology and plant engineering into a few seaworthy containers, representing a very compact and efficient coal-grinding plant. It has designed the new plant for grinding all types of coal, from dried lignite to anthracite with a grain feed size of 5-30 mm. The grind will produce coal dust in the range of 5%-45%R 90µm, with a potential output of 2-4 mt/h.

Capable of operating at temperatures between -30° and 40°C, the plant offers a number of advantages, including its standardized design, six-month delivery time, three-week commissioning period, high flexibility on site, and the opportunity to write off its purchase cost quickly from energy-cost savings by using coal rather than oil or gas.

### ***Sandvik's Crushing-technology Hub***

**Sandvik Mining & Construction Crushing Technology GmbH** has supplied a broad range of crushing solutions to the mining sector for nearly 60 years, with a widely spread customer base covering requirements that vary from copper and iron ore production in Australia and Africa to coal-processing equipment in China and throughout Europe.

The company says its CR810 Hybrid is unique in its product line, combining the benefits of a classic double-roll crusher with

sizer technology to create a compact machine that achieves high throughput with relatively low power consumption. The aggressive teeth configuration of the CR810 Hybrid is capable of crushing lumps up to 2,100 mm with a reduction ratio ranging from 1:4 to 1:6, depending on the feed material. A standard CR810 Hybrid is capable of achieving a throughput of up to 10,000 mt/h, and is designed for use in crushing ores, coal, salt and limestone, and in applications where the feed material is wet and sticky.

Sandvik's CR610 Centre Sizers are generally used in open-pit mining; other potential uses include primary crushing in underground mining, and secondary and tertiary crushing applications, the company says. Inward-rotating rolls crush a variety of materials with hardnesses of up to 120 MPa, including ores, coal, coke, potash and salt. The machine is used for dry or sometimes moist material, and when used as a primary crusher can handle feed lumps of up to 1,500 mm.

CR620 Side Sizers are primarily used for secondary and tertiary crushing applications in both underground and surface mining. These machines can handle feed sizes of up to 300 mm, and are commonly used for crushing coal and lignite. Other materials up to a hardness of around 120 MPa can be crushed, Sandvik notes, including ores, gypsum and salt.

The company says these machines are designed to handle feed material efficiently, and reduce product fines and dust production. Shields and guards are built into the machine to isolate moving parts from the operator. The focus of safety in the design is evident in the maintenance of the equipment; replaceable picks and segments are designed for safe handling and installation, Sandvik points out.

Finally, its CM420 Hammer Mills are used to crush boiler and coking coal, limestone, gypsum rock, salt and other minerals. They are designed exclusively for low- and medium-abrasive materials, have a high rotor speed (usually between 50 and 60 m/s) and have a throughput capacity up to 1,000 mt/h. The maximum feed size is 250 mm, and they achieve a crushing ratio of up to 1:25 (sometimes up to 1:50). Noise and vibration insulation options are also available.



Building on the experience and reputation that came when it acquired Aubema, Sandvik has a crushing technology production hub in Germany.



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The increased global need for raw materials, and the further decrease in quality of the mineral raw materials in demand, has kindled an interest

in the development of high-intensity magnetic separators with larger capacities. Some reasons to choose the new **gaustec**<sup>®</sup>-magnetic separator are the numerous upgrades, significantly simplified maintenance, reduced energy consumption and increased flexibility through variable individual settings of the GX 3600 – but even more convincing is its extremely high throughput rate of 800 tons per hour.

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## **Innovative Sorting Systems and Separators**

**Steinert Elektromagnetbau GmbH**, a family company from Cologne with a workforce of more than 200, has been delivering top technical separation solutions for the primary and secondary raw materials sector for more than 120 years. The company says its international sales network provides close contact with its customers, with subsidiaries in the U.S., Australia, Brazil and Japan, and at Zittau in Germany, and a range of sales partnerships worldwide. Steinert claims to be one of the world's leading companies in its field, with systems that include magnetic separators and sensor sorters such as the ISS induction-sorting system, the FSS color-sorting system and the XSS X-ray sorting system.

Steinert Australia in particular specializes in delivering separation technologies, not only for upgrading coal, but also for minerals and iron ore, and for contaminant removal. The company claims to offer an unrivalled, extensive product range for mining operations, with its services including the customized design, application and commissioning of ore-sorting, beneficiation and tramp-removal systems that can increase product yields, improve concentrate qualities, reduce operating costs and boost process efficiencies.

Steinert notes that it also invests heavily in product development and testing, both in Australia and in Germany, where customers can enjoy the confidence of having a fully appointed test facility for equipment performance analysis at its corporate head office.

The company's range for the mining sector includes tramp-material detection and removal systems to protect conveyors, crushers and high-pressure grinding rolls; heavy-media recovery and iron ore beneficiation; upgrading upstream concentrator feedstock in mineral processing; wet and dry low-, medium- and high-intensity magnetic separators; induction, X-Ray, XRF, 3-D/laser, color and near infra-red ore-sorting systems; electro and permanent suspension magnets; metal-detection systems; and magnetic drums and pulleys.

Steinert says its 'Boomerang' magnets are used to remove ferrous tramp metal from bulk materials, such as coal, at ship-loading facilities located at key export terminals on Australia's eastern seaboard. Coal is delivered by train from the mines to these terminals, where the requirement for high-powered, deep and wide field magnets is paramount for efficient and effective tramp-iron

removal. The latest Boomerang left its Melbourne factory in September 2011, bringing the number of these super-sized, powerful magnets installed in Australia to six. Weighing in at 43 mt, these magnets are the largest of their kind in Australia, Steinert reports.

## **Schmidt, Kranz Takes allmineral Stake**

In November 2011, the Schmidt, Kranz group bought a 75% holding in **allmineral Aufbereitungstechnik GmbH & Co. KG**, the Duisburg-based supplier of mineral-processing plants to the coal, metals and extractive industries. "The Schmidt, Kranz group's involvement is a further expression of our consistent, internationally orientated market strategy," said allmineral's managing director, Dr. Heribert Breuer about the new partnership. "The international market for ore and coal processing, which is our core business, has grown considerably over recent years. Now that an established company with a strong global presence like the Schmidt, Kranz group has joined us, we will be able to offer our clients even more qualified expertise, and enter new markets." Schmidt, Kranz's other interests in the mining equipment field include Hazemag & EPR, the sizer and underground machinery company, and GHH Farhzeuge, which makes LHDs and other underground vehicles.

Founded in 1988, allmineral has developed processing and separation technologies for coal, ore, slag, gravel, crushed stone, sand and various recycling materials. More than 600 allmineral plants are now in operation around the world, the company says, in both dry and wet mineral processing. With subsidiaries in the U.S., South Africa, Poland and India, it is currently working in more than 30 countries. allmineral notes that, together with Schmidt, Kranz, it is now targeting India as a major market.

Earlier in the year, allmineral announced it had won three independent contracts to supply its mineral processing products and equipment to Rio Tinto's Low-grade iron ore pilot plant, which will be located at the Brockman 4 mine site in the Pilbara region of Western Australia. Being built by the engineering firm, Onyx Projects, this will play a strategic role in the optimization of beneficiation options for future Pilbara lower-grade deposits.

allmineral will be providing an alljig with a design capacity of up to 80 mt/h of feed material. The alljig separates high-density iron ore from gangue material using stratification and separation processes. It is fitted with flexible design features that allow it to treat fines and lump material up to 32 mm, as well as treating wide-ranging particle-size ratios of up to 1:8, allmineral says.

The company also secured an order for its unique three-product AFX 100 allflux classifier. This is designed to treat up to 2 mm iron ore particles in two classification stages that upgrade the valuable mineral by size and density, and also thicken and deslime in one step. The third allmineral product for the pilot plant, specifically developed for the beneficiation of haematite ores, is a model G 1000 gaustec wet high-intensity magnetic separator (WHIMS). This separates iron ores, including paramagnetic and feebly magnetic minerals, up to a particle size of 3 mm if required, but typically around 1 mm. High-gradient magnetic fields are used, which can be independently adjusted for each rotor, allowing scavenger and cleaner process steps to occur in one single machine.

"The equipment being supplied comprises of our proven technologies in haematite beneficiation, and we consider ourselves fortunate to be associated with the next generation of large-capacity downstream operations planned for the Pilbara," Dr. Breuer said. "We are confident the upgrading processes for low-grade iron ore have the potential to significantly add value to Rio Tinto's existing and planned operations."



Ready for delivery—the latest Boomerang magnet from Steinert's Australian factory.





Jürgen Winckler



PNEUFLOT



BATAAC jig



CMP / Chile iron ore flotation by using PNEUFLOT



Yenny Wong



Evren Ören



Assmang KEP / South Africa, iron ore beneficiation by using BATAAC jigs



JONES WHIMS

Ore-, minerals- and coal beneficiation are our key markets since business decades. Processes with BATAAC® jigs, flotation system PNEUFLOT® and magnetic separators like JONES® WHIMS and PERMOS® MIMS are widely used and worldwide well proven beneficiation technologies. It is daily quality control. It is the employees and the technologies that have stood behind our name in the past – and will continue to do so in the future. Our team is looking forward to provide you with the best possible solutions and state of the art technology.

**MBE COAL & MINERALS TECHNOLOGY GMBH**



# PUMPING TECHNOLOGY: FOR WATER, SLURRIES, SOLIDS AND MORE

Virtually every mine or mineral-processing plant in operation today needs pumps, and as duties have become more demanding, pump technology has become more sophisticated. As in other equipment sectors, German companies are right up there on the world stage, putting innovative ideas into practice.

Not all pumping requirements are the same—far from it—so this chapter of *Best of Germany* takes a look at a variety of products from a cross-section of member companies of the VDMA's Mining Equipment Association. Requirements covered include mine dewatering (always a critical safety issue in its own right), handling tailings and mineral-processing applications, with each of the companies offering their own special solutions to the mining world's pumping needs.

## **Putzmeister: Pumping Solids for Mining Markets**

According to Peter Peschken, key accounts manager for Aichtal-based **Putzmeister Solid Pumps GmbH**, a recent restructuring at the company has led to a renewed focus on the mining industry, a point emphasized by the appointment of Dr. Archibald Richter, himself a mining engineer, as its new CEO. And, while the company is renowned worldwide in the construction sector for its extensive range of concrete-placing pumps and systems, the same pumping concepts are finding increasing use in mining and mineral processing, Peschken told *Best of Germany*.

Typical mining-sector applications include handling high solids-content backfill materials in both metal and coal mining, transporting tailings at high solids density from processing plants to storage areas and, at the utilization end of the business, pumping power-station ash to disposal ponds. As Dr. Richter explained, Putzmeister has recently completed the largest pump it has ever constructed, a 1 MW unit that will handle 300 m<sup>3</sup>/hr of ash slurry at a power station in India. "Next year [2012], we aim to build an even bigger pump, which will move 400 m<sup>3</sup>/hr at 100 bar pressure," he said.

Dr. Richter said the company currently has more than 1,550 pumps working in the mining industry worldwide, many of which are of its KOS type. In these units, which are used for handling highly viscous backfill and coarse-grained slurries containing particles of up to 80 mm in size, the intake and delivery cylinders are connected by an S-transfer tube. This, the company says, allows the pump to move material continuously without the use of valves. The simple design and few wear parts offer a very robust, low-maintenance, long-life pump with low operating costs, Dr. Richter added.

Other pump types that Putzmeister offers for mining applications include its HSP, HSP Triplex and KOV series; the one thing that all have in common is that they are driven by a hydraulic power pack that the company can supply with outputs from 15 kW to more than 1 MW.

Referring to the pumps' low operating costs, Dr. Richter said: "We have won customers who had originally bought cheaper pumps, but then found that their running costs were too high. Another advantage is that being able to pump high-density slurries means that you need less water in the mix, and that's becoming increasingly important in many parts of the world."

Dr. Richter cited Barrick Gold's Plutonic mine in Australia and Coeur d'Alene Mines' San Bartolomé silver mine in Bolivia as examples of mines that use Putzmeister pumps for solids handling, as well

as explaining that the company is currently investigating opportunities in the bauxite and red mud market. "However, it's important to realize that there are two completely different application sectors in mining—for handling solids and for pumping water that often contains abrasive sediment. Piston pumps have a big advantage there in terms their lift capability, whereas centrifugal pumps can have wear problems, especially where there are high lifts and the water being pumped has a high solids content," he said.

## **Special Pumps and Motors for Mining**

With a justifiable claim to be one of the country's longest-established pump manufacturers, **Oddesse Pumpen- und Motorenfabrik GmbH** has been based in the eastern German town of Oschersleben since 1854. Today, the company is at the forefront of innovative design and the production of dewatering borehole pumps for surface mining, in-situ leaching (ISL) and a range of other applications.

The company recently moved into new manufacturing premises, with new ownership since a buy-out that took place in 1998. General Manager Harald Schmidt told *Best of Germany* that Oddesse's focus is on producing multi-stage submersible pumps and special submersible motors for the mining market, with a track-record of having supplied pumps into the opencast coal mining industry since the 1930s. Diversification into other mining sectors has taken place over the past 10 years, he added.



Installing one of Oddesse's innovative dewatering pumps.





Maximum tonnage under extreme conditions?

Absolutely.

The history of belt conveyor systems started in the early sixties. Ever since, ABB has been supplying engineering solutions for electrical control, automation and drive equipment for large scale conveyors such as a 13-kilometer overland conveyor system for a high-altitude copper mine in Collahuasi, Chile – with downhill conveyor and electric power regeneration. Our expertise shows in more than 700 kilometers of belt conveyor systems worldwide, meeting the challenges of long distances in extreme environments and transportation conditions as well as ever increasing belt loads. Our new gearless conveyor drive (GCD) combines all our experience in conveyor drive solutions meeting the highest demands such as minimum wear plus maximum efficiency and controllability. For more information, please visit us at [www.abb.com/minerals](http://www.abb.com/minerals)



With water ingress often a major problem with submersible-pump motors, Odesse has overcome this by adopting a wet motor design. As Schmidt admitted, this has its own challenges in terms of ensuring the windings themselves are water-tight, while the company's current capacity of 8,000 motors a year is soon to be increased once a new motor-winding machine has been commissioned. Small motors take around 30 minutes to wind by machine, he explained, while for larger units, hand-winding is still needed and takes commensurately longer.

Odesse produces its submersible pumps and motors in sizes up to 45 kW for 6-in motors, and right up to 400 kW for 12-in motors. It designs pump bodies and components in materials that are appropriate to the pH of the fluid being pumped, with gray cast iron and bronzes having been replaced with materials such as high-quality elastomers, chrome steels and duplex steels for more-acidic applications.

Today, the company's main markets for this type of pump are in Germany, Russia and Kazakhstan, with sales into both the dewatering and ISL markets. In South Africa, it gained customers in the coal and iron ore sectors, while in Chile, Odesse pumps are used for brine production in the lithium industry.

Pump overhaul also represents a significant part of the company's business, Schmidt said, and is likely to increase in the future as more customers see the benefits of having their pumps maintained properly in a dedicated repair shop.

### **Abel's Pumps Solve a Gold Mining Problem**

With its headquarters in Büchen, **Abel GmbH & Co. KG** is one of Germany's leading manufacturers of specialist pumps. Founded in 1947, it initially supplied pumps to the mining industry before branching out into other sectors as well. Its focus is on reciprocating positive-displacement pumps for varying flow rates and pump pressures, with a specialization in the design and production of membrane pumps that are suitable for abrasive, aggressive and even shear-sensitive media.

Abel comments that it has seen a trend developing over recent years whereby mines are moving away from using centrifugal pumps, and are using slow-running, oscillating-discharge pumps instead—pumps that have higher efficiencies and lower operating costs. Its hydraulic membrane pumps are used for feeding filter presses, reactors and autoclaves, transporting mine slurry and tailings, and for mine dewatering and backfilling, the company states, with stainless-steel components available for units handling acidic ore slurries.

In the last edition of *Best of Germany*, Abel focused on a salt-mining application to demonstrate the capabilities of its pumps to solve a materials-handling problem in a highly corrosive environment. This year, the company has reported on its success in helping one of the world's top gold producers, Newmont Mining, to address successfully the challenges it was facing in handling abrasive thickener underflow material at its gold-recovery plants.

Abel explains that Newmont's process flowsheet includes initial ore grinding in semi-autogenous (SAG) mills, with regrinding in ball mills. Pulp outflow from milling is partially dewatered in a thickener before being sent to the filter-press circuit, with the material being pumped from the thickener underflow to the filter-press holding tank at between 50% and 60% solids.

The thickener concentrate is abrasive, with Abel describing the pumping duty here as being 'a daunting task'. The company explains that Newmont was using centrifugal slurry pumps that had regular maintenance issues and required the addition of seal water. Repairs were costly, time consuming, and—worst of all—threatened gold production. Given the price of gold, unscheduled downtime is not looked upon favorably, Abel points out.

Newmont needed a solution to improve reliability and greatly reduce its operating costs that were associated with this part of the process, and in 2006 it replaced its centrifugal thickener underflow pumps with two of Abel's EM100 electro-mechanical diaphragm pumps—one operating and one on standby. Each pump is capable of handling some 62.5 m<sup>3</sup>/h at 0.35 MPa.

The EM100s operate without any thickener cone dilution water or the gland water that is typically required when using centrifugal pumps. As a result, a higher-density material is fed to the filter presses, which improves their efficiency by reducing the filtration time. Operation of the EM100s also requires considerably less operator attention because of a number of advantages, Abel says. These include low maintenance and inventory costs, high operational flexibility, their ability to handle particles in the 3- to 25-mm size range, their self-priming, seal-less design, and their low energy requirements.

### **Advanced Pumps for Dewatering**

**Düchting Pumpen Maschinenfabrik GmbH & Co. KG** has more than 70 years of experience in the field of advanced centrifugal pumps for use in the applications such as reverse-osmosis desalination, flue-gas desulphurization, mining and the production of chemical pigments. The company's product range includes optimized high-pressure pumps, slurry pumps and non-metallic lifetime anti-corrosion-warranted low-pressure pumps, with most applications dealing with chemical and/or aggressive and abrasive liquids.

Düchting's products designed specifically for the mining industry include multi-stage high-pressure pumps for mine dewatering and single-stage heavy-duty slurry pumps for water and slurry transportation. It produces two series of multi-stage high-pressure pumps: the LHK and HK series, and the DH and ROWA-E series of slurry pumps.

The LHK pumps are available in sizes from 32 to 250 mm (1¼-10 in.), and can produce flow-rates of up to 1,440 m<sup>3</sup>/h at a working pressure of 40 bar. The HK series offer higher pressure capabilities, up to 120 bar, are available in sizes from 32 to 300 mm (1¼-12 in) and can handle up to 2,160 m<sup>3</sup>/h.

For slurry pumping, the company's DH series, available in 65-400 mm (2½-16 in.) sizes, have a flow range up to 4,000 m<sup>3</sup>/h, while the ROWA-E series, at 32-900 mm (1¼-36 in.) handle up to 12,000 m<sup>3</sup>/h. Both slurry-pump types operate at 10 bar working pressure.

Düchting points out that, from a safety aspect, keeping mines dry is one the most important targets for the mining industry, and that its dewatering products are both highly sophisticated and reliable in this application. The company cites an example of where its pumps have been used for dewatering, at the Sobieski coal mine in Poland.

Sobieski is one of the wettest mines in Europe, with a pumping duty of more than 60 m<sup>3</sup>/minute. Modernization at the mine has led to an increase in production, as well as the need to upgrade its pumping capability.

One of the targets here was to replace an existing pump at the main pump station, at a depth of around 500 m, with a further aim of reducing the energy requirements for pumping. Düchting replaced the 10-stage pump there with a MHK 250-650 five-stage pump, with subsequent analysis having shown that the installation has indeed saved up to 10% on the mine's energy costs.

Other benefits, Düchting says, include a longer life-span for the pump because of the use of high-quality stainless steel components for its moving parts, lower noise, less heat generation from the modern electric motors used, and the use of an advanced condition-monitoring system, while the smaller dimensions of the pump mean that maintenance can be undertaken in a safer working environment. Further modernization of all of the main pumps at Sobieski is now planned, Düchting adds.





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# DRIVES TECHNOLOGY: PLACING POWER WHERE IT'S NEEDED

Often overlooked, but a critical component of most machines, a drive system involves converting raw energy into useful work—usually motion. Mining shovels and draglines need to turn and travel, conveyors need to run, mills must rotate, crushers reciprocate. The one thing all of these have in common is a drive system, whether or not it uses gears.

Drive technology is high technology, with tight tolerances needed to minimize noise, maximize efficiencies and optimize operating economics. Little wonder, then, that German companies are at the forefront here, with the country's engineering and manufacturing traditions combining to produce state-of-the-art drive systems for every conceivable mining-sector application.

## ***Gearless Conveyor Drives Offer Major Benefits...***

In many mining areas, ore grades are declining. New mines are being developed in more remote areas, pits are getting deeper and underground mines are becoming larger. This means that more and more material must be transported over long distances, with materials handling posing new challenges. In order to achieve the increasing volumes and high demands for availability, conveying systems will need to make use of the technologies that are made possible by today's larger drive systems, says **Siemens**.

For many years, Siemens has worked with **ThyssenKrupp Fördertechnik** to help build some of the most impressive conveyor systems in the mining industry, the company adds. One of the greatest success stories is the Los Pelambres downhill conveyor in Chile, the highest-tension conveyor in the world, which transports 10,000 mt/h of copper ore downhill over a distance of 12.7 km.

Continuing their successful teamwork, the two companies are now delivering a gearless drive system for the overland conveyor at Xstrata Copper's new Antapaccay mine in Peru. The conveyor system will transport ore over a distance of some 6.5 km from the mine to the processing plant on a 1.37 m-wide belt travelling at 6.2 m/s. When the belt conveyor system has been commissioned in 2012, it will be capable of transporting some 5,260 mt/h of material.

The Siemens drive system comprises two low-speed synchronous motors—each with a total power of 3.8 MW—and the associated Sinamics SL150 cycloconverters. In addition, Siemens is supplying the motor-cooling system, converter transformers and complete e-



Gearless drives offer significant advantages in high-capacity conveyor applications, according to Siemens.

house for the drive station. The closed-loop control, which is part of the delivery, improves load sharing between the two motors.

Gearless drives for conveyors can be a good alternative for power requirements above 3 MW, Siemens says. The capex is similar to, or can be less than that for a conventional geared solution. Furthermore, gearless conveyor drives offer high availability and robustness, as well as lower operating costs, maintenance costs and noise.

Gearless drive technology is nothing new to the mining business, of course, and Siemens points out that mining companies have been installing gearless drives for mine hoists, excavators, draglines, pumps and mill applications for many years. While the technology is similar, the circumstances differ, however: similarly to mills, conveyors require a lot of torque during start-up, especially in uphill applications.

Siemens states that long conveyors with a high throughput and a large difference in elevation require a significant amount of power. When this exceeds 3 MW per pulley, gearless drives for the conveyor are the right solution since drive configurations for large conveyors with gearboxes will reach their physical limits.

There will be a lot of large overland conveyors being built in South America in the next few years, and since mining companies will be looking to save energy and increase reliability, there will be big opportunities for gearless drive applications there, it adds.

## ***...While Geared Drives Also Have Major Uses***

After an independent history dating back to 1899, the specialist gear and drives company **Flender** became part of the Siemens group in 2005. Today, Flender acts as Siemens' center of excellence for the production of geared drive technologies, including gearboxes, motors, couplings, starters, converters and controls. Flender's product range covers helical, bevel-helical and bevel gear units, as well as planetary gear units in both standard and customized industry-specific configurations.

Within the Siemens structure, Flender looks after the company's mechanical drives, as part of the 'drive technologies' division of its industry sector. Flender's product portfolio for gear units encompasses two main categories: FZG-type standard gear units, and Planurex II standard planetary gear units.

Flender produces 28 sizes of its FZG helical and bevel-helical units, with one to four stages and power ratings of up to 4.5 MW. Typical mining-sector applications include drives for belt conveyors, aerators and agitators. Meanwhile, it offers 27 sizes of its planetary gear units, capable of transmitting up to 13 MW and suitable for applications such as drives for bucket-wheels, slewing and travelling gears on rope shovels and draglines, and roller presses.

When it comes to mill drives, Flender offers an alternative to Siemens' gearless drives for large grinding mills, as well as supplying mechanical drives for vertical mills.

According to Flender, it can offer the right gear unit for every drive task, and its standard gear units are designed to be suitable for use in nearly all fields of mechanical power-transmission technology. Most of the tasks can be solved by using gear units from its universal standard range, the company says, providing a low-cost solution, while it can also quickly adapt these for application-specific uses. Customization represents a further step in the process.

Examples of Flender's drive units in mining applications include belt conveyors, where the company's extensive experience enables it to





design gears, seals, cooling systems and anti-friction bearings, and to select lubricants that are appropriate for the working environment. For apron feeders, which require a lot of torque, Flender offers a very compact, high-efficiency shaft-mounted planetary gear unit. Its products for rope shovels and draglines cover customer-specific gear units for the hoist, swing and propel drives, with bucket and crawler drives for bucket-wheel excavators.

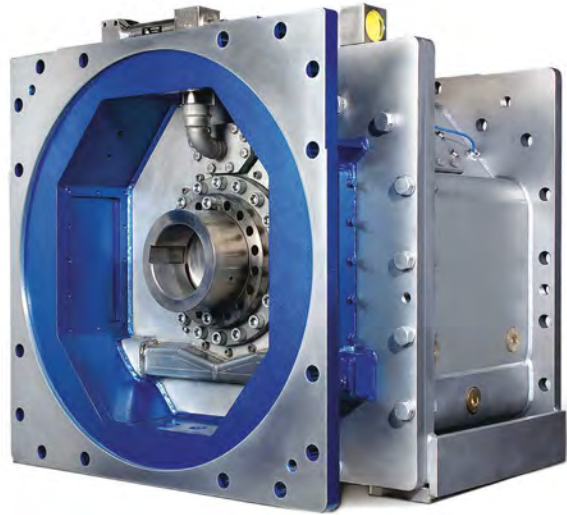
Recent applications within the mining industry have included the supply of a 600 kW-rated planetary drive for an apron feeder for CNRL at its Horizon oil sands mine in Alberta, Canada, a 2.5 MW-rated bevel-helical drive for an overland conveyor for Southern Copper's Tia Maria project in Peru, and a planetary gear unit supplied to **Tenova Takraf** for use as a travelling gear drive on a bucket-wheel excavator in Bulgaria.

The company has also supplied planetary gear units to Bucyrus (now Caterpillar) for use as hoist and swing drives on its 495 electric rope shovels, as well as a 7 MW-rated helical gear unit to **Polysius** for use as a ball-mill drive at a project in Australia.

### Fluid Couplings for Conveyors, on Surface and Underground

With its headquarters in Crailsheim, **Voith Turbo** is a division of Voith GmbH. The company has more than 80 years of experience in designing fluid couplings, with its start-up components being used on belt and chain conveyors, bucket elevators, mills, crushers and other bulk materials-handling machines.

Voith Turbo recently introduced a new fluid coupling, the TurboBelt 780 TPXL, for the drives on long-distance open-pit mining belt conveyors. The coupling has been specially designed for induction motors operating at speeds of 900-1,200 rpm, the company says, and can transmit twice the power that previous couplings of the same size could achieve. The controlled start-up with a precisely-dosed intro-



Voith Turbo says its CPC 1600 is the most powerful mining coupling now available to AFC OEMs.

duction of torque is especially easy on the belt and on the entire drive-line, and start-up times of up to several minutes can be set individually in the control system.

At the heart of the new development is the profile of the blade wheels in the coupling. Voith says its fluid engineers have optimized this profile using computational fluid dynamics, such that the blade wheels transmit double the power with the same diameter—1.1 MW at 900 rpm, 1.5 MW at 1,000 rpm and 1.9 MW at 1,200 rpm. Power transmission is wear-free, as with all hydrodynamic couplings, the company points out.



## Protect Your Belt Conveyors with Voith Turbo Fluid Couplings

They have been in service for decades under toughest conditions – and have proven themselves worldwide. Voith fluid couplings protect belt conveyors against wear and damage and allow smooth but fast start-ups in any situation. The soft force transmission leads to reduced belt tensioning.

In multi-motor drives they ensure natural load distribution. Result: fewer downtimes – and the service life of the belt and the drive components is increased.

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ABB supplied retrofit drive technology for this SchRs 1200 bucket-wheel excavator in Bulgaria.

When combined with reliable mechanics, hydrodynamic power transmission provides extremely high system availability, Voith adds. The TurboBelt itself offers availability of up to 99.8%, with very low maintenance requirements—for example, the first overhaul is due in around 10 to 15 years. The company reports its latest technology has already won over a Brazilian mine operator, which is using TurboBelt couplings on belt conveyors that transport iron ore.

Voith's couplings are also widely used underground, with special applications including the drive units on armored face conveyors in coal mines. Here, Voith has developed what it says is the world's most powerful mining coupling available to OEMs, with a transmission capacity of 1.6 MW—the CPC 1600 (Chain Protection Coupling).

This is a further development of the company's 1.2MW CPC 1200, of which more than 30 have already been installed in various coal mines over the past year. Designed to work reliably under extreme operating conditions, the CPC units are robust and cope with rough surroundings. They are fill-controlled and use water as an eco-friendly, non-flammable operating fluid.

A coupling of this output class offers clear advantages to operators: compared to a standard coupling of a similar size, the transmission output of the CPC 1600 is 60% higher. In comparison with the CPC 1200, the increase in performance is around one-third. As a result of this improved capacity, up to 12 m-high coal faces can be cut to their full height. In short, Voith says, the CPC makes coal extraction even more efficient, as none of the seam remains unexploited.

The CPC 1600 was officially launched at the China Coal Exhibition in October 2011, since when couplings have been supplied to two of the leading mining equipment suppliers in China.

### **ABB: Drives for OEMs**

Headquartered in Cottbus, in the heart of eastern Germany's lignite mining region, ABB's main technology center for materials handling has an enviable record in export markets, with exports accounting for around 80% of its business. However, as the center's head, Peter Mühlbach told *Best of Germany*, much of the company's business is done with OEMs, with ABB's control and drive technology fitted to equipment supplied by the likes of P&H, Tenova Takraf, ThyssenKrupp Fördertechnik, FAM, Sandvik and others.

ABB's mining and minerals business unit operates in 27 countries and includes four product groups, Mühlbach said. These include the

materials handling group in Cottbus, while others focus specifically on grinding, mineral processing, underground mining and services.

The Cottbus group's area of expertise is in the electrification and automation of open-pit mining, conveying and stockpiling equipment. This includes electric mining shovels, draglines, in-pit crushers, bucket-wheel excavators, stackers, belt conveyors and spreaders, while in the stockyard environment, it not only handles the needs of stackers and reclaimers, but also complete management systems and the design of centralized control rooms.

Looking at the company's recent progress, Mühlbach explained the boom in mineral development projects that took place up to 2008 provided ABB with a strong order-book that helped it weather the worst of the global financial crisis in good shape. What is more, he said, it has built further on this foundation, such that it now has a much stronger project pipeline. "We use ABB's international network to help generate business here," he said.

With regard to developments within the mining sector, Mühlbach said: "There is obviously a trend toward larger mines, especially in copper. That is important for us, especially where mines are being expanded.

"There is also a trend toward the more widespread use of conveyors, and more dragline projects where these are suitable, so we expect both more greenfield and retrofit applications for our drive and control technologies," he said.

Retrofitting is particularly important for draglines, as the head of ABB's discontinued mining business center, Boris Rathmann, pointed out. "P&H, for example, has begun an initiative to go down the retrofit route for its existing machines, and this has obvious attractions in terms of time- and cost-saving over buying a new one," Rathmann said.

ABB recently delivered drives for an in-pit crusher fitted with its mining-drive technology and this, Rathmann said, marks an interesting development for the company. "With the world trend toward in-pit crushing and conveying, we can now deliver systems that cover the complete haulage chain. The technology is already well-established in the coal industry, and it's now moving into hard-rock mining as well.

"There is also a steady increase in ship-borne trade in commodities such as coal and iron ore, and that means more bulk-handling systems at ports and stockyards," he said.





In another move, in mid-2011 ABB bought the Australia-based software company, Mincom with the aim, it said, of establishing itself as a market leader in enterprise asset management software and services. Mincom has mining-sector clients that include 17 of the top 20 global players, ABB added, noting that Mincom has a strong presence in both Latin America and Asia.

### Geared Drives Have the Edge

From its headquarters at Bargteheide, near Hamburg, **Getriebebau Nord GmbH & Co. KG** (Nord Drivesystems) is a major supplier of full-scale, comprehensive drive solutions. Its portfolio ranges from standard drives to customized solutions for demanding applications, including those where energy-efficiency or explosion protection are required. Its product range includes a wide variety of gear types, covers torques from 10 to 200,000 Nm, motors delivering outputs from 12 to 200 kW, and power electronics ranging from frequency inverters to servo controllers.

Nord suggests that in applications such as quarrying, using geared drives on conveyors may offer an advantage over conventional shaft and belt drives. The idea is not new, the company admits, while explaining that since the 1980s, many plants changed to belt drives because spare parts were always quickly available, while manufacturers and suppliers of geared motors could not offer equally flexible stocks of spares. However, the downside came with reduced reliability, and hence more interruptions to production as belts required regular replacement.

Nord recently supplied geared-drive technology to NorStone, Norway's largest producer of gravel products, at its Tau operation in the southwest of the country. Despite its 2.3 mt/y capacity, the Tau plant struggles to meet demand, so it is important to maximize plant availability and minimize unplanned downtime.

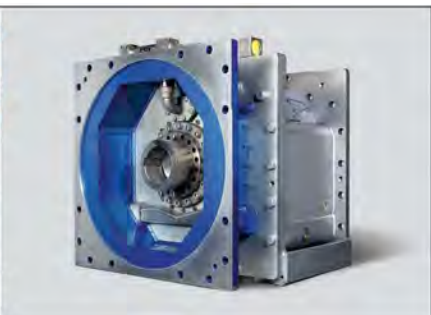
Working conditions at Tau are tough, with most of the plant's conveyors situated outside, unprotected against the region's harsh



Nord's geared conveyor drives have helped NorStone improve plant availability.

weather conditions. Wind, rain and sleet, as well as dust, make maintenance difficult, so NorStone tries to minimize repair and maintenance times for its maintenance staff.

"We have found that service and spare parts for geared motors are now available to us very quickly. We keep some parts in stock ourselves, and for all of the rest we have complete trust in Nord as a supplier," said Ivar Ullestad, Tau's maintenance manager. "Now we can use all the advantages of drive solutions based on geared motors. In particular, direct actuation increases reliability, which means less downtime and therefore less production-time loss. Another important



## Achieving Higher Output with Voith Turbo Fluid Couplings

Voith fluid couplings in armored-face conveyors do an incredible job under toughest conditions. They protect the driveline in overload situations and prevent production downtimes and standstills: in the event of a chain blockage, the conveyor can be restarted as often as required until the

system breaks away – while the motor is protected. Thanks to nominal power of up to 1 600 kW, Voith hydrodynamic couplings allow mining on longwalls with a height of up to 12 meters. Uniquely robust, reliable – and proven for many decades. [www.voithturbo.com/startup-components](http://www.voithturbo.com/startup-components)





aspect is that less maintenance is required, which cuts costs and helps to improve safety in the plant.”

Aside from being more reliable, Nord says the changeover has resulted in measurably less wear than with shafts and belts. Other benefits that NorStone has noticed have been that water and dust cannot enter the drive mechanism, while the investment cost for buying new gear units also turned out to be lower than that for maintaining the old technology. NorStone is now working on standardizing on its conveyor-belt drives as a means of making maintenance and stock control easier and more cost-effective, Nord adds.

### **Custom-built Drives and Transport Systems**

With its headquarters in Moers, the **Bräutigam** group is an internationally active designer, manufacturer and supplier of machinery for the mining and tunnelling industries. The company's expertise encompasses drives technology, monorail transport systems, and mining and tunnelling locomotives, enabling it to claim to be one of the world's leading suppliers of high-performance mining gearboxes and monorail transport systems.

As well as its home base in Germany, Bräutigam has operations in the U.S., Poland and China. It also has two joint ventures with Chinese partners covering drives (gearboxes and accessories) and monorail transport systems and auxiliary equipment, while its service center maintains and refurbishes the majority of RAG's mining gearboxes.

Bräutigam's long experience with heavy-duty gearboxes, together with regular feedback from users, means it has built up comprehensive expertise in the field of drive engineering. As a result, and by evaluating damage and weaknesses from these types of gearboxes, which are often subject to extremely heavy loading, it has been able to develop improved components that have a longer service life and increased performance, that have proved themselves worldwide.

The company claims a number of advantages for its drive technology, not least of which is the extremely compact, robust gearbox design. Gearboxes are also symmetrical, which means they can be mounted on either side of the unit being driven, such as an armored face conveyor. Forced lubrication ensures that the input stage of a gearbox is kept lubricated, even in steeply inclined installations, while cooling is provided through an integrated water system connected to radiators in the gateroad.

Bräutigam also supplies an intrinsically safe monitoring unit to measure gearbox parameters such as temperature, inclination, the current and optimum oil level, oil pressure, the moisture content in the oil, and vibration. Data collected can be accessed on-line by maintenance personnel, or can be transferred to a memory card for further analysis. These units can also be retrofitted to mining gearboxes of any kind, the company notes.

Bräutigam expanded into monorail transport systems through its acquisitions of Ruhrthaler and Muckenhaupt, both of which had developed significant expertise in the technology. Today, it says it is one of the major suppliers of diesel- or electric-powered self-propelled monorail systems for heavy-load transport in underground mining and tunnelling, with custom-designed systems for all transport requirements.

Benefits of its monorail technology include the safety of the rail system used, and the ability to use monorails throughout a mine, regardless of the roadway floor conditions. This makes supplying working areas easier, with less labor input, while the drive and carrier units can be adapted to meet a range of applications and transport tasks. Systems can be designed to be operated from the cab, or through remote control, with built-in control systems that include operational data monitoring, diagnostics, methane-concentration monitoring and brake performance measuring.



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## Drives Around the World

**SEW-Eurodrive GmbH & Co. KG** is one of the global market leaders in drive technology, equipping many of the systems and machines that are widely used across the manufacturing and process industries. Its equipment can be fast, dynamic and highly precise, as used in DVD production, or big and strong for use in the primary industries.

Originally established in 1931 as Süddeutschen Elektromotoren Werke, and having celebrated its 80<sup>th</sup> anniversary in 2011, today the company is headquartered in Bruchsal, with overseas operations in some 45 different countries and a world-wide workforce of 14,000. An example of an application for its compact MC industrial gear units comes from South Africa, the company reports, where they are used for driving conveyor belts at one of Xstrata's chromite mines.

The MC series is designed for the small torque range, up to 48 kNm, and features a low installation space requirement and high availability, SEW notes. These gear units are suitable for horizontal, vertical and upright installation, and are particularly strong in the medium gear-ratio range. A modular gear-unit concept includes a broad range of optional accessory equipment, such as motor adapters, belt drives, and backstops, and the gear-ratio range can be expanded by combining the gear unit with a standard gearmotor.

Xstrata's Thorncliffe mine produces 100,000-110,000 mt of chromite ore every month. Overground conveyor belts transport the run-of-mine ore from the mine to the process plant. Underground, in the mine itself, the ore is also moved by conveyor, with SEW-Eurodrive South Africa having supplied two drive units to power this system.

The MC-series industrial gear units were adapted to Xstrata's specific requirements, SEW says, with Xstrata being particularly interested in their energy efficiency and the condition monitoring option. "It is worthwhile taking a look at the total operating costs when buying a system," said Lloyd Murenzvi, plant manager at Thorncliffe. "The unit

must be both energy-efficient and able to operate independently. Condition monitoring is an major advantage when it comes to solving a problem before the system fails."

Condition monitoring uses the latest methods to detect the condition of the entire drive equipment systematically. The approach includes the measurement, interpretation and visualization of defined parameters, then passing this information to the mine's maintenance department.

Two condition-monitoring systems are used with the industrial gear units at Thorncliffe. A DUV (Diagnostic Unit Vibration) unit, used for monitoring the roller bearings and gears, measures structure-borne noise and calculates the frequency spectrum to evaluate their condition. In addition, a DUO10A (Diagnostic Unit Oil Aging) unit, used to monitor the aging of the oil, consists of a temperature sensor and an evaluation unit. During operation, the unit uses the oil temperature to continuously calculate the remaining service life, in days, until the next oil change.

These condition-monitoring measures enable the maintenance department at Thorncliffe to address problems early on, as well as extending the gear units' service life through preventative maintenance.



The DUO10A unit calculates the remaining service life of the gearbox oil.



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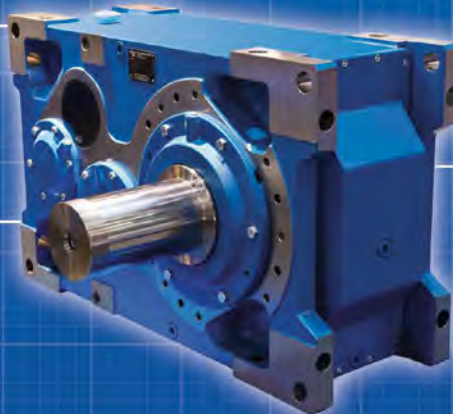
# Unicase industrial gear units from NORD

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- Mirror image installation thanks to symmetrical construction
- Lower weight than jointed housing gear units
- Same physical size for 2 and 3 stage gear units
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## Oil & fans

- Oil supply by flange-mounted pumps in all installation orientations
- Optimal axial fans
- Synthetic oils for greater reliability



## Production and quality

- High precision production due to rigid housing
- High power density
- Longer bearing life than with jointed housing gear units

NORD industrial gear units were developed according to the tried-and-tested unicase principle. The design was developed for a wide range of applications in many different sectors of industry. With all of the available options and modules it is very easy to configure especially compact drive solutions. This standardisation guarantees quality, reduces the number of components, simplifies storage and ensures rapid availability for our customers. You can find out all about NORD energy efficiency under [www.nord.com](http://www.nord.com).

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# CONSULTING SERVICES: TAKING GERMAN EXPERIENCE TO THE WORLD

Germany's mining heritage dates back to the Middle Ages, so it comes as no surprise that its mining and utility companies, and consulting firms, have built up a massive pool of knowledge about all aspects of mining and mine-safety technology. Today, these companies offer their experience and expertise to the international mining industry, with projects undertaken around the world.

## **IPCC—German Technology Conquers South America**

In recent years, in-pit crushing and conveying (IPCC) technology has been gaining ground as an economically and environmentally attractive alternative to pure shovel-and-truck operations for both greenfield and mine expansion projects. This was the view expressed to *Best of Germany* by Martin Schmid, deputy head of business development for the consulting and engineering firm, RWE Power International (**RE GmbH**).

RE draws on the operational experience of its parent company, the utility RWE Power, which operates Europe's largest opencast lignite mines. Material is loaded by bucket-wheel excavators, the continuous haulage is done by belt conveyors and the waste is dumped by spreaders. The conveyors, of which RWE operates 237 km, are the most critical part of the system, since this is the part that actually competes with trucks.

As RWE Power's consulting subsidiary, this unique operational experience in state-of-the-art large-scale continuous mining equipment enables RE to advise both mine operators and investors on IPCC technology worldwide. "We provide our operating knowledge and experience," Schmid said. "What we give is independent advice, tailored to individual clients. Our engineers are well-known for their experience in the long-term planning of continuous mining systems, with belt systems designed to RWE's standards."

The company has been active in South America for more than 20 years, having been awarded a contract by Chile's copper giant, Codelco, for its J-1 Norte project at Chuquicamata in 1990. RE was commissioned to plan, design and supervise the construction of a crusher-belt conveyor-spreader system, including six 1,800 mm-wide belt conveyors totalling 7 km in length and capable of handling 9,600 mt/h. This, RE says, was a pioneer project in Chile: it was successful and has led to many others.

In 1995, for instance, RE began work on the very challenging conveyor project at Antofagasta's Los Pelambres copper mine. A downhill tunnel conveyor system was chosen to move ore from the mine to the plant, involving a vertical drop of 1,200 m and allowing the system to generate up to 25 MW. The world's strongest belt, type ST 7800, was used. RE continues to carry out audits for Minera Los Pelambres, as well as assisting the company in operation and maintenance, and has also provided services for two capacity increases at the mine.

More recently, RE has supplied services to the Antamina mine in Peru and to Carbones del Cerrejón in Colombia for IPCC pre-feasibility studies. In both cases, the company says, the results were sufficiently encouraging for the projects to move on to the feasibility stage.

## **Bringing Better Safety to Underground Mining**

**DMT GmbH & Co. KG**, headquartered in Essen, together with its IMC consulting subsidiaries, is an independent exploration, engineering



The world's first explosion-proof 3-D laser scanner, developed by DMT.

and consulting organization operating on a global scale. About 600 employees (more than 70% of whom are engineers, scientists and technicians) provide services in the form of individualized engineering and support tailored specifically to client needs. DMT personnel also serve as impartial assessors. The firm's activities focus on the fields of natural resources exploration, construction and infrastructure projects, mining, coke-making technology, product testing, measurement instrumentation in industrial settings, and safety in buildings.

One area of core expertise is in improving mine safety. Gas-emission control, gas drainage, gas outburst prevention and, of course, mine ventilation, are all essential to safe underground coal mining. In this area, DMT is now providing consultancy and technology to the coal mining industry in Kazakhstan. The objective of the project is a turnkey solution for the delivery and installation of a gas laboratory, including on-site training for the technical staff.

The company notes that laser scanning has been one of the main inventions of recent years that has changed the world of surveying. Laser scanning enables surveyors to carry out 3-D as-built-documentation of complex structures easily, quickly and cheaply, and while underground mine surveying has been revolutionized by the technique, underground coal mining has been excluded because no intrinsically safe 3-D laser scanner has been available—up to now.

Working together with Zoller & Fröhlich GmbH, DMT has developed the first explosion-proof laser scanner, the IMAGER5006EX, with development having been funded by RAG Deutsche Steinkohle AG. As the technology fulfills the requirements of the European ATEX regulations for mining zone 1, as well as for zone 2 (other industries), it is now available for projects in international coal mining and for applications in other industries such as refineries where potentially hazardous conditions could exist.

## **From Investor Support to Full Feasibility Studies**

For decades now the DMT-group company, **IMC-Montan Consulting GmbH** (IMC-MC), has offered consulting services to the international mining industry. The scope of its services ranges from mineral expert reports for mining companies' initial public offerings (IPOs), to full feasibility studies of coal and metalliferous mining projects.



An example of its mineral expert report capabilities was that prepared by IMC-MC on the coal assets of Sadovaya Co. in Ukraine, which the company used to support its successful IPO on the Warsaw stock exchange in 2010. IMC-MC independently assessed Sadovaya's assets by site visit and reviewing data including resources, reserves, manpower requirements, environmental issues and life-of-mine plans relating to production, productivity, operating and capital expenditures and revenues.

In 2011, IMC-MC finalized a full feasibility study for Shougang Hierro's open-pit iron ore mine, located some 500 km south of Lima, Peru, near the Port of San Nicolas. The mine owner, a subsidiary of one of the largest Chinese steel companies, is planning to expand the open-pit from 10 to 20 mt/y. The expansion includes all the associated infrastructure such as the processing plant, a small (around 150 MW) power plant and the transport system to the harbor. IMC-MC was commissioned to prepare a comprehensive feasibility study for the planned expansion, as well as for subsequent engineering services.

### **Providing Proven Mining Solutions**

From its headquarters in Herne, **RAG Mining Solutions GmbH** markets German know-how in the underground coal mining industry worldwide. It also offers a wide range of consulting and engineering services, as well as training in areas such as technical planning, logistics, support technology and development, ventilation and air-conditioning, extraction, automation, health, safety and environment (HSE), and testing.

Together with its associate company, RAG Deutsche Steinkohle, RAG Mining Solutions employs integrated approaches to the optimization of processes in underground coal mining. Its services, offered under the motto "We know how—because we do it ourselves," always focus on their benefit to the customer, the company states. Planning, training, the monitoring of face operations, and advice on 'lean processing'—the long-term optimization of performance, and thus cost reduction, by implementing improved processes for its clients—are integral parts of its range of services, it adds.

The company has developed a comprehensive modular, flexible range of services for successfully carrying out international projects. For example, it offers various consulting and engineering services, as well as specialized training, for the implementation of the planning steps for roadway support. These services are based on the experience gained in German coal mining, with planning cycles and training being part of the day-to-day work within the RAG Group.

The planning tools offered by RAG Mining Solutions are based on RAG's system of standard technical support planning, which are then customized to meet individual clients' needs. One particular focus is the provision of safe support options that comply with mathematical stability verification. If required, planning can also provide monitoring concepts for roadway support systems. For gate roads, meanwhile, different usage options can be provided, ranging from one-side retreat working through to double usage of a roadway by two operations, if this is allowed. Operators who are new to this area can benefit from the company's long experience in planning roadway support systems, and can be helped to cut costs and improve their productivity by the introduction of innovative support technologies.

HSE is another area for which RAG Mining Solutions offers its expertise, with the company pointing out that this should be treated as an integral part of the coal-mining process. Efficient solutions can be devised on this basis in order to prevent mine accidents, to establish a safety culture, and to improve employees' safety-consciousness, it adds. As a result, client companies can increase their productivity, meet legal safety requirements and fulfill their social responsibilities—with improved public perception being an important spin-off from this.

## **RWE Power International**



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# SAFETY AND PRODUCTIVITY ACROSS THE BOARD: COMPLETING THE PORTFOLIO

Safety has always played an important role within mining operations. Globally “Safety First” has long been made a top priority by all of the key players in the mining industry. Great endeavours have been made to reduce the number of fatalities and improve the lost-time and injury-frequency rates. To ensure the safety of employees and minimize downtime, the key industry players continuously strive for zero harm to people and the environment across their operations.

Originally introduced in Britain in 1887 to disadvantage imported goods, the term “Made in Germany” soon became associated with product reliability and quality—a perception that continues to this day. German companies’ approach to built-in safety in their products comes in many forms, albeit with one over-riding goal: to minimize the risk of injury to people and damage to equipment, while giving mining companies world-wide a competitive edge in terms of life-cycle costs of doing business.

Today, German technology is not just about the hardware that is visible when you walk through any mine or processing plant; behind the equipment for digging, hauling, processing and smelting, there is a vast array of systems that are all aimed at making the mining industry safer and more productive.

## **Mine Safety Technology: a Holistic Approach**

Founded in Lübeck in 1889, **Dräger** has been an international leader in the fields of safety and medical technology, committed to miners’ health and safety, for more than 100 years, “Technology for Life” continues to be its guiding philosophy, the company says, as it supplies a broad spectrum of safety equipment that can be combined and used as an integrated safety concept to protect, support and save lives.

For daily operational safety, Dräger notes its comfortable disposable masks are commonly used in underground mines as everyday respiratory protection, while its X-plore 1320 and 1720 series can also effectively filter diesel particulate matter.

Apart from airborne particulates, Dräger also offers a comprehensive line of gas-detection products. The single-gas Pac series and the multi-gas X-am series alert miners to dangerous gas concentrations, including toxic and explosive gases, vapors and oxygen deficiency. The X-am 5000 or X-am 7000, which can measure both 0%-100% LEL

and 0-100 vol% methane concentrations, can be used for regular cave monitoring and seal checks. In combination with an external pump for the X-am 2/5000 series or with the built-in pump for the X-am 7000, its monitors are also suited to other applications such as confined-space entry and post-blast inspection, the company says.

Measurements of diesel-engine exhaust can be carried out with the classic Dräger Tube or the MSI EM200-E, an electronic tester is specifically designed to process flue gas. This measures carbon monoxide and nitrous fumes, as well as logging each test result for underground machines.

In case of emergency, Dräger provides different technologies and systems to mine operators to enhance self-escape and rescue capabilities. With nominal durations of between 25 and 60 minutes, its chemical oxygen self-contained self-rescuers (SCSRs) can be incorporated into a self-rescue system, while the company’s new Oxy 6000 SCSR offers a 10-year service lifetime without additional testing and maintenance.

Dräger says its new ChargeAir system presents an enhanced concept for self-rescue and first-response capability of underground personnel. The system provides cached self-contained breathing apparatus (SCBA) that allow for voice communication and the potential to react to, as well as to escape from hazardous situations. As workers exit the mine, they can recharge their SCBAs at designated points without doffing the sets, thereby ensuring that they always breathe uncontaminated air.

In the event that a mine cannot be safely evacuated, Dräger refuge shelters, which provide their own breathable air and power source in a sealed positive-pressure chamber, further supplement the mine emergency response plan.

For mine-rescue teams, Dräger has its PSS BG4 Plus closed-circuit breathing apparatus, which provides a four-hour working duration and the option for hydration while wearing the set. The company also offers the first certified intrinsically safe thermal-imaging cameras, the UCF 7000 and 9000 which, it says, are invaluable tools for casualty search and situational assessment during rescue missions.

Last but not least, in response to the new ‘fitness for duty’ requirements in the mining industry, Dräger’s Alcotest 7510 and DrugTest 5000 systems represent an easy yet discreet and hygienic approach for non-invasive workplace alcohol and drug testing.

## **Large-diameter Drilling Options**

**Prakla Bohrtechnik GmbH** is Germany’s leading manufacturer of universal, multi-purpose drilling rigs, with its R&D and manufacturing facilities located at Peine, near Hanover. As a member of the Bauer group, and a wholly-owned subsidiary of Bauer Maschinen GmbH, Prakla is able to benefit from the group’s extensive production facilities at Nordhausen, as well as being part of the international Bauer service network.

Prakla says its drilling rigs are designed for multi-functional drilling operations, under any climatic conditions—from the Russian tundra to the blazing desert sun in the Arab Emirates; from the humid jungles of the Congo to the high altitudes of Tibet, or at depths of more than 3,000 m on the ocean floor.

When it comes to mining, Prakla rigs are used in a wide variety of operations, the company adds. Examples include drilling in-situ



Dräger’s closed-circuit breathing apparatus offers a four-hour working duration.



leaching wells for uranium production, as at Katco's operations in Kazakhstan, or for the production of coal bed methane. De Beers uses its rigs for large-diameter core and mass bulk-sampling drilling for exploration and mine-extension evaluation, while Newmont drills large-diameter holes for dewatering wells with Prakla rigs. Other applications can include drilling ventilation and escape shafts, and drilling boreholes during mine-rescue operations—as happened in Germany in 1963 and 1988, Prakla reminds us.

The company states that reasons for choosing one of its rigs include their ease of operation, since they are fully hydraulically operated, they have long working lives, with spares availability guaranteed, and they are economical to run. Given their modular construction, Prakla drills can be supplied to meet customized needs, and users can choose from a selection of carrier vehicles, from skids to trucks. Changing from one drilling method to another (including wire-line coring) is quick and simple, the company adds, while deep, large-diameter drilling is also possible—Prakla says its RB 50 rig can drill a 1,200 mm-diameter (47¼ in.) hole to a depth of 200 m, or deeper still at smaller diameters.

### **Mining Products with a Worldwide Reputation**

Founded in 1745, **J D Neuhaus GmbH & Co. KG** (JDN) has been designing and manufacturing handling equipment for over two and a half centuries, and pioneered the use of compressed air for powering handling equipment in the early 1950s. This ensured that the company's lifting and pulling equipment was suitable for use in hazardous areas, and in environments where there was a potential explosion risk.

JDN's products, which now also include optional hydraulic-powered operation, are used worldwide in all major heavy industries such as mining, oil and gas, construction, shipbuilding, steelworks and



J D Neuhaus Profi 37 TI hoist handling a 1,000 m-long pipeline string weighing 30 mt, being positioned in a shaft.



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even aerospace. With a range that covers lift capacities from 250 kg up to a full 100 mt, they are used wherever the safe lifting, moving and precise placement of loads is required. These Ex-rated hoists ensure the highest levels of safety for operating in potentially explosive or other dangerous atmospheres.

Over the years, JDN has developed many purpose-designed products for use in specific industries, including mining, which is acknowledged as one of the toughest fields, making extremely high demands on both men and materials. Here, JDN hoists can be found in applications such as positioning longwall shield supports, lifting and lowering working platforms, in combination with monorails for equipment transport, and for hoisting and lowering equipment in shafts.

JDN products designed specifically for mining and other underground applications include the M series air hoists. These operate off a 4-bar pressure, can be supplied in lift capacities of 1, 2, 3 and 6 mt, and have twin chain pulls for alternate working.

Another specifically designed mining product is the SK125 shunting trolley. This also operates off a 4-bar air supply and offers the economic transportation of loads when suspended from lifting beams. Gradients of up to 18° can be negotiated, and the unit provides a minimum push/pull of 14 kN at 4 bar pressure.

Profi TI series hoists are also suitable for underground working and operate off air pressures of 4 or 6 bar, with hydraulically operated units also available. Lift capacities from 250 kg up to 100 mt are available, with traverse trolleys for overhead monorail operation also available for lift ratings of up to 20 mt.

The company reports that one of its Profi TI hoists with a 37 mt lifting capacity has been used for the safe and successful handling of an assembled pipeline string, some 1,000 m long. This involved the connection of individual pipeline sections, each 8 m long, to create a completed string weighing 30 mt, which then had to be positioned within a mine shaft.

### **Without After-treatment: Tier 4 Solutions from MTU**

With its two business units, Engines and Onsite Energy & Components, the Tognum group is one of the world's leading suppliers of engines and propulsion systems for off-highway applications and of distributed energy systems. These products are based on diesel engines with up to 9,100 kW power output, gas engines up to 2,150 kW and gas turbines up to 45,000 kW. Under the MTU brand, Tognum markets engines and propulsion systems for ships, for heavy land, rail and defense vehicles, and for the oil and gas industry.

For the mining industry, MTU offers solutions with power outputs up to 3,000 kW (4,023 hp). One of the company's most popular prod-



The 12-cylinder version of MTU's new Tier 4-compliant Series 4000 engine.

ucts is the Series 4000 engine, with more than 26,000 units having been sold since its launch in 1996. MTU's latest advance, the next-generation Series 4000, was developed to meet the most stringent non-road emissions mandates from the U.S. Environmental Protection Agency (EPA)—without the use of any exhaust-gas after-treatment.

MTU says that following guidance provided by intensive dialogue with OEMs, it was able to define the design targets for the new engines: meeting future emission requirements while keeping the effect on the equipment to a minimum and reducing the total cost of ownership. The major Series 4000 engine features that are crucial for customers—such as the power-to-weight ratio and low fuel consumption, compact physical dimensions and a thermal protection function—will remain unchanged, the company adds. In order to keep maintenance to a minimum, intelligent electronic features for remote diagnosis and status monitoring will be available. MTU also supplies engines for mining applications with full EPA Tier 4 certification so that customers can integrate its drive systems quickly, simply and economically.

MTU reports it will offer a full product family for Tier 4 final from 2015, covering the 800-3,000 kW power range with 8, 12, 16 and 20-cylinder versions. Based on the Tier 2 engines of this series, the next generation engines' technology package includes exhaust-gas recirculation, high-pressure common-rail fuel injection and two-stage, intercooled turbocharging with an adjustable high-pressure stage. In combination, these technologies result in a very low-particulate and low-nitrogen oxide (NO<sub>x</sub>) combustion with low carbon dioxide (CO<sub>2</sub>) emissions. Low pollutant/emissions levels can be achieved by using only in-engine technology without requiring after-treatment, additives or related infrastructure.

At the same time, MTU says, the engines retain the high levels of performance, reliability and fuel efficiency that customers have come to appreciate over the years. For OEMs and mine operators, the powering of their vehicles without after-treatment translates directly into a more cost-effective business. Lower weight and volume, less complicated maintenance and highly efficient fuel consumption help to minimize costs—which, the company suggests, makes the Series 4000 the most suitable solution for mining equipment requiring compliance with Tier 4 emissions levels.

### **World Leader in Tire Protection**

Originally developed some 70 years ago to protect the pneumatic tires of the early hydraulic loaders working with sharp or abrasive rock, today **RUD-Erlau** claims a 65% share of the world market for tire-protection chains, with designs to match the most demanding environments.

Erlau's light-weight but strong tire chains save energy, save tires, increase safety, cut maintenance down-time, aid productivity and significantly reduce the cost per loaded tonne, the company says.

Sidewall piecing by slate or flint can reduce a tire to scrap in an instant, so for applications where this is a risk, the company offers its RING-RING system—a close-meshed chain that embraces the entire tire surface and deflects sharp-edged rocks for all-round protection. Where abrasive rocks are a problem, Erlau has developed the RING-LINK system that creates a barrier between a vehicle's tires and the haul surface and can double and, sometimes, treble, tire life, the company adds.

Working clayey seams or on icy haul roads can make loaders, trucks and graders hard to handle. Erlau notes that operators are fitting an open-ring chain such as its GARANT series to provide extra control or, where additional grip is required, its Terraplug system would be an option, as it has studded links for extra 'bite'.

For underground, where any or all three of the these conditions may be encountered, the company produces the TORO X19—a





Erlau tire-protection chains provide comprehensive protection in the toughest mining environments.

lightweight, compact, all-embracing tire-protection chain that fits within the tight wheel arches of low-profile LHDs and trucks.

Erlau points out that with high demand for mined products and no foreseeable end to the shortage of earthmover tires, tire-protection chains can be an essential add-on. It is not by chance, the company says, that it has come to dominate the market for tire-protection chains, with a high level of quality control from the metallurgy used, through fitting, to life-of-product support. State-of-the-art production facilities ensure consistent weld integrity and lighter, stronger, energy-saving links. Before delivery, each batch of chains is tested to destruction before being embossed with an unique tracking code.

The introduction of a chain-monitoring system gives a new dimension to its product support, Erlau adds, with each set of chains

incorporating a 'Smart Link' that records the set's complete service history. A hand-held smart reader collects, updates and records data from several sets of chains; these data are then available for download and interpretation by maintenance staff.

Erlau points out that its confidence in its tire-protection chains is such that it is providing the Smart Link free-of-charge, with Smart Links being shipped with every set of chains in the 22 mm range, and Erlau offering the smart reader at cost. Smart Link systems are already deployed in the U.S., South Africa, Europe and Australasia.

### **Flexible Cables for Special Applications and OEMs**

Today part of the Prysmian group, **Draka Cable Wuppertal GmbH** is involved in the development and production of flexible rubber-insulated cables to standard or harmonized designs, as well as special flexible cables for power and medium-voltage applications. The group (Prysmian and Draka) is a major supplier in the high-tech energy and telecom cables and systems industry, and is one of the leading suppliers of special mining cables world-wide. According to the company, users appreciate the advantages of its cable designs, their quality and reliability, with its products manufactured to DIN ISO 9001 standards. Its flexible cables are produced to conform to DIN VDE rules, the CENELEC harmonization documents and European standards, as well as to international IEC recommendations and numerous national specifications.

As examples of its product applications, Prysmian says, 30 kV trailing cables are used to provide power supplies to heavy plants such as excavators and stackers in opencast lignite mines. Underground, steel-wire-armored coal-cutter cables also make a vital contribution to electrification and mechanization.

Tough operating conditions in the mines can lead to problems such as excessive material strain, harsh climatic conditions and the



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risk of explosion. However, Prysmian says that its trailing and coal-cutter cables ensure that power supplies are maintained, even under these conditions.

The company produces slim, lightweight cables, especially for large mining machines, which means that longer cable runs can be stored on standard reels. This in turn allows users to find new technical solutions and achieve lower costs, it adds.

All Prysmian cables can be tailored to include specific features, with optical fibers, pilots and monitoring cores being just three of many additions that can be incorporated in the cable design. For instance, since 2000 the company has been producing a hybrid copper/fiber-optic cable that is certificated for underground use and can transmit high-resolution video. Prysmian says that advantages of this type of cable include the high data-transmission rate, its unchanging transmission quality, the lack of influence from magnetic fields, and the fact that the cable is both water- and explosion-proof.

### **Betek's Solution for High-wear Situations**

Based at Aichhalden in the Black Forest, **Betek GmbH & Co. KG** has been supplying tungsten carbide cutting tools to the mining industry for more than 30 years. Its international sales have been booming, the company says, with its main overseas markets now in the U.S., Russia, South Africa and Australia. Its wear parts are supplied either through OEMs or directly to mines through its dealer network. As well as supplying picks for underground mining, Betek has products specifically designed for applications such as road construction, tunnelling, excavation, surface mining, crushing operations of all kinds, recycling, soil cultivation and biomass production, with a comprehensive range of tungsten carbide parts in numerous shapes and grades.



Welding Betek TungStuds as wear protection for a cutting drum.

The company introduced its TungStuds concept as an additional anti-wear solution at the 2010 bauma exhibition. Small wear-protection bolts containing a core of high-quality tungsten carbide, TungStuds are available in graduated sizes that are suitable for all types and sizes of machines, the company says. They can be easily welded onto parts of a machine that are particularly susceptible to wear, and can be repeatedly replaced without the machine parts themselves wearing down.

In a recent application, Betek supplied TungStuds to Atacama Minerals' Aguas Blancas open-pit mine in northern Chile, which since 2001 has been producing iodine from caliche deposits in the Atacama Desert. Mining conditions are tough, with the cemented caliche consisting of various proportions of gypsum, sand, lime and stone in addition to iodine, rock salt, sulphate and nitrate minerals. The climate is harsh, too, with temperatures that vary between 30°C during the day to -15°C at night.

The operation's main mining machine, a terrain leveler, is operated round the clock, cutting into the surface of the caliche in repeated passes across the deposit. However, the abrasiveness of the material was leading to major wear on the sides of the cutting drum, with the machine repeatedly being out of service for unscheduled maintenance.

The local Betek agent supplied 3,300 TungStuds, which were welded in place overnight; the company reports the miner immediately went back into operation and has been running non-stop ever since, with the TungStuds protecting the sides of its cutting drum.

Last October, Betek began a new partnership with Wirtgen Zwickau through which the two companies will cooperate on sales and after-sales support for the TungStuds range. Wirtgen Zwickau will not only be handling TungStuds sales, but will also be offering an on-site TungStuds welding service.

### **Plarad: Ensuring Accurate Tensioning**

With its headquarters at Much, not far from Cologne, **Maschinenfabrik Wagner GmbH & Co. KG** claims to have the largest range of torque and tensioning systems available worldwide. Trading under the Plarad brand name, referring to its original focus on planetary gear systems, the company has been in existence since 1962 and now has customers in over 50 industry sectors, including mining.

The company's introduction of torque multipliers and hydraulic bolting equipment in the early 1970s was followed in 1980 by electric





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and pneumatic torque tools and in 2002 by automatic power packs with microprocessor technology. In 2009, it established international companies in the U.S., UK, Italy and Turkey, and opened an office in China, as well as having a network of distributors in other parts of the world.

Today, its product lines include hydraulic bolting systems, tensioners, torque multipliers, nut-runners, high-tech measuring technology and special tools: in fact, everything to do with tightening big bolts.

Plarad specializes in analyse of customers' bolting requirements, and coming up with the most efficient solution to meet specific situations. In both underground and surface mining, bolted components are often subjected to extremely high mechanical loads on a continuous basis, so it is vital that bolt tensioning is undertaken to the correct specifications. The company can supply systems that can apply the correct torque through yield-point controlled, torque/angle of rotation or precise pre-tensioning methods, thereby making sure that exactly the right torque is applied.

Torque tensioning tools can be supplied for both workshop and on-site use, with those specified for underground coal being made with steel housings rather than aluminum. A key feature of Plarad's systems is their reproducibility of torque applications, with the ability to produce documentation for certification purposes also very important. In this respect, the pneumatic-hydraulic XP power pack can deliver measurement records directly on site, so that an operator can set the torque required, then download the torque information for each bolt either there-and-then, or back at a workshop or office.

Plarad points out that it is becoming increasingly common for the documentation of bolt fastenings to be required for quality-control purposes, and that simple procedures are needed, especially when bolted joints are being made up on site. It adds that its systems do not need additional sensors to be fitted to the bolting equipment in order



Getting the correct torque on critical bolts using a Plarad tensioning system.

to handle documentation, while they are also able to record failed bolt-tensioning incidents so correct remedial work can then be carried out.

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Scheppe, executive vice president for shaft hoisting mining technology at **Siemag Tecberg GmbH**. “Technological leadership and customer orientation are the motivating factors behind our day-to-day work. Alongside our company headquarters in Haiger (north of Frankfurt), we have established our own subsidiaries in China, South Africa, the U.S., Poland, and Australia, and we also have representatives working for us in Russia and Chile.”

The company claims to be the global market leader as a system provider for machinery and plant construction for shaft hoisting and heavy-duty hoisting technology, as well as for mine and tunnel cooling, and has noticed a clear trend toward increasingly large plant concepts in these areas. Its successful cooperation with the Luan Mining Group in Shanxi province, China, for example, is continuing with the supply of a two-compartment skip-hoisting installation that Luan ordered for the main shaft at its Licun mine. Using a four-rope ground-mounted winder with a diameter of 5,000 mm, the system will hoist 30 mt capacity skips from a depth of 546 m at a speed of 12 m/s, and will handle about 5 million mt/y of coal.

Working with its consortium partner Converteam (GE), Siemag Tecberg has also been awarded a contract by The Mosaic Co. for the delivery of the production and service hoists for its new Esterhazy K3 potash mine in Canada. The production hoist will be a six-rope Koepe hoist with a payload of 54.4 mt and a hoisting speed of 18.3 m/s. A 4 m-diameter Blair single-drum hoist with a payload of up to 24.5 mt will be supplied as the service hoist.

“Time and safety are two crucial factors for success in maintenance work such as regular rope-changing in a shaft-hoisting installation,” states Wolfgang Schubert, the company’s general manager for shaft hoisting technology for raw materials. In response, the company offers its special clamping and lifting devices (CLDs) that fulfill ‘load-bearing’ functions when ropes are being installed or changed. It



A Siemag Tecberg clamping and lifting device, used for shaft rope changing and maintenance.

recently delivered one of these, designed for a four-rope installation with a load of up to 1,600 kN, to PotashCorp for use at its Allan shaft hoisting plant in Saskatchewan.

“Safety aspects also played a major role in one of our most recent orders from China,” said Josef Fuhrmann, a senior project manager at Siemag Tecberg. The Xinwen Mining Group in Shandong province commissioned the company to supply a mobile shaft and rescue winch for its hoisting plants. This will be used for shaft inspections and, when fitted with a special cage, for rescue purposes to depths of up to 1,100 m. In addition, its hydraulic operating unit can be driven by a diesel engine, meaning that the system does not have to rely on a local power supply in the case of emergency.

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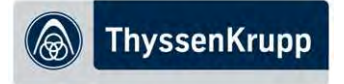
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## Main exhibit categories

- Sinking
- Drilling and heading
- Extraction (underground)
- Roof support
- Cutting heads
- Shearer drums
- Conveying and transport
- Ventilation and air conditioning
- Open-cast mining
- Highwall mining equipment
- Process control and automation
- Central control and stations
- Disposal mining
- Deep well drilling
- Preparation plants
- Coke oven and equipment
- Up-garding plant
- Driving aggregate
- Pumps and compressors
- Electrical equipment and Control devices
- Communication, data processing and transmission
- Measuring devices and safety installations
- Pneumatic and hydraulic tools
- Tools
- Safety measures and health protection
- Chemical products and building materials
- Fittings and valves
- Chains, ropes, pipes, wires and wire goods
- Rubber and plastic products
- Fixing materials, bearing lubrication and other products
- Mining companies/contractors
- Consulting/Engineering
- Machines and plants for process control, process measuring technique
- Mining companies
- Environmental Protection
- Pit gas
- Research, theory, technology transfer
- Mining special literature, film and photo documentary
- Other products

## Special Show:

### Safety and Health at work

- Personal protective equipment
- Firedamp protection, fire prevention, environment protection
- General safety at mines

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With the acquisition of Bucyrus in 2011, Cat surface mining machines now include hydraulic and electric shovels, draglines and blasthole drills in addition to the proven Cat line of trucks, wheel loaders, track-type tractors, motor graders and other support equipment. For underground coal and soft rock mining, Caterpillar offers complete lines of longwall equipment and room-and-pillar equipment. For underground hard rock mining, Cat loaders, trucks and drills deliver high performance. The Cat MineStar System provides technology solutions for both surface and underground mining.

Bucyrus Europe GmbH is now part of the Caterpillar Global Mining Division, headquartered in Oak Creek, Wisconsin, USA. Caterpillar Group President Steve Wunning has executive office accountability for Caterpillar's Global Mining business. "We are

***"No matter what the mining challenge is and no matter where the mine is located, Caterpillar can help. Wherever there's mining, we're there."***

bringing together the best people, the best products and the best facilities from both companies," Wunning said. "This acquisition is all about growth and unprecedented opportunities. Combined with our aggressive product development and capacity expansion plans, it will position Caterpillar to offer a broad range of surface and underground mining products and solutions to our customers."

Wunning acknowledged that the rapid development of the world's emerging markets is expected to continue to drive an increasing need for commodities as billions of people around the world seek to improve their standard of living. "Wherever there is mining, Caterpillar and our dealers will be there to serve our mining customers," Wunning said.

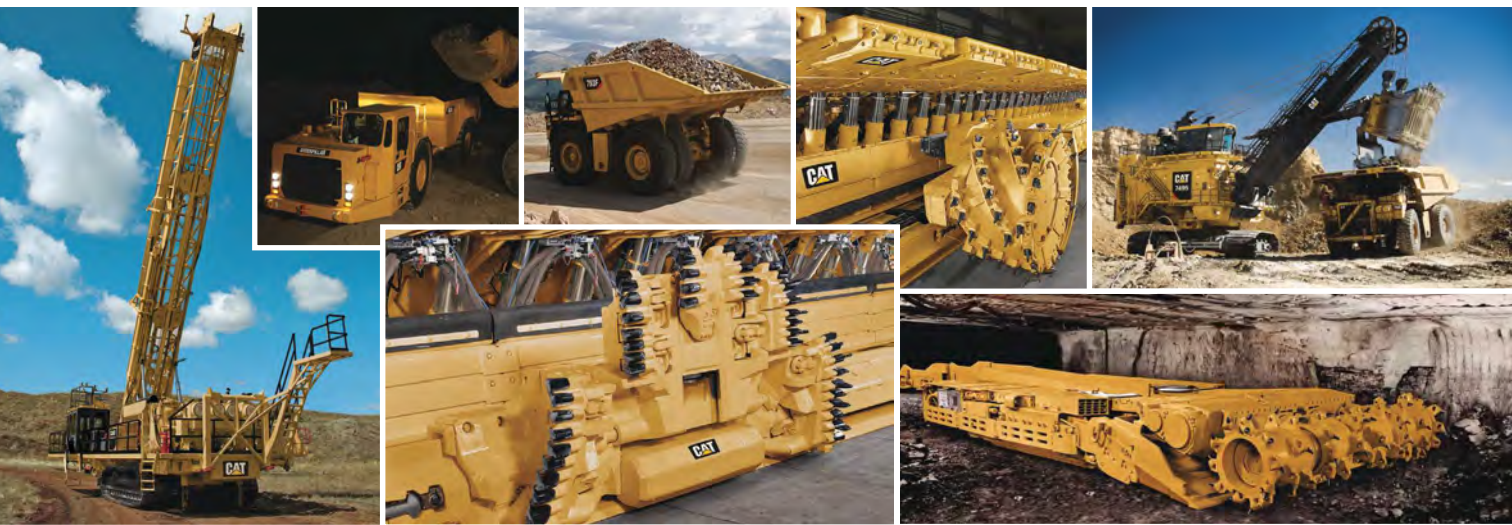
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For additional information go to: [www.mining.cat.com](http://www.mining.cat.com).

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## 100,000 kW worldwide in mines

### Product Data

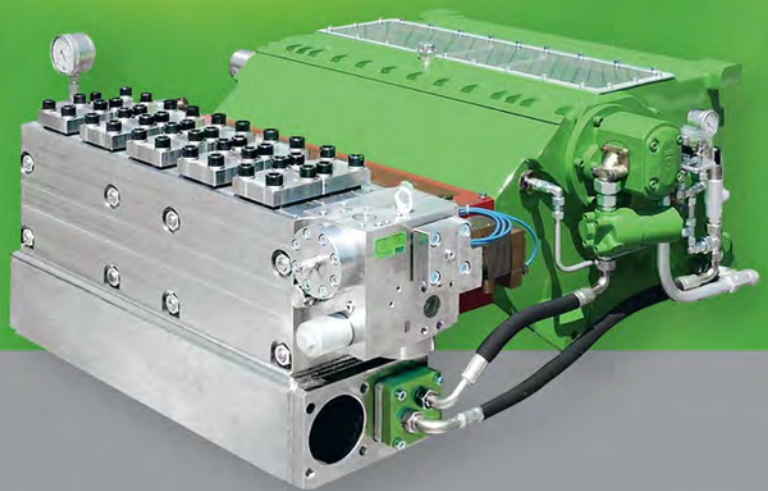
max. 772 l/min at 370 bar  
typ. 523 l/min at 350 bar  
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up to 641 l/min without booster pressure

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