

# Mining Engineers' Journal



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*Mining Engineers' Association of India*

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MONTHLY

June - 2022



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## *President's Message.....*

**Dear members,**

Greetings .....

I wish to share with you all the various activities undertaken by the Association in the preceding month....

One day National Seminar on **“Mining sustainability and waste management”** on 08.05.2022 at Bagalkote was organised by Belgaum Chapter. Eminent scientist Prof. Udaykumar R Yaragatti, Director (In-charge), NITK Suratakal graced the occasion as Chief Guest. Some very relevant technical papers on sustainability and waste management were presented in the seminar.

MEAI Bellary-Hospet Chapter, jointly with NMDC Limited, got the approval for imparting First Aid Training at NMDC, Donimalai complex from the DGMS. This First Aid Training Centre (**NMDC Limited-MEAI BH Chapter First Aid Training Centre**) was formally inaugurated on 14.5.2022 in the presence of Shri. Umesh Sawarkar, DMS, Bellary Region, Dr. Kaushik Sarkar, Inspector of Mines (OH), Hyderabad, Sri. B Sahoo, ED, NMDC Limited and members of BH Chapter. This is an important move towards skill development and will aid many aspirants in this mining sector. It is also a pleasure to note that this is a maiden centre under the wings of MEAI. Hoping to see many more ...

MEAI got a positive feedback from the industry on our 1<sup>st</sup> MPDP programme and there was a request from many circles to plan the next batch as early as possible. We are planning to organise the 2<sup>nd</sup> batch of MPDP ( MEAI Professional Development Program) in the month of September 2022 in virtual mode.

The 3<sup>rd</sup> Professional Development Course on Indian Mineral Industry Code (IMIC ) was concluded on 13.5.2022 in virtual mode . Sri. K. Mohan Reddy, Director-Projects & Planning, NLC India limited graced the occasion as the Chief Guest and Sri. Arun Kothari, Past President, MEAI and Former Co-Chair of NACRI was the Guest of Honour.

On 20.5.2022, the Chairmen and Secretaries of all Chapters meeting was conducted in virtual mode. All Chapters presented their activity reports for the year 2021-22, along with the activities planned for the year 2022-23.

There were some recent developments concerning the mining sector. On 20<sup>th</sup> May 2022 Honourable Supreme Court lifted the curbs on exports of Iron ore & Pellets in the State of Karnataka and further allowed iron ore operators to sell excavated ore through direct sale instead of e-auctions. This could be a win-win for merchant miners and steel companies. On 21<sup>th</sup> May 2022 vide notification 28/2022-Customs, Ministry of Finance ( Department of Revenue) Government of India, increased the export duty on Iron ore and others.

We request all our members to celebrate the **World Environment Day (WED)** on 5<sup>th</sup> June with the theme **ONLY ONE EARTH** and create sustainable living in harmony with Nature.

We have scheduled the next Council meeting, AGM and Award Function on 25.6.2022 at Bengaluru, hosted by the Bangalore Chapter.

Regards,

**K. MADHUSUDHANA**  
President



# Mining Engineers' Association of India

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## EDITOR'S DESK



**Dr. P.V. Rao**  
Editor, MEJ

A prosperous mining sector is a key component in attaining the goal of a diversified and healthy economy. Exploration of a mineral target ensuing establishment of Mineral Resources, Reserves and development of a mine is a capital intensive and high-risk endeavour with no assured success and no realisation of revenue at any of these stages. With the objective of giving desired thrust to mineral exploration, the Central Government established the National Mineral Exploration Trust (NMET) under sub-section (1) of section 9C of the Mines and Minerals (Development and Regulation) Act 1957 (MMDR). The Ministry of Mines (MoM) notified the NMET Rules 2015 on 14 August 2015 and the Amended Rules 2018 on 7 March 2018. The Fund shall comprise of payment of two percent equivalent of royalty payable (Rule 6(3)) by the holders of the Mining Lease (ML) or Prospective Licence-Mining Lease (CL).

The Fund shall be utilized for carrying out the objects and functions as specified under Rule 9 of NMET Rules 2015. Hitherto, the fund has been mostly utilized for facilitating grant of ML for bulk minerals, CL for non-bulk minerals, and completion of detailed exploration in brown field exploration projects in G2/G3 blocks. The priority objects listed under NMET Rule 9, viz., (a) *funding special studies on deep seated or concealed mineral deposits*, (b) *undertaking studies for mineral development and sustainable mining*, (c) *taking up exploration of areas for strategic and critical minerals*, have received least consideration. As the Trust funds cannot suffice the emergent exploration needs, it is essential for the Government to **encourage largescale private investments and participation of all stakeholders by proposing tax and other incentives, and designing processes congenial for ease of doing business.**

The MMDR Act 2015 permitted exploration of blocks only by the Central and State Government companies/ agencies, leading to allotment through auction. MMDR Amendment Act 2021 allowed the private companies also to explore blocks for auction, funded through NMET. The private explorers are required to obtain accreditation for undertaking exploration and preparing Geological Report (GR). However, the exploration agencies in the Government sector such as GSI, and DMGs of the State Governments, CPSEs such as MECL, CMPDIL, and others and State and Central PSUs are exempted from this accreditation scheme. The accreditation list also includes some private companies that belong to the Indian pre-independence era and responsible for establishing the mineral industry best practices. Since the accreditation was proposed to assure quality GR to prospective investors, **all the explorers, irrespective of Government or Private, must be treated at par and subjected to the same quality assurance and quality control protocols** in undertaking exploration and preparation of GR.

The MoM, vide Order dated 12.08.2021, issued guidelines for notification of accredited private exploration agencies developed by the National Accreditation Board for Education and Training (NABET), under the second proviso to sub-section (1) of section 4 of the MMDR Act, 1957. The exploration agencies already accredited for coal and lignite exploration under sub-rule 21C of Mineral Concession Rules, 1960 can be accredited through supplementary assessment. The NABET has developed a Scheme for accreditation of private agencies for undertaking mineral exploration and preparation of GR. It is applicable to all minerals for which MoM has made policy enactments. The NABET shall grant accreditation to exploration agencies in accordance with the Rules/ guidelines prescribed/ specified under the MMDR Act, MEMC Rules 2015 and amendments thereafter. One complete 3-year cycle of accreditation process comprises Initial Accreditation, Surveillance Assessment and Re-accreditation, and is renewable every 3 years. The accreditation scheme has the provision for accreditation of exploration under two categories viz. Category-A and Category-B.

The Ministry of Coal (MoC), at present, adopted the NABET developed Accreditation scheme for Prospecting/ exploration Agency (APA) and Mining Plan Preparation Agency (MPPA). However, a Mining Plan for major and minor minerals has to be prepared by a Qualified Person as outlined in Mineral Concession Rules and approved by the Indian Bureau of Mines/ State governments, respectively. The Mineral Resource and Reserve vocabularies and / or definitions appearing in the NABET prepared schemes or the MEMC Rules are not in harmony with any internationally recognised public reporting standards and universally accepted by the financial institutions or global stock exchanges. To instil confidence in prospective investors on our technical reports, and attract the much-needed private investments in non-bulk minerals exploration and mine development in India **the Government should adopt the globally recognised CRIRSCO compliant Indian Mineral Industry Code (IMIC)** for reporting of Exploration Results, Mineral Resources and Mineral Reserves in lieu of MEMC Rules and NABET scheme.

- Editor

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## NEWS FROM THE MINING WORLD

### ► **Coal import target to be hiked to 15 per cent for 'erring' power companies**

The power ministry said on Wednesday that it would increase the coal import target to 15% for power generating plants that were not following its directive to meet 10% of their fuel requirement with imported coal. The ministry's warning came even as Rajasthan chief minister Ashok Gehlot alleged on Tuesday that the Centre was forcing states to purchase imported coal, which costs three times the fuel produced in the country, for blending. He urged the Centre to remove the requirement of purchasing imported coal. Rajasthan may have to bear a burden of ₹1,736 crore if it purchases imported coal, he said. The All India Power Engineers Federation, meanwhile, said since the coal crisis was not the fault of state power generating houses, the Centre should bear the additional cost.

The power ministry said on Wednesday if the orders for the import of coal for blending were not placed by electricity generation companies by the end of this month, and if the imported coal for blending did not start arriving at power plants by June 15, then the defaulters would have to import 15% of coal requirement up to October 31.

"Not much blending has taken place in April and May, the power plants (who have not yet started blending by imported coal) will ensure that they blend coal at the rate of 15% up to Oct 2022," the statement said.

*ET Bureau | May 19, 2022*

### ► **Global diamond trade fractures under the weight of Russia sanctions**

Udachny, Alrosa's biggest diamond mine. Near city of Udachny, Yakutia. Photo by Alrosa.

Russia's invasion of Ukraine is fracturing a billion-dollar trade that spans the permafrost-laden diamond mines of Siberia, secretive trade houses in Antwerp, dusty polishing powerhouses in India and New York's glittering designer jewelry stores.

Russian mining giant Alrosa PJSC supplies about a third of the world's raw gems, and US sanctions against the company are causing panic in the industry. Firms from Tiffany & Co. to Signet Jewelers Ltd. have announced plans to suspend sales of Russian diamonds. With wedding season looming in America, desperate delegations have been seeking a workaround from India, the world's largest exporter that cuts and polishes nine of 10 stones.

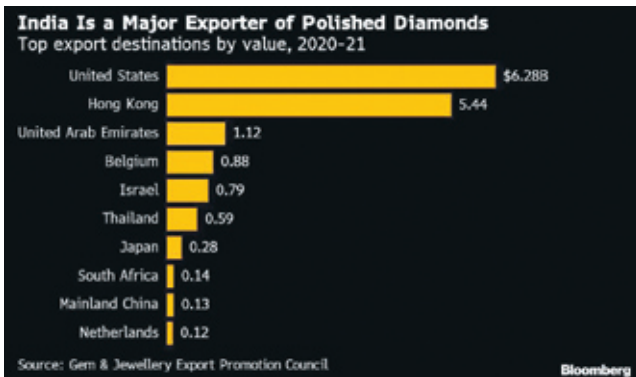
The US relies on India for close to half its diamonds. That makes New Delhi an unmatched stakeholder in managing the fallout and keeping shops on Fifth Avenue stocked. Disruptions could crimp supplies across North America and cost India \$2.5 billion this quarter, or nearly 10% of its annual sales. As pandemic restrictions ease, Signet and other jewelers expect 2.5 million weddings in the US this year, the highest number in four decades.

In the Indian city of Surat, one of the world's largest polishing hubs, the diamond bazaars have gone quiet in recent weeks. Workers sit idly and grumble over cups of tea. Imports of new stones are down. Prices have fallen. Practically everybody has the same complaint: Sanctions have pushed exporters into a tough spot. "Normally the streets are chock-a-block with buyers and sellers," said Manish Jain, a trader who was commiserating with several others on a hot day last month. "Prices suddenly dropped after the war began and we are now left holding high-valued stocks with no buyers."

For now, a caveat in US sanctions allows imports that are "substantially transformed" in a country like India, though lawmakers are pushing to close loopholes. But polishers say some clients have started refusing Russian-mined stones, characterizing them as conflict diamonds. With so much uncertainty, India's traders are preparing to mark the origin of every stone — re-routing Russian ones to friendlier markets in China, Southeast Asia, or the United Arab Emirates.

India is still exporting Russian diamonds to the US since the current stock was obtained pre-sanctions. But that supply will run out by the first week of June, according to Vipul Shah, vice chairman of India's Gem & Jewellery Export Promotion Council. And while many European countries have yet to restrict imports of Russian luxury goods, the list is growing there, too. The UK announced that high-end items from diamonds to caviar would be prohibited or heavily taxed.

De Beers, the world's second major diamond provider, is also limited in cranking out more gems. The company now only carries working inventory stocks and its mines are running at full tilt. There is little chance of material increases in supply before 2024, when an expansion at its flagship South African mine is slated for completion. "It's very difficult to see us bringing on any new production," Bruce Cleaver, chief executive officer of De Beers, said in an interview in Cape Town.



Losing access to Russian diamonds over the long term would devastate the industry, Shah said, jeopardizing thousands of jobs in India and hitting major trading centers across the world. Alrosa canceled its last sale in April and is unlikely to sell any large volumes again this month, according to people familiar with the situation. The price of a small rough diamond, the type that would end up clustered around the solitaire stone in a wedding ring, has surged about 20% since the start of March, the people said.

“Diamonds are not like oil, where some other country can jump in to make up for a shortfall,” Shah said. “No new mines are coming up elsewhere. Our dependence is huge.” Gems and jewelry are India’s third-largest source of export revenue, pulling in about \$39 billion for the fiscal year that ended in March. In Manhattan’s diamond district, where salesmen corral tourists outside dozens of neon-lit stores, dealers said business has stalled over the past few months. The war is the latest blow to a market beleaguered by supply chain woes, slowing mine production and rising inflation.

Avi Davidoff, a consultant at Leon Diamond, said customers are now asking if stones are coming from Russia — though interest is still more muted than after the release of the Hollywood movie “Blood Diamonds,” which centers on ones mined in African conflict zones. “The cherry on top is no one knows where this war is going,” he said.

Sanctions from the US have caused friction in New Delhi. While much of the West remains united against Russian aggression, India, which considers Moscow a close political and trade ally, continues to import oil, weapons and commodities. That has provoked irritation — and sometimes out-right fury — from NATO allies and Washington power-brokers. They see Prime Minister Narendra Modi’s subtler approach to Russia as a betrayal of a fellow democracy.

The quagmire facing India is one shared by many nations with long-standing ties to Russia: In a hyper-

globalized economy, how do you placate sparring allies while also protecting domestic growth? It’s a riddle with no clear answers. India is the world’s largest buyer of Russian weapons, though the overall trade relationship is fairly limited. Officials are mulling ways to continue doing business after the US and European Union blocked Russia from SWIFT, the Belgium-based cross-border payment system operator. One approach involves Russia depositing rubles into Indian banks, where they would then be converted into rupees.

A delegation from Alrosa visited India last month and met customers and trade groups to discuss selling diamonds using that workaround, people familiar with the matter said. But talks were inconclusive, the people said, and officials remain sensitive to provoking the US, which sees India as a regional check on China’s power. Alrosa declined to comment.

Amitendu Palit, a senior research fellow in South Asian studies at the National University of Singapore, said India faces a “tough, complicated balancing act” in managing “pro-Russia and pro-rest of the world stances.” American commerce secretary Gina Raimondo has likened a ruble-rupee arrangement to “funding and fueling and aiding President Putin’s war.” “Challenges are likely to increase if the conflict continues for a long time,” Palit said. “There will be tacit pressure on India to shift away from Russia for its trade.” With no longer-term solution in place, traders are getting nervous in Surat, an industrial hub in Modi’s home state of Gujarat.

The city houses about 5,000 polishing units, ranging from those that employ hundreds of workers to ones with just a handful of people. In Mahidharpura, the biggest bazaar, traders use tweezers and magnifying glasses to inspect thousands of gemstones bound for Western jewelers. There are so many polishers that some spread cotton sheets on the streets and do their work outside. Factories are bubbles of calm. Often the only sound is the hum of a radio playing the Ramayana, an ancient Hindu epic. At B. Virani & Co., which supplies to clients such as Tiffany, employees work 10-hour shifts at a turntable-like machine that cuts diamonds. Salaries hover around \$450 a month.

On a recent visit, traders said they were working on borrowed time. Smaller factories, some of which have been in operation for decades, would be the first to go should sanctions persist. Several units have already started reducing working hours. The messy logistics of separating Russian stones — which are typically no bigger than a few millimeters — from ones mined in places like Africa or Canada could derail the industry, which employs about a million people in Surat. Abhishek

Baid, a third-generation trader, said it's a prospect that worries everybody. "A trained eye may be able to differentiate diamonds of varying origins due to the color, but to do this on a larger scale will be impossible," he said.

*Bloomberg News | May 12, 2022*

### ► **Mining is key to the energy transition, but it's still unloved**

Mining is probably the most vital sector to the global energy transition and the success of the much-vaunted net-zero carbon emissions by 2050 targets. Still, it's currently the laggard in the process. The mining industry is largely at an inflection point insofar it knows its raw materials are the building blocks of the move from fossil fuels to clean energy, but it can't seem to convince the rest of world that this is the case.

The overwhelming message from miners, and investors at two major mining conferences in South Africa this week is that the situation is urgent, and getting worse. The challenges do seem pressing, given the vast volumes of copper, lithium, cobalt, nickel, zinc, manganese and graphite that will be required, and the limited plans to develop new mines to produce the metals needed. The mining industry faces several issues that it needs to address, but still seems to be grappling with how to get its message across.

These include, how to convince investors that the real action in mitigating climate change has to be at the very start of the process, namely producing raw materials, rather than at the end, namely making electric cars and things like solar panels. Once convinced, the battle then becomes to get investors to put capital into new mines, which are often located in challenging jurisdictions and will take several years to return a profit. Even if you can get that far, the process of dealing with governments is fraught, even in developed mining countries such as Australia.

There is a myriad of development and environmental approvals to be secured, local communities to be consulted and won over, and then transport and logistical issues to be overcome. And even if you can succeed to this point, the cost of developing new mines is rising at a faster pace than the price of the commodities they produce. In other words, just because copper has traded this year at record highs above \$10,000 a tonne doesn't mean that building a new copper mine is necessarily an economic no-brainer. And finally, the mining industry has to battle its largely negative image problem and its ongoing association with the climate bogeymen of coal miners. Mines tend to be scars on the countryside, even well-managed and environmentally sound projects often

look like blighted landscapes with large open pits, heavy vehicles, processing plants and tailings dams.

Investing in a shiny new Tesla motor car or a household battery wall unit looks far more attractive than a copper mine in Zambia or Indonesia. Perhaps this explains why Tesla trades on a price-earnings ratio of about 106, while the world's biggest mining company BHP Group has a P/E ratio of 9.96 and peer Anglo American has one of just 5.95.

The question for the mining industry, and the broader energy transition, is how mining reverses the current lack of interest and urgency.

### **Total change**

It seems likely that commodity prices will have to remain at historically high prices, while being less volatile, in order to convince those with capital that the returns are viable. Governments will have to do much more to speed up permitting and environmental approvals, and finally, those with an interest in meeting the net-zero by 2050 will have to overcome their innate distaste for mining.

A panel of investors at the 121 Mining Conference in Cape Town this week saw speaker after speaker lament the lack of government urgency, the seeming lack of interest among the major mining companies to build new mines, the reluctance of banks to finance projects and the poor image of mining among green investors, notwithstanding how vital metals will be to the energy transition. "We have to totally change the image of the mining industry," said Brian Menell, chief executive of investment company Techmet, adding that only this would serve to attract investors focused on environmental, social and governance (ESG) issues.

Lloyd Pengilly, chairman of Qora Capital, said a "quantum leap in demand" coming for battery metals that the industry is in no position to meet. Taking graphite as an example, Pengilly said the current global market for the battery anode component was about 1 million tonnes per annum, of which China controlled about 650,000 tonnes. This needs to double to 2 million tonnes within five years in order to meet battery demand, but there are only a handful of graphite projects under development, and even if all proceed, which is unlikely, it still won't meet the expected demand.

The message may be starting to get across, with South African President Cyril Ramaphosa delivering a mining-friendly address to the Mining Indaba event on Tuesday, pledging his government will fix transport infrastructure, and electricity generation while making exploration and

building mines easier. However welcoming the change in rhetoric may be, the words need to be followed with action to avoid a crunch of raw materials that threaten the intended pace of the energy transition.

*Reuters | May 11, 2022*

► **Fertilizer buyers are eyeing Canada to fill global potash deficit**

Canada's ample potash deposits are drawing "high levels" of interest around the world since sanctions upended global fertilizer markets.

Saskatchewan is capturing "renewed interest" in its potash resources due to disrupted supplies of the key fertilizer from Belarus and Russia, according to Bronwyn Eyre, energy and resources minister for the western Canadian province. Saskatchewan has the world's largest potash deposits and Eyre said the provincial government is working with companies to encourage more production of the mineral and expects to see "a growing demand for new projects" in the coming years.

"We are a critical-minerals powerhouse and we can be a bigger one," Eyre said in a phone interview. Fertilizer markets have been in disarray since the U.S. imposed sanctions on Belarus, and from economic measures taken against Russia following its invasion of Ukraine in February. Russia and Belarus account for about 40% of global potash production and exports, according to Saskatoon, Saskatchewan-based Nutrien Ltd., while Canada is the other major source for the commonly used fertilizer that contains potassium.

Saskatchewan has roughly 1.1 billion metric tons of potassium oxide, enough to supply the world for several hundred years, according to the province's energy ministry. Only a small fraction of that is in production, with 10 mines in the province operated by K+S Potash Canada, Nutrien and Mosaic Co. Saskatchewan produced a record 14.2 million tons of potash last year. BHP Group has a \$5.7 billion project to build what will be the world's largest potash mine in the province.

Saskatchewan expects an uptick in exploration and mining projects, though it takes awhile for new mines to get up and running, Eyre said. "It's a case of supply meeting demand right now," Eyre said. "That does take some time."

*Bloomberg News | May 3, 2022*

► **India eases green rules for coal mines to tackle fuel crisis**

India has eased environment approvals for coal mine expansions to boost output amid fuel shortages that

have triggered hours-long blackouts. Some existing sites will be able to raise production by a further 10% without requiring new impact assessments and rules on consulting local residents have been loosened, according to a government note. The changes come after the coal ministry flagged "huge pressure on domestic coal supply," the message said.



*Photo of coal mine in Jharkand, India by Nitin Kirloskar, sourced from Flickr.*

Coal supplies at power plants are shrinking amid a grueling heat wave that's pushed electricity demand to a record in recent weeks, with several facilities operating with critical reserves of the fuel, power ministry data show. Blackouts and curbs on supply to some industries have prompted street protests.

The fuel accounts for more than 70% of India's electricity generation, and the country's coal mining and transportation infrastructure is failing to keep pace with rising demand. A lack of railway carriages to transport the fuel from mines to power plants has exacerbated the shortages.

Changes will last for six months and follow complaints that lengthy processes to win environmental approvals could hamper efforts to ease the crisis. Miners are aiming to quickly accelerate output before a rainy season arrives in late June, which can flood operations and slow down production rates.

Weakening environmental regulations could ultimately prove counter-productive, according to Sunil Dahiya, an analyst with the Centre for Research on Energy and Clean Air. Bypassing public consultation risks creating friction between mining operations and local communities, which can result in delays from protests and legal challenges.

"Policymakers think such exemptions bring an ease of doing business, whereas the reality is exactly the opposite," Dahiya said. "It's a very myopic vision by the environment regulator."

The environment ministry's exemption is valid for mines that have already won approvals to expand output by 40% and will allow them to produce as much as 50% more than the original planned capacity.

India should stick to its decarbonization goals to avoid future supply shocks, and take action including modernizing the electricity grid and adding capacity to produce solar and wind equipment, according to Vibhuti Garg, an energy economist at the Institute for Energy Economics and Financial Analysis. "The long term solution is to build more renewable energy," she said in a Bloomberg Television interview.

*Bloomberg News | May 11, 2022*

### ► **Desperate for coal, India's metal makers hunt for fuel overseas**

A coal crisis in India has forced producers of sponge iron — a steelmaking feedstock — to scour the planet for supplies to keep their mills running, adding to inflationary pressures as they turn to pricier imports.

Jindal Steel & Power Ltd., which is running its sponge iron plants at 40% capacity as it doesn't have enough of the fossil fuel, has contracted orders for 150,000 tons of thermal coal each for the months of May and June from South Africa and Mozambique, according to Managing Director V.R. Sharma. That's the most it has ever imported in a month, he said. "There is no coal available and we are at a hand-to-mouth situation now for inventories," Sharma said in an interview. "We have to keep on importing coal till the time domestic coal is not available."

India's battling an energy crisis that is threatening to cut production in the world's biggest sponge iron industry. Industries are running out of the fossil fuel as state-run behemoth Coal India Ltd. diverts most of its output to power plants to keep the lights on amid worsening blackouts. The situation has been made worse as global coal prices have surged on tight supply, adding to the persistent inflation pressures in the South Asian country.

In the central state of Chhattisgarh, a hub for iron ore and steel-making, sponge iron makers are running at about 60% of usual levels, the Chhattisgarh Sponge Iron Manufacturers Association said last month. India's sponge iron industry may ship in as much as 35 million tons of coal this financial year, 30% more than a year earlier, according to the Sponge Iron Manufacturers Association. Sponge iron is a steel-making raw material produced after heating iron ore at high temperatures using carbon in the form coal or gas.

South African and Australian traders have been flooding the industry group with queries on the quality and

prices of coal that mills need, as "they know that India will have to import a lot of coal because of the energy crisis," according to Deependra Kashiva, executive director at the sponge iron group.

### **Long-drawn crisis**

"The coal situation is very bad in India," as inventories are drying up and the availability of railway carriages to transport the material gets tougher, Kashiva said in an interview. Mills are ready to pay a higher premium for coal in e-auctions as "they are desperate to run their plants," he said, adding that companies don't want to miss out on the booming export demand for steel.

India's steel exports jumped 25% to 13.5 million tons in the financial year ended March, according to government data.

"The government or Coal India should try to cap coal prices" to rein in energy costs, Sharma said. The country should also speed up environmental clearances and set a production deadline for miners that have won leases in auctions to bring more output quickly, he said.

"Because this is not a one-day situation. This will remain forever. This will remain in December also and next March also and next June also," Sharma said. "The faster the mines start production, the better it is for the country."

*Bloomberg News | May 9, 2022*

### ► **Tycoon Adani's Australia chief says shunned coal needs support**

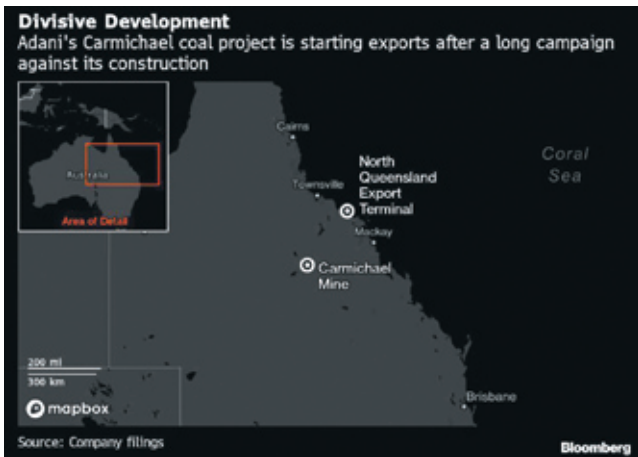


*Adani's Carmichael project, pictured here, is the largest coal mine in Australia and it took eight years to be approved.*

Billionaire Gautam Adani's top executive in Australia is calling for more support for a coal sector that's being shunned by banks and insurers in the shift away from fossil fuels. Lawmakers must protect the industry by "ensuring coal communities can access reasonably priced finance and insurance services," Lucas Dow, chief executive officer of Adani Australia, said Thursday in a text of a Sydney speech. "It's time for our political

leaders of all colors to step in and act where the market has failed.”

Dow’s appeal comes before a national election on May 21 in which the role of coal, the nation’s second-biggest commodity export, is again the focus of debate. A squeeze on international energy markets due to the war in Ukraine is lifting short-term demand for Australian coal, while legislators are also being pressed to accelerate climate action and plan for a future in which the fuel’s global role diminishes.



Adani began shipments from its self-funded Carmichael mine, inland from Australia’s iconic Great Barrier Reef in Queensland state, at the end of 2021 after years of opposition from environmental activists to insurance firms and Wall Street banks.

Coal companies are seeking government support to help establish a self-funded mutual insurance system, according to Dow. “While demand for Australian coal remains strong, the prosperity and sustainability of coal mining communities is being put at risk by the actions of banks and insurers,” he said.

*Bloomberg News | May 4, 2022*

➔ **Holcim to sell India business to Adani in \$10 billion deal**

Swiss building-materials firm Holcim Ltd. agreed to sell its Indian operations to local billionaire Gautam Adani, currently the richest person in Asia, another step in Chief Executive Officer Jan Jenisch’s pivot away from traditional cement.

The company will sell its 63% stake in Mumbai-listed Ambuja Cements Ltd. to Adani Group, it said in a statement Sunday. Adani said it plans to spend about \$10.5 billion on the stake purchases and open offer consideration for Ambuja and related entities. As part

of the deal, Adani will inherit Ambuja’s controlling stake in another publicly traded cement producer, ACC Ltd., and buy Holcim’s direct 4.5% holding in the unit. Holcim expects to receive 6.4 billion Swiss francs (\$6.4 billion) of cash proceeds from the sale, according to the statement. “We have quite a list of businesses we would like to acquire, so I think we can put this money here very well to use,” Jenisch said in an interview on Sunday. “At the moment, we’re working on more than 10 deals.”

Jenisch, who joined Holcim in 2017 from Sika AG, has been selling non-core cement businesses and buying new construction companies to benefit from rising demand for energy efficient buildings. As part of the strategy to expand the so-called solutions and products division, he has spent about \$5 billion for acquisitions including Malarkey Roofing Products in December and Firestone Building Products in early 2021.

The 55-year-old German, has been cleaning up the company after the messy mega merger of Holcim and France’s Lafarge SA in 2015. Jenisch divested a Brazilian unit for \$1 billion in September and Asian businesses such as Holcim Indonesia in 2019.

Holcim’s sale of its Indian business — which is subject to local regulatory approvals — is expected to close in the second half of 2022, helped by the fact that Adani doesn’t have sizable overlap. The company began reviewing new asset sales over the last year after the roofing acquisitions, and concluded negotiations with a handful of potential Indian buyers in about three months, Jenisch said.

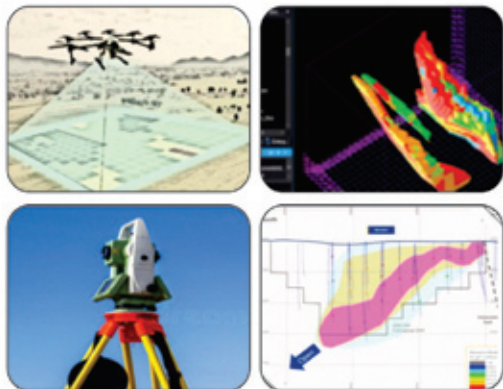
**‘Position of strength’**

“That’s something important to us that we have a strong balance sheet,” he said in the interview, adding that quick completion, the right price and good fit were key to choosing the winning bidder. “It’s always wise to be in a position of strength and have the opportunity to realize transactions and not to think about, oh, how can I raise this money.”

For Adani, the deal gives Asia’s richest person a foothold in the subcontinent’s fragmented cement sector. His group beat out other local companies including JSW Group, according to people familiar with the matter. Bloomberg News previously reported that Adani Group was in advanced talks with Holcim. Adani Group is offering 385 rupees per share for Ambuja Cements, a 7.2% premium to Friday’s closing price, according to Sunday’s statement. It will pay 2,300 rupees per share for ACC. The conglomerate has been moving beyond its core business of operating ports, power plants, coal

*(Continued on page 28)*

## Vision to Enforce Digital Base compliance



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## MEMBERS' NEWS

A two-day long refresher course on the 'Best Practices in Mineral Resource Estimation' was offered on 30<sup>th</sup> April & 1<sup>st</sup> May 2022 by Dr. Abani R Samal, Principal and owner of GeoGlobal LLC (<https://geoglobal.co>) at the GSN Symposium (<https://www.gsnsymposium.org/>) held at Reno Nevada, USA. Nearly 900 participants from throughout the USA and abroad attended the Symposium.

Dr. Samal is planning to offer a similar program online (live) for mineral industry professionals in India in the third quarter of 2022.

For further information, Dr Abani Samal may be contacted at [arsamal@geoglobal.co](mailto:arsamal@geoglobal.co)



Attendees of the short course with the instructor (Dr Abani Samal) in the middle



## Mining Engineers' Association of India

### 2<sup>nd</sup> COURSE OF MPDP (MEAI PROFESSIONAL DEVELOPMENT PROGRAM)

Enthused by the phenomenal success of the first Course of MPDP, MEAI launches the 2<sup>nd</sup> Course in the month of **September 2022** On line.

The previous course was successfully held on line on WebEx platform in the month of **March 2022** on three consecutive weekends and was well attended by **35** participants from 10 reputed mining organizations including NMDC, Tata Steel, MSPL, HGML, JSW, OMC, NALCO, BAUMA, Sai Universal Mining Services besides a few independent consultants.

**26 technical sessions** were held by 15 eminent faculties and industry experts covering 20 relevant subjects. Participants were awarded Certificates of participation. **Attendance and Assessment** test are mandatory for all participants to be eligible for the MPDP Certificate.

An added attraction of the MPDP Course is that the **RCPs** who attend the course would get **40 credit hours!**

#### FEEDBACK FROM PARTICIPANTS

Feedback from participants of the first Course of MPDP is appended below:

- On Course Duration: **ADEQUATE:** 89.70 %; **TOO LONG:** 03.03 %; **TOO SHORT:** 07.27 %
- On Course Content: **OUTSTANDING:** 17.25 %; **EXCELLENT:** 65.50 %; **GOOD:** 17.25 %
- On Faculties: **OUTSTANDING:** 27.60 %; **EXCELLENT:** 58.60 %; **GOOD:** 13.80 %
- Meeting Personal Objectives: **YES:** 75.90 %; **NO:** NIL; **PROBABLY:** 24.10 %
- **EXCERPTS:**
- Overall, the Program was Excellent
- Thank the Organizers for the Wonderful effort
- It was a very knowledgeable program with good sessions
- This type of Professional Development Program may be conducted half yearly
- Overall, informative Sessions
- Include more topics on Mine Safety and Costing
- This type of Courses are Best for off line training
- Overall, the topics were related and very informative

#### SCHEDULE

The 2<sup>nd</sup> Course is scheduled as follows:

**Sept 09<sup>th</sup> (Fri), 10<sup>th</sup> (Sat), 16<sup>th</sup> (Fri), 17<sup>th</sup> (Sat), 23<sup>rd</sup> (Fri), 24<sup>th</sup> (Sat) & 25<sup>th</sup> (Sun).**

**Inauguration** On Sept 09<sup>th</sup> (Fri): **09:30 AM / 10:30 AM**  
Sessions: 09:00 AM / 05:15 PM

**Sep 25<sup>th</sup> (Sun):** Session I: 09:00 AM / 10:30 AM  
Participants feedback;  
Assessment: 10:45 AM

**Valedictory Function:** 11:15 AM / 12:15 PM

#### COURSE FEE

For MEAI Members: Rs. 15,000.00 + 18% GST  
For Non-Members of MEAI: Rs. 20,000.00 + 18% GST

Interested professionals may please contact:

The Secretary General, MEAI at [meai1957@gmail.com](mailto:meai1957@gmail.com) /  
Phone no: 040- 66339625/ 040-23200510 or

Mr. Deepak Vidyarthi, Chairman, Training, Development & Program Committee of MEAI at [vidyarthikud@hotmail.com](mailto:vidyarthikud@hotmail.com) for more details.

Payment of **Course fee** may be made on line at A/c No. **037810100028696**; IFSC: UBIN0803782; Bank: UNION Bank of India, Nampally Branch, 5-4-445, Nampally Station Road, Hyderabad 500 001

#### REGISTRATION

Please click on to the following link for Registration: <https://forms.gle/Sb7Cg66Sanbr8QP98>

**Hurry up ! We have limited Seats !! Allotment would be on First Come First Served Basis !!!**

**Deepak Vidyarthi**

Course Coordinator, MPDP /  
Chairman, Training,  
Development & Program Committee of MEAI



# OCCUPATIONAL HEALTH HAZARDS IN MINES AND ORGANIZATIONAL INTERVENTIONS IN INDIA.

Mandapalli Raju

## *Abstract*

*Employees who work in mines face occupational health hazards. They are mainly due to unsafe and polluted working conditions at work places resulting in health hazards and some of them lead to chronic diseases. A few important causes are dust, mine gases, noise, heat, humidity, vibration, ergonomic hazard, radiation resulting in occupational health hazards. Various organizational supports incorporated by the government to improve working conditions for employees work in mines are indicated. Activities of DGMS, NIOH and other related organizations and their yeoman services working towards alleviating occupational hazards of miners and mining sector are also briefed.*

### **1. Introduction**

The mining industry is known for its risky and hazardous working environment. Mines can often pose dangerous occupational hazards which can become difficult to address them effectively. Occupational hazards are risks associated with working in specific occupations. With this assumption, we take it for granted that the mining industry is always hazardous. Studies in the field indicated that many incidents in the industry take place because of human error, the control of which would enhance safety levels in working sites to a considerable extent. It is essential to create awareness of the fact and employees should be encouraged to participate to promote safety culture. Various initiatives need to be taken on a continual basis to convey the gravity of the issue. Though there are laws to address health and safety concerns, their implementation is a big task due to multiple reasons. In fact, issues like mine safety, miner's safety, occupational health hazards and their causes are interrelated and hence their study and corrective measures overlap many times. Further, problems related to open-pit mining, underground mining and oil & natural gas extraction are also similar in nature many times, barring a few specific issues. Hence, it is attempted to outline a generalized picture on this broad subject, without dealing much with specifics.

Miners face more risky and worse working conditions compared to employees of many other professions. Even the technical expertise needed for a miner is no way less. But the importance and remuneration miners get is comparatively low. A modern miner should have adequate basic education with an aptitude for mechanical work and to lead a very hard life style. Considering the developments made in the process of working, such as introduction of instrumentation and its application, the miner should be receptive and enterprising. The entire success of a particular mining project revolves around the capabilities of the miner. A receptive mind, flair for hard work, with a sense of adventure and military discipline

build an efficient miner. As a result, the miner turns out to be a dedicated and committed soldier of a mining project, no way less than a military assignment.

Over commitment, perceived physical environment, work-family conflict, marital status, education, monthly income, and weekly working time are considered significantly associated with depressive symptoms of miners, which may lead to accidents at work sites. Apart from accidents, miners are also associated with a few occupational health hazards due to their continuous exposure to a mix of pollutants, chemicals and many other irritants in the environment, which can badly affect their health. It attempts to brief a few commonly reported hazards in mines, both underground and on surface, for a better comprehension. Miners' exposure varies with the job, its proximity to the source of hazards and the effectiveness of hazard control methods. However, policies and safety measures continue to be updated to ensure disasters do not take place in mines, there are still measures the industry needs to ensure hazards are minimized and workers are kept safe. Various organizational support and administrative interventions are incorporated by the government to improve working conditions, to provide support to employees working in mines. A few measures enhancing the safety of the mining sector are highlighted.

### **2. Prominent causes of health hazards in mines**

It was noted since prehistoric times that workers in mines of copper, lead, silver and mercury among others, had a limited span of life, mainly due to the toxic effects of the metal and aggravated conditions of work. Subsequently, efforts were initiated to protect them from such hazards through developing awareness and eventually by legislation. Two main factors are common in an occupational disease: (i) the causal relationship between exposure in a specific working environment or work activity and a specific disease; and (ii) the fact that the disease occurs among a group of exposed

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persons with a frequency above the average morbidity of the rest of the population. It is not necessary that all types of hazards listed need to occur at any single mine. However, occurrence of one is enough to deteriorate working conditions and affect many at such work places.

**i. Mine Fire:** Mine fires and explosions can be destructive and dangerous especially in underground mines. They occur normally in coal mines, and may occur even at the most protected places too. There can be a number of vulnerable areas in a mine that can trigger a fire and traditional fire extinguish systems may not always be suitable for certain mine environments. Because of this, it is necessary to focus on fire hazards and fire safety measures in the mine safety program. Nevertheless, preventive measures against such fire accidents are inevitable and at the same time to provide adequate safe emergency exit passages within the reach. Some of the common causes of fire accidents could be like, friction generated from defective bearings in conveyor idlers, drums and wheels/axles, running in spillage and seized brakes on vehicles, internal combustion engines, including exhaust systems, air inlets, hot surfaces, spontaneous heating of coal in the waste, electrical sparks, short circuit and earth failure on electrical equipment, explosives and detonators, compression of air or gasses, smokers' materials like cigarettes, lighters and matches etc.

**ii. Inundation:** Sudden inrush of water into a working mine creates inundation at mine working space and can also turn devastation in a mine causing miners trapped and die underground. There are many reasons for mines to get flooded in such a way. A few reasons could be, unsafe conditions in the mine itself, explosions removing impervious strata and exposure to pervious horizon, which can lead to an inrush of water into mined space; lack of proper infrastructure which may prevent leaks, broken water mains and pipes etc.

**iii. Strata failure, roof collapse and slope failure:** Roof collapse in a mine can occur due to several reasons. Strata failure due to inherent joints and other discontinuities present in the rock strata are common causes of roof collapse in a mine. Accidents in mines can occur where miners work with the support of pillars and timber posts and their failures to support roofs can fatally affect miners working underground. The roof of a mine can become unstable and cave in, resulting rocks and debris possibly striking workers. Inadequate and improper support measures provided, excavation to wider rooms of ore are commonly attributed to such failures. Slope instability, steep slopes of cut slopes in surface mining can also develop into similar hazards.

**iv. Blasting:** Many fatalities in underground mines related to explosives, as the blast was too close to the miner or because the rock is thrown much farther than expected in both surface and underground mines. There are a few

accidents with premature blasts, which are caused due to carelessness or are accidental due to faulty wiring and fuses. The explosive products used in surface and underground produce a variable quantity of toxic gases. Harmful concentrations of such gases are more likely to appear in underground confined environments. An efficient, well-designed and maintained ventilation system is key to prevent or mitigate the risk. The explosive or pyrotechnical products that remain on the ground or in the muck pile might be triggered by any subsequent mechanical effect during digging, milling or crushing stages of the mining process, causing injuries or fatalities to operators.

**v. Toxic Contaminant:** Considering the atmosphere underground is confined, the contaminants may include dust, aerosols, diesel fumes and particulates, and fumes from blasting, as well as gasses released from the rock strata. Mine ventilation is the key to extract or dilute the toxic contaminants to a harmless level.

**Engine exhaust:** Diesel engine exhaust is a complex mixture of gases, vapors and particulate matter. The most hazardous gases are carbon monoxide, nitrogen oxide, nitrogen dioxide and sulphur dioxide, besides many volatile organic compounds (VOCs), such as aldehydes and unburned hydrocarbons, polycyclic aromatic hydrocarbons (PAHs) and nitro-PAH compounds. Nitrogen oxides, sulphur dioxide and aldehydes are all acute respiratory irritants. Diesel particulate matter consists of small diameter (<1 mm in diameter) carbon particles that are condensed from the exhaust fume and often aggregate in air in lumps. The particulate matter is carcinogenic and can increase the risk of lung cancer. The generation of diesel exhaust can be reduced by improved engine design and by using high quality, clean and low-Sulphur fuel.

**Methane:** Methane, a naturally occurring gas in coal mines, is an odourless, tasteless, colourless, inflammable, lighter-than-air, formed by the decomposition of organic materials. Methane's low density causes it to concentrate in the higher parts of underground mines. If ventilation is insufficient, methane levels attain about 5%, and if ignited, can turn to a violent explosion that may result in further explosions in the presence of combustible coal dust. Fires and explosions are common hazards of coal mines. Risk of explosion can be reduced by diluting methane to below its lower explosive limit and by prohibiting potential ignition sources in face areas, where the concentration of gases is usually at their maximum. Drainage of methane from coal seams and from overlying formations is an effective technique to alleviate methane emission problems in coal mines. It needs proper design, excavation plans to suit the specific geologic conditions present in the mine area.

**Carbon monoxide and other gases:** Gaseous hazards include Carbon monoxide, a highly toxic gas, found mostly

in engine exhaust. The conventional practice to avoid excessive exposure to such gases and dust is to wait until mine ventilation removes them from the mine before re-entering into the area. Normally, after a gas explosion in an underground mine, a large amount of poisonous CO gas is generated, with the maximum concentration reaching about 7–8% of air, which far exceeds the minimum concentration of 0.0024% allowed in a normal work environment. In order to eliminate or minimize CO, techniques like cryogenic process, pressure swing adsorption, catalytic oxidation, and porous media adsorption are normally adopted. Catalytic oxidation method is yet another method, considered convenient, fast, economical, and environmentally friendly for CO elimination.

**Mercury, arsenic, nickel:** There are varieties of other airborne hazards to which particular groups of miners are exposed. Exposure to mercury vapor, and thus risk of mercury poisoning, is a hazard among gold miners and millers and among mercury miners. Exposure to arsenic, a risk of lung cancer, occurs among gold miners and lead miners. Exposure to nickel, also to risk of lung cancer and skin allergies, occurs among nickel miners.

**Plastics:** Some plastics are finding their use in mines also. These include urea-formaldehyde and polyurethane foams, both of which are plastics made in-place. They are used to plug up holes and improve ventilation and to provide a better anchor for roof supports. Formaldehyde and isocyanates, two starting materials for these two foams, are respiratory irritants and both can cause allergic sensitization making it nearly impossible for sensitized miners to work around either ingredient.

**vi. Airborne Particulate matter:** Nano particles are common in the mining environment. They may be more toxic than large sized respirable particles. Particulate matter is the sum of all solid and liquid particles suspended in air, many of which are hazardous. If they are inhaled directly, they can have adverse effects on human health. Details of a few such particulate matter commonly associated with mining are briefed here.

**Free silica:** Free crystalline silica is the most abundant compound in the earth's crust and, consequently, the most common airborne dust that miners and quarry-workers face. Free silica is silicon dioxide that is not chemically bonded with any other compound as a silicate. The most common form of silica is quartz. Respirable particles are formed whenever silica-bearing rock is drilled, blasted, crushed or otherwise pulverized into fine particles. Sandstone can be up to 100% silica, granite up to 40%, slate, 30%, with lesser proportions in other minerals. Exposure can occur in any mining operation, surface or underground, where silica is found in the overburden of a surface mine or in the roof, floor or ore deposit of an underground mine. Silica can be dispersed by

the wind, by vehicular traffic or by earth-moving machinery. The most common processes that produce respirable silica dust in mining and quarrying are drilling, blasting and cutting silica-containing rock. Freshly fractured silica dust appears to be more reactive and more hazardous than old or stale dust. This may be a consequence of a relatively higher surface charge on freshly formed particles. With sufficient exposure, silica can cause silicosis, a typical pneumoconiosis that develops insidiously after a few years of continuous exposure or depends on the sensitivity of the individual. Exceptionally high exposure can cause acute or accelerated silicosis within months with significant impairment occurring within a few years. Exposure to silica is also associated with an increased risk of tuberculosis, lung cancer and of some autoimmune diseases, including scleroderma, systemic lupus erythematosus and rheumatoid arthritis. Systemic Lupus Erythematosus (SLE) is an autoimmune disease, in which the immune system of the body attacks healthy tissue, affecting skin, joints, kidneys, brain and other organs. Several methods prevail to estimate cumulative exposure to respirable crystalline silica (RCS) that reduces lung function to an extent corresponding with airway obstruction equivalent to chronic obstructive pulmonary disease (COPD). As per a specific study report, the estimated threshold value for the exposure concentration is 0.089 mg/m<sup>3</sup>. Using this threshold, the estimate for the corresponding reference dose for RCS is 2.33 mg/m<sup>3</sup>.y. The analysis confirmed that RCS has a negative impact on lung function. The effect is primarily due to exposure above a concentration threshold of 0.1 mg/m<sup>3</sup>. The study recommended that COPD should be compensated as an occupational disease if cumulative exposure was at least 2 mg/m<sup>3</sup>.y above this threshold.

**Coal dust:** Respirable coal dust is a hazard in underground and surface coal mines and in coal-processing facilities. It is a mixed dust, consisting mostly of coal, but can also include silica, clay, limestone and other mineral dusts. The composition of coal mine dust varies with the coal seam, surrounding strata and mining methods. Coal dust is hazardous to workers if it is suspended in air outside the controlled environment of grinding and combustion equipment. It poses the acute hazard of forming an explosive mixture in air and the chronic hazard of causing pulmonary illness in people who inhale excessive quantities of it. Explosion can be prevented by controlling the coal-dust concentration below LEL, which, furthermore, can be used to estimate the dangerous threshold of coal-dust layer thickness and accumulation. The lower explosible limit (LEL), also known as the minimum explosible concentration (MEC) is the lowest concentration of dust cloud that will allow combustion. Coal dust is generated by blasting, drilling, cutting and transporting coal. The generation of coal dust can be reduced by changes in coal cutting techniques and its dispersion can be controlled with the use of adequate ventilation and water sprays. Coal dust causes coal workers' pneumoconiosis (CWP) and contributes to the occurrence

of chronic bronchitis and emphysema. Coal of high rank (e.g., high carbon content such as anthracite) is associated with a higher risk of CWP. There are some rheumatoid-like reactions to coal dust as well. Further, inhalation of coal dust can cause a disorder, known as ‘miner’s lung’ or ‘black lung’. It is a form of occupational lung disease group pneumoconiosis. It varies in severity, but symptoms include shortness of breath and scarring of lung tissue, which can cause many respiratory issues. Occupationally related airway diseases include asthma and chronic obstructive pulmonary disease (COPD).

**vii. Noise:** Mines are normally noisy places, with the constant of drilling, movement of heavy machinery, blasting and transportation of the ore etc. The underground mine usually has limited space and thus creates a reverberant field. Noise exposure is greater underground than if the same sources were in a more open environment. There could be potential for hearing damage issues, the main culprit in it could be segmental vibration. It sounds normal to mentally get used to loud noises, but that does not mean that damage is not being done. Many people do not notice the damage to their hearing until long after they are first exposed to the noisy environment, as most damage occurs very slowly. Over-exposure to excessive noise can result in tinnitus (ringing in the ears), sleep disturbances, concentration problems and even permanent hearing loss. To protect workers against noise, mining companies should evaluate working conditions and noise exposure through risk assessments. It is also necessary to use proper personal hearing protection amongst noise-exposed employees. Deep mines can become very warm, making hearing protection devices more uncomfortable to wear for longer work shifts. Hearing protectors combined with regular audiometric testing is often necessary to preserve miners’ hearing. Once the loss is acquired, it is irreversible. Efforts to prevent occupational hearing loss have been hindered because the problem is insidious and occurs without pain or obvious physical abnormalities in affected workers. Directorate General of Mines Safety (DGMS) prescribed the permissible noise level of 90 dB (A) in a shift of 8 hours for unprotected ear, whereas the “warning limit” is fixed at 85 dB (A) and 90 dB (A) is the “danger limit”. It is recommended that precautionary measures such as using personal protective equipment, periodical rotation in the job task and workplace, timely health check-up, specifically audiometry test should be performed. Detailed job specific (task based) exposure assessment needs to be carried out in the mining environment to ascertain the extent and degree of exposure.

**viii. Vibrations:** *Whole body vibration (WBV)* is a slow forming physical hazard that affects the mineworkers and other occupations working with heavy machinery. In the mining environment, WBV can be caused either by spending a lot of time sitting on machinery, which is most of the time in mining extraction. Some forms of vibrations are dangerous

when they involve uneven surfaces, vehicle activity such as ripping versus pushing material in a bulldozer, and engine vibrations etc. A few more places that produce vibration in mining and quarrying are drilling, blasting and cutting rock. Most holes drilled for blasting are done with an air powered percussion drill mounted on a tractor crawler. The hole is made with a combination of rotation, impact and thrust of the drill bit. Air not only powers the drilling, it also blows the chips and dust out of the hole, which if uncontrolled, injects large amounts of dust into the environment. The hand-held jackhammer or sinker drill operates on the same principle but on a smaller scale. Symptoms of WBV include musculoskeletal disorders, reproductive damage in females, vision impairment, digestive problems and cardiovascular changes. The risk may be minimized by replacing manned with unmanned machines such as remotely controlled conveyors. Where risks cannot be avoided, should reduce working hours of the employee on the machine each day. The primary characteristics of whole-body vibration are vibration frequency, magnitude, direction and duration. Vibration frequency is expressed as the reciprocal of the period in hertz (Hz). Magnitude is expressed as displacement, velocity or acceleration. In relation to the human body, direction is expressed in terms of vertical (head to foot), side-to-side (right to left) and back to chest. Duration is the time interval of the exposure.

*Vibration white finger (VWF)*, also known as hand-arm vibration syndrome (HAVS) or dead finger, is an industrial injury, triggered by continuous use of vibrating hand-held machinery. The symptoms of vibration white finger are the vascular component of HAVS, a disorder that affects the blood vessels, nerves, muscles, and joints of the hand, wrist, and arm. Most of devices used in drilling, blasting, track drill and the jack-hammer used in construction projects where rock must be drilled or broken to make a highway, to break rock for a foundation, for repair works and other purposes are source to convey significant amount of vibration to the operator and can lead to the risk of vibration white finger.

*Musculoskeletal Disorders:* Musculoskeletal disorders, such as low back disorders, are common in mineworkers. Although causes are complex, substantial evidence indicates some work activities and awkward postures as significantly contributing to the problem. Back pain is one of the most common and significant musculoskeletal problems of a miner. Every worker whose job involves stressful lifting tasks or awkward postures is at risk for such a disorder.

**ix. Thermal stress:** A common health risk that miners face is thermal or heat stress. Mining environments are often very hot and humid, which over time can cause thermal stress in workers. Heat is a hazard for both underground and surface miners. Very deep mines (deeper than 1,000 m) can pose significant heat problems. It is reported that the temperature increases 5° for an average depth of every 1,000 ft of depth. Other sources of heat stress include the

amount of physical activity workers are doing, the amount of air circulated, the ambient air temperature and humidity, and the heat generated by mining equipment. Overexposure to heat and humidity can cause the body to become fatigued and distressed. This can result in heat stroke or more serious health problems. It needs to control the temperature using engineering solutions, provide mechanical aids to reduce work rate and regulate length of exposure to hot environments. Central air-conditioning in mines can also be planned to suit the mine environment with cooling power plants on the ground and transporting cooling energy to heat exchangers underground is designed when the heat load of mine is more than 4 MW.

**x. Chemicals:** Mineworkers are often exposed to harmful chemicals. The most common group of chemicals that cause concern in a coal mining environment are polymeric chemicals. Regardless of the chemicals in close proximity, appropriate safety wear and precautions need to be taken to minimize exposure to them. Risks include chemical burns, respiratory problems and poisoning. Each chemical has a unique set of hazards and needs to be handled properly to ensure worker safety. A standard operating procedure (SOP) that addresses the use of correct personal protective equipment, safe handling and proper disposal should be established. Ventilation is an important factor in minimizing exposure, as well as general housekeeping and cleanliness. Thorough training and drills should be conducted regarding the company's spill response plans and chemical hygiene plans.

**xi. Radioactivity:** In case of Uranium mines, miners are at a risk of exposure to radon and its progeny. Radon is a naturally occurring radioactive gas that has been found in uranium mines and in tin mines. The primary hazard associated with radon is its being a source of ionizing radiation, which can be liberated from rock strata while it is loosened by blasting, but it may also enter a mine through underground streams. It is a gas and therefore it is airborne. Radon and its decay products emit ionizing radiation, which are carcinogenic, mostly affecting lungs; as a result, death rates from lung cancer among uranium miners are significant. Uranium mining is also involved with ototoxic effects of radiation, with more intense in the presence of other potential chemical agents like diesel exhaust, hydrocarbons etc. Ototoxicity is the property of being toxic to the ear, especially the cochlea or auditory nerve and sometimes the vestibular system, for example, as a side effect of a drug. The effects of ototoxicity can be reversible and temporary, or irreversible and permanent.

**xii. UV exposure:** Over-exposure to UV (ultraviolet) radiation in sunlight is a serious problem, which can turn to the risk of skin cancer, normally faced by open-pit miners. Not only do UV rays cause melanomas to form, but also can cause serious damage to eyes, if not wearing protective eyewear. Further, over exposure to the sun can cause dehydration,

headaches and nausea. Mine workers often spend whole days out in the baking hot sun, so are naturally at a very high risk of developing cancer and eye problems, if they are not adequately protected. The most effective way of reducing UV exposure is to use a combination of protection methods, including re-organizing work to avoid the UV peak of the day, providing natural or artificial shade, providing appropriate protective clothing, and applying sunscreen.

**xiii. Mine at great depth:** Increasing mine depths cause significant change in barometric pressure and enhanced ground temperature, a few common problems which can seriously affect the miner there. At great depths, violent failures of pillars and long wall faces and rock bursts produce extreme hazards to underground workers. Rock bursts may be reduced by proper mine layout and mine sequencing. Explosives used to drive openings for underground mines commonly damage beyond the perimeter of the opening often result from fractures extending from blast holes into surrounding rock mass, which may contribute later to unexpected rock falls.

**xiv. Allergic and Irritant Dermatitis:** Allergic and irritant dermatitis (contact dermatitis) is yet another important cause of occupational skin diseases. Research is needed to better identify the prevalence, causes, exposure assessment methods, and early biologic markers of this ubiquitous condition. In the workplace, the skin is an important route of exposure to chemicals and other contaminants.

**xv. Fertility and Pregnancy Abnormalities:** The inadequacy of knowledge coupled with the ever-growing variety of workplace exposures pose a potentially serious public health problem. Disorders of reproduction include birth defects, developmental disorders, spontaneous abortion, low birth weight, preterm birth, and various other disorders affect offspring. They also include reduced fertility, impotence, and menstrual disorders. Birth defects are also the leading cause of infant mortality. Many of birth defects and developmental disabilities are of unknown cause. Most of the problems have not been studied in detail, but specific case studies suspect the mine environment responsible for such issues.

### 3. Prominent hazards associated with oil and gas extraction activities

Workers in the oil and gas industries face the risk of fire and explosion due to ignition of flammable vapors or gases. Flammable gases, such as well gases, vapors, and hydrogen sulfide, can be released from wells, trucks, production equipment or surface equipment such as tanks and shale shakers. Toxic chemicals or gases encountered during these processes may present an additional risk of burns, asphyxiation, cancer, or system corrosion. Workers might be required to access platforms and equipment located high above the ground. It requires fall protection to prevent falls from the mast, drilling platform, and other

elevated equipment. Prominent causes of health hazards associated with the industry are, such as, diesel particulate matter, fatigue, hazardous chemicals, hydrocarbon gases and vapors, low oxygen environments, hydrogen sulfide, naturally occurring radioactive material, noise, silica and temperature extremes etc.

#### 4. Organizational interventions

The ILO-WHO Joint Committee was formed in 1950 to provide guidance to the ILO and WHO regarding international occupational health issues. The committee meets periodically. According to the Protocol of the Occupational Safety and Health Convention (2002), the term “occupational disease” covers any disease contracted as a result of an exposure to risk factors arising from work activity. The ILO Employment Injury Benefits Recommendation, 1964, defines occupational diseases as, ‘Each Member should, under prescribed conditions, regard diseases known to arise out of the exposure to substances and dangerous conditions in processes, trades or occupations as occupational diseases.’ 109<sup>th</sup> session of the International Labour Conference held at Geneva on December, 2021 also elaborated upon Occupational Safety and Health in Mines (coal and other mining sector)

Just for an historic perspective on Mines Safety, the then British Empire constituted a committee of experts in 1894, formulated regulations for mine safety and ensured regulated mining in India. The committee was also responsible for passing the 1<sup>st</sup> Mines act of 1901 which led to a substantial drop in mining-related accidents. The 1<sup>st</sup> Mines Act notified regulation, inspection of mines, and creation of the post of Chief Inspector of Mines applicable to the whole of British India. Main issues of the Act were to control mining activities related to safety to the operational area. The Act was repealed by a more comprehensive Act of 1923. It was again followed by ‘Indian Coal Mines Regulation’ and ‘Indian Metalliferous Mines Regulation’ of 1926, both were aimed at controlling methods of extraction and ensuring safety working in mines and also to study avoidable waste of non-renewable national assets of mineral resources. Subsequently, India made more comprehensive legislation during 1952. Mines Act, 1952 mostly deals with inspectors and certifying surgeons, powers of inspectors of mines, constitution of committees, duties and responsibilities of owners, agents and managers in mining operations and management of mines, hours of work and their wages etc. The Act also passed a legislation stating the minimum age of employment 15 years for surface and 16 years for underground; Women were not permitted underground but may work on the surface between 6.00 am and 7.00 pm; No person is allowed to work more than 6 days/week and up to 10 hours/day, inclusive of ‘overtime’. In exercise of powers conferred by the Mines Act, 1952, Ministry of Labour of the Central Government made Mines Rules in 1955. These Rules mainly deal with structure and appointment of Committees, Court of Inquiry, Certifying

Surgeons, medical examination of persons employed or to be employed in mines, workmen’s inspectors, safety committee and other medical issues, welfare amenities, accounts etc. Subsequently, in the MMDR Act, 1957, it was directed to take all such steps as may be necessary for conservation and systematic development of minerals in India and for protection of the environment by preventing or controlling any pollution, which may be caused by prospecting or mining operations. A perusal of the entire framework of rules, policies and Acts of the mineral sector of the country mostly concern Mining Policies or Mineral Trade Policies; facilitate mining entrepreneurs for their ease of doing business. Mine rules mostly pertain to administrative, commercial and managerial issues of mines and mining practices. Possibly, the issue of ‘safety of miner’ and associated ‘occupational hazards’ deserve more attention in its future framework.

- i. **NHRC:** The National Human Rights Commission of India is an embodiment of India’s concern for the promotion and protection of human rights. The NHRC recommended certain elaborate measures pertaining to survey, medical, preventive, remedial, rehabilitation and compensation aspects of Silicosis and other related mining health hazards. The NHRC also recommended establishing The National Commission on Occupational Health and Safety Committee to formulate comprehensive standards on Occupational Health and Safety. The NHRC also recommended constituting a joint committee of representatives of Central Pollution Control Board, State Pollution Control Boards, and other related departments so that proper coordination is established among these organizations and recommendations made by them and State governments take appropriate action.
- ii. **District Mineral Fund (DMF):** DMF was instituted under the Mines and Minerals (Development and Regulation) Amendment Act 2015. It has been conceptualized as a benefit-sharing mechanism with mining-affected communities. DMF’s objective is to ‘work for the interest and benefit of people and areas affected by mining’, through a participatory process. In September 2015, the Centre further aligned DMF with the Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY) scheme, to implement various developmental projects and welfare programs in mining-affected areas using DMF funds. Programs formulated like providing support to women self-help groups (SHGs) on micro enterprises to improve women participation in the workforce.
- iii. **OSHC Code, 2020:** The Code on Occupational Safety, Health and Working Conditions, 2020 (“Code”) received President’s assent on September 28, 2020. Its provisions will come into force from the appointed date to be notified by the Central Government. This Code, amongst others, seeks to regulate the engagement of contract labour by offices, shops, commercial, and industrial establishments, including factories, and repeal the existing Contract Labour (Regulation and

Abolition) Act, 1970 ("CLRA"). It is to consolidate and amend laws regulating the occupational safety, health and working conditions of persons employed in an establishment and for matters connected therewith or incidental thereto. The Code shall not apply to offices of the Central Government, offices of the State Government. The Code shall apply to Contract Labour employed through contractors in the offices of the Central Government or in the offices of State Government where the CG or SG is the principal employer. Along with many others, the Code applies to 'mines' also. Under this Code, every employee in an establishment shall have the right to obtain from the employer information relating to employee's health and safety at work. If the employee has reasonable apprehension that there is a likelihood of imminent serious personal injury or danger to health or death, he may bring the same to the notice of his employer directly or to the Safety Committee. In addition, the Central Government shall, by notification, constitute the 'National Occupational Safety and Health Advisory Board' to discharge functions conferred on the Code and to advise the Central Government on related matters. Further, the State Government shall constitute the 'State Occupational Safety and Health Advisory Board' to advise the State Government on matters related to the Code.

- iv. DGMS:** The Directorate General of Mines Safety, under the Union Ministry of Labour & Employment, having its headquarters at Dhanbad (Jharkhand) is an agency, which administers provisions of the government of India Mines Act, 1952 and, the Rules and Regulations framed there under. As per the Constitution of India, occupational safety, welfare and health of workers employed in mines (coal, metalliferous and oil-mines) are the concern of the Central Government. DGMS has a vision to attain risk and hazard free conditions of work and welfare of persons employed in mines. The directorate carries out the mandates of the Mine Act at all mining and mineral processing operations in the country, regardless of size, number of employees, commodity mined, or method of extraction, subject to excavations covered under the definition of a mine in the Mines Act, 1952. The non-statutory measures like organizing National Conference on Safety in mines, National Safety Awards in mining, Safety Weeks, and awareness programs are normally undertaken. DGMS conducted 12<sup>th</sup> National Conference on Safety in Mines, held on 28-29 January 2020 at New Delhi. The Conference deliberated upon and made certain valuable recommendations on related subjects, such as, (i) electrical safety, (ii) role of Information Technology in mining sector, (iii) prevalence of pneumoconiosis / silicosis amongst workers, status of dust control measures and strategy for improvement, (iv) strategies for disaster prevention in coal mines, (v) occupational safety and health issues of contractual workers – strategy to improve safety and health status etc.
- v. National Safety Awards (Mines):** NSA (Mines) are instituted by the Directorate General of Mines Safety, Ministry of Labour and Employment, GoI, in recognition of good safety performance in mines. These prestigious awards for safety of mineworkers in coal, metalliferous and oil mines are being presented to the mines every year in two categories: (i) Longest Accident-Free Period, (ii) Lowest Injury Frequency Rate.
- vi. NIOH:** The Indian Council of Medical Research-National Institute of Occupational Health (ICMR-NIOH), Ahmedabad, works under administrative control of the Ministry of Health and Family Welfare. The Institute has been working for many years towards improving the management of occupational health risks in India. The Institute is responsible for helping the national policy makers to develop the most suitable and effective policies for eliminating and reducing cases of work-related ill health and disease. The vision of ICMR-NIOH is to prevent and control occupation related health problems by creating a safer work environment through intensive research, development of appropriate technology for risk minimization and dissemination of knowledge thus generated. ICMR-NIOH undertakes and oversees multidisciplinary research aimed at developing the most effective technologies and programs for controlling workers' exposure to health hazards. Another important aspect of NIOH is developing education programs for training the country's doctors and other medical professionals on occupational healthcare.
- vii. NIMH:** National Institute of Miners' Health was an autonomous Institute under Ministry of Mines, located at Kolar Gold Fields, Karnataka and a Central Laboratory at Nagpur. Presently, the Union Cabinet has approved the merger of NIMH with ICMR-NIOH to enhance its expertise in the field of occupational health. The lab conducts applied research in occupational health and hygiene and specializes in providing technical support services to the mining and mineral-based industry with special reference to the metalliferous sector. It has the state-of-art infrastructural facilities and expertise for conducting Airborne Respirable Dust, Heat Stress, Vibrations, Noise Monitoring & Mapping, Illumination, ergonomic, surveys in underground and opencast mines and routine & specialized health surveillance of persons employed in mines.
- viii. CSIR-Central Institute of Mining and Fuel Research:** CSIR-CIMFR, Dhanbad, under Ministry of Science and Technology, GoI, has an R&D laboratory facility of international repute, a strong visibility to industry and society in Mine Environment Safety Engineering. The lab has facilities in areas of Mine Fire, Ventilation, Miner's Safety and health. The lab also has a facility

of study for spontaneous combustion and coal dust explosion. CSIR-CIMFR, Dhanbad and its Nagpur Research Center focus mainly on rock excavation and mine modeling techniques for safety of a mine.

### 5. Conclusions & recommendations

Despite many efforts, vulnerable conditions continue to exist in mines. The exposure to such vulnerable conditions may be minimized to a working miner by minimizing his working hours in a mine. The Mines Act prohibits employees from working in a mine more than six days in any one week, more than 48 hours in any week, or more than nine hours (or ten hours inclusive of overtime) on any day, subject to their employer's permission. It is opined that the working hours per day for an active miner in an underground mine could be suitably moderated. Concerned authorities may examine the issue in perspective of the industry. It will help the miner to minimize his continuous exposure to hazardous conditions, betterment of his health and output could be at his peak level.

Management needs to identify work places of hazards and risks in each mining operation, prepare a risk assessment and safety management plan for every mine. The mining

program should develop the means to continuously monitor data with the possibility of response via intelligent system analysis. The mining program should investigate the applicability of current or newly developed technology in detecting voids, especially those containing gases or water. Prevention, control, escape, survival, response, rescue etc., should be addressed in mine design and operations. Protective and rescue equipment to be provided in systems engineering framework to eliminate or to minimize occurrences of disastrous events and enhance chances of survival. Though the subject of occupational health hazards and safety measures is very commonly discussed in the mining sector, it is worth reminding often even at the cost of redundancy.

Prominent measures towards welfare and safety of employees in mines are contained in the Mines Act and Mines Rules. They mainly related to working conditions, sanitation provisions, working hours and penalties for non-compliance. Employers must also ensure compliance with the requirements of the legislation under the Mines Act. The DGMS is the regulatory agency overseeing compliance with mining safety laws and ensuring the safety, health and welfare of persons employed in mines.

## MINE SAFETY WEEK: MY UNDERSTANDING / MEMOIRES

Mining fraternity is very much aware of "Annual Mine Safety Week". It is a knowledge / technology / methodology / SOP sharing platform for the mining fraternity. Simultaneously, it is also celebrated as a "Festival" by the mining fraternity to restore safety awareness in the consecutive working days. Consequently, it is a scope to learn the different safe practices/ mine technology from different mines, which may help to adopt good practices for avoiding the incidents/ hazards, as well as to be a good reminder the whole year for checking wrong practices in mines. It is the best way to make all miners/ officers/ competent persons aware of the mine to achieve the zero accident free mines.

"Mines Safety Week" is celebrated in different mining regions by all the mines under the aegis of the Director General of Mines Safety, once in a year. A meeting with the mine organization/ Mine Managers is convened to plan and organize inspection of all the mines to propagate the message of safety & safe operating procedures among the mine workers. Accordingly, Six days for mine inspection and the last day or a convenient day is chosen as a final celebration program, after completion of the mines inspection/ other events. The entire mining fraternity eagerly awaits this final day to know the appraisal of the mines.

According to a meeting held under the aegis of the DGMS with mine organizations, inspection teams consisting of several groups, select the Manager (Mine) from different mines, which are formed based on the categorisation of the mines. Consequently, inspection teams may cover all the mines for inspection during the safety week period. One Mine manager from amongst each group is selected to lead the inspection team as its convener and the officials DMS/ DDMS may also join to monitor all the activities during the Mines Safety Week inspection period.

Mines Safety Week looks like a Festival for the mining fraternity where they engage their best efforts for their mines for obtaining the prizes. On the day of MSW the mine gets a new look through decoration by whitewashing & Colour, displaying safety-slogan board, housekeeping by dressing & levelling. They also update their latest knowledge; hold competitions like first-aid competition, modelling of the mine, trade test, publicity propaganda and others.

On the final day, miners also participate in a celebration program, which will remain memorable for the whole year and until the next year's Mines Safety Week.

**Kali Charn Bagdi,**  
BE (MINING), 1ST FIRST CLASS MANAGER (METAL/R)



## MEAI NEWS

### BELLARY-HOSPET CHAPTER

#### EXECUTIVE COMMITTEE MEETING

The Executive meeting & the Chapter's development Committee meeting were held on 09.05.2022 at 6.00 pm. The following members attended the meetings.

#### Office Bearers & Executive Committee Members

1. Sri. K. Madhusudhana - President, MEAI
2. Sri. K. Prabhakar Reddy - Chairman
3. Sri. S.H.M Mallikarjuna - Secretary
4. Sri. K. Krishnudu - Executive member
5. Sri. M.M Rakesh - Executive member
6. Sri. Jagadeeshwar S.M. - Executive member
7. Sri. Y.V.R. Krishna Reddy - Executive member

#### Development Committee Members

8. Sri. G. Laxmi Narayana
9. Sri. Chandrashekar Halli
10. Sri. P. Venkateswara Rao
11. Sri. T.L. Yoganand
12. Sri. Vishwajit Gosh
13. Sri. S. Ravindra
14. Sri. Jitendar Reddy
15. Sri. Suraj Kumar
16. Sri. L Gnana Pragasan



#### The following points were discussed:

1. Sri. Mallikarjuna, the Secretary of the Chapter welcomed all the members present for the meeting. He congratulated all the members and the staff of NMDC Ltd., Donimalai for their support in achieving the approval of the Training center for First aid at NMDC Ltd.
2. Sri. K. Prabhakara Reddy, the Chairman of Chapter has briefed regarding the approval obtained from Director General of Mines Safety, Dhanbad for the First aid Training at NMDC Ltd., Donimalai and thanked all the members and staff of NMDC Ltd., who supported in achieving the milestone. The Chairman asked all members to extend future support to impart the First aid training at NMDC Ltd., Donimalai.

3. The President of MEAI, Sri. K. Madhusudhana has greeted all the members that contributed their valuable time & effort in getting the approval of First aid centre at NMDC Ltd., Donimalai and He also expressed special thanks to Sri Sanjeev Sahi, the Chief General Manager, Sri. B. Sahoo the Executive Director, Sri. Jahadeswaran, the Dy. General Manager, the Doctor Smt. Sawarupa Padi, Sri. Siraj and Sri. Vinay Kumar from the NMDC Ltd., Donimalai.

The President declared that the BH Chapter is the first to get an approval to conduct the First aid training at NMDC Ltd. He suggested for formulating a sub-committee and Standard Operating Procedures for the purpose of First aid Training.

The President and the Chairman suggested that the standards of Training should be high and meet the guidelines issued by the Director General of Mines Safety in this regard.

4. The President and the Chairman informed the forum that the Inauguration of First Aid Training Centre at NMDC Ltd will be celebrated on 14.05.2022 and subsequently training classes for the 1<sup>st</sup> Batch will be commenced.
5. Opening of New Bank account: The Executive committed & Development committee members accepted to open a new bank account at Union Bank of India, Hosapete on the name of Mining Engineers Association of India, BH Chapter for the purpose of First aid Training.
6. Formation of sub-committee: The committee has decided to form a sub-committee for organizing, conducting the Training and to manage the matters. Sri. Chandrashekar Halli, Dy. General Manager of GVTC, Sandur is nominated as the Chairman of the sub-committee.

The following members are nominated for the sub-committee:

1. Sri. Chandrashekar Halli, GVTC, Sandur - Chairman
2. Dr. Swarupa Padi, NMDC Ltd. - Member
3. HOD (Training & Safety), NMDC Ltd. - Member
4. Sri. K. Krishnudu, MGVTS, Hosapete - Member
5. Sri. Gnanaprakash, Sandur - Member
6. Sri. M.M. Rakesh, Sandur - Member
7. Fee for the First aid Training: The committee has decided the Fee (including GST) to be charged for

imparting First aid training, which does not include any food or accommodation. One booklet of Training, both in Kannada & English Languages, shall be given to the candidates appearing for the Training.

- a) For MEAI Life Membership - Rs. 2,950/- candidates
  - b) For other candidates - Rs. 3,540/-
8. Charges for the Faculty: The committee discussed and decided the charges to be paid to the Faculty for taking the Training Classes and the Assessor (Examiner) as follows:
- 1) For 4 Hours Session for Trainers - Rs. 1,000/-
  - 2) For 2 hour Session for Trainers - Rs. 500/-
  - 3) Doctor for Training - Rs. 3,500/-
  - 4) For Assessor / Examiner for test - Rs. 3,500/-
9. The President Sri. K. Madhusudhana has suggested that one part-time clerk shall be appointed for the maintenance of records of Training and issue of Certificates on the basis batches of training.
10. Record maintenance: It was decided to maintain the following documents of First aid Training & Certification:
- 1) Proforma of the candidates appearing for the training
  - 2) Daily attendance register of the Trainees batch wise
  - 3) Register of Training batch wise
  - 4) Details of faculty classes conducted
  - 5) Register of Issue of Certificates to the Candidates
  - 6) Any other record required as per the Guidelines of DGMS

Shri. S H M Mallikarjuna, Secretary, BH Chapter presented the vote of thanks to the members at the end of the meeting.

## **BHUBANESWAR CHAPTER**

### **MEAI Technical Seminar held on 24 April 2022**

Mining Engineers Association of India (MEAI) organized its 3<sup>rd</sup> Council Meet at Bhubaneswar on 23 April 2022. On 24 April 2022, a National Seminar on "Technological and Digital advancements in Mining and Mineral Beneficiation" was organized in hybrid mode. It has witnessed very good participation and deliberations from the government and industry stakeholders on the recent advancements in mining and mineral processing.

The seminar was inaugurated by the Chief Guest Shri Prafulla Mallik, Hon'ble Minister, Steel and Mines, and Works,

Government of Odisha in the august presence of Shri Debidutta Biswal, Director of Mines, Government of Odisha, Shri K Madhusudhana, President MEAI, Shri D B Sundara Ramam, Vice President –III, MEAI & Vice President, Raw Materials, Tata Steel, Shri Pankaj Satija, Chairman, Bhubaneswari Chapter & Managing Director, Tata Steel Mining and other dignitaries.

Speaking on the occasion, Minister Shri Mallik said *Harnessing technology is imperative to make mining safer and more efficient from cutting-edge exploration technology using computer vision and sensing, to predictive monitoring systems that enhance worker safety through the Internet of things, AI and machine learning, to more efficient means of extracting value from increasingly low-grade deposits.*

Addressing the conference, Shri Debidutta Biswal said that there is a need for a well-developed Mining and Mineral beneficiation industry in India as it provides important raw materials to many industries, which are the backbone for economic development. The Government of Odisha has welcomed and adapted to the changing technologies in mining and has introduced revolutionizing systems like I3MS in the State.

Speaking on the occasion, Shri K Madhusudhana said MEAI would strive to act as a bridge between the companies, mining fraternity and the Government-both State and Centre. Capacity building will be the thrust area of MEAI going forward.

Shri Sundara Ramam said the importance of Technology introduction in mining has gained paramount importance over the years to improve safety, environment, and production. The topic chosen for the seminar is very apt as it will introduce the mining fraternity with the latest digital and technological developments in the field of mining.

Shri Pankaj Satija said the reason for the flourishing Mining Industry in Odisha is due to the progressive policies and handholding efforts of the Industry by the Government of Odisha. With the increasing usage of minerals in several existing as well as emerging applications coupled with new technologies, we can expect a paradigm shift that can change the way minerals will be produced and consumed in the future, he added.

The event enlisted the participation of key stakeholders of the mineral sector from policymakers, representatives of government, mining companies, MEAI fraternity from different states among others.

### **Technical Session Details**

1. Latest Technological Advancements in Blasting Technology in Mining by Shri Ankit Saxena (Technical

- Services Manager – Orica India), Shri Alok Rai (Digital Solutions Manager – Orica India)
2. Latest Technological Advancements in Mineral Beneficiation Technology in Mining by Mr Senthil kumar, Project Manager, FLSmidth
  3. Usage of Drone Technology in Mining by Shri Sambit Parida, Chief Technology Officer IG DRones
  4. Application of Microwave heat energy in mineral and material processing by Shri Raghupatruni Bhima Rao, Former Chief Scientist, CSIR-IMMT, Bhubaneswar

The conference explored efficient decision making through broader technological and economic upheaval brought about by rapid and disruptive digital innovations across mining, assessed the impact of different digital initiatives within the sector and quantify the value they could create for the industry and wider society, highlight the digital innovations that, over the next decade, have the greatest potential to create value for the mining and metals industry, its customers and wider society, etc.

The session ended with a vote of thanks proposed by Mr. Shambhu Nath Jha, Secretary, Bhubaneswar Chapter.



Lighting of Lamp by the dignitaries in the Inaugural session of the seminar



L-R: Mr. D B Sundara Ramam, Mr. K Madhusudhana, Mr. Prafulla Mallik, Mr. Debidutta Biswal and Mr. Pankaj Kumar Satija

### RAJASTHAN CHAPTER-UDAIPUR National Technology Day Celebration

Rajasthan Chapter-Udaipur celebrated National Technology Day on May 11, 2022 in association with Vigyan Samiti and the Institute of Engineers (India), Udaipur Local Centre in the premises of Vigan Samiti, Ashok Nagar, Udaipur. Shri Gulab Chand Kataria, Ex Home Minister, Rajasthan and presently

Leader of Opposition in Rajasthan Assembly graced the occasion as Chief Guest and congratulated the technocrats present on the National Technology Day. Shri Kataria underlined on the ability of Indian scientists in development of the country through international level research works. He put forward the example of two corona vaccines developed by India during the pandemic times, which immensely helped in serving mankind across the globe.



(L to R) Shri MS Paliwal, Shri YK Bolia, Shri Gulab Chand Kataria, Ex Home Minister, Rajasthan, Dr. NS Rathore, Dr KL Kothari, Founder and Head Vigyan Samiti & Dr KP Talesra, Vigyan Samiti.

The keynote speaker Dr NS Rathore, Vice Chancellor, Maharana Pratap University of Agriculture and Technology, Udaipur presided over the function. His talk explained in very colloquial words the need for 'Sustainable Development' as a key to the future of civilization. Future is not planning for tomorrow but is a result of what we are doing today. Sustainable Development means maintaining the natural resources balance by understanding the difference between the need and demand, avoiding over exploitation and that our practices should make ample use of science and technology in a fruitful manner to enhance the production concurrent to biosphere safeguard measures. Dr Rathore gave several examples of scientific and technological applications in agricultural fields including wheat, vegetable and milk production and animal husbandry in India since independence.



A view of Audience present on National Technology Day.

Welcoming the guests, Shri RK Chatur, President of Vigyan Samiti highlighted various activities undertaken by the Samiti in popularizing the science among the common folk and specially the students. Shri YK Bolia, President of Institute of Engineers (India), Udaipur Local Centre discussed the importance of giving opportunities to the talent to facilitate skill development. Such an initiative has a proven record in accelerating the national technology build up.

On this occasion, Dr DS Kothari Excellence Award was given to Shri Abhay Ji, Shri Shrimal Jain, Chairman, Life Cell International Pvt. Ltd., Chennai who joined in a virtual mode, for his outstanding contribution on Stem Cells preservation and applications of Nano-technology.



Vote of thanks was given by Shri MS Paliwal

Shri MS Paliwal, Secretary of the Chapter, extended vote of thanks. On this occasion, Shri Paliwal discussed the innovations and technologies in the mining field and informed the audience of the upcoming National Seminar on ‘Role of Innovations and Technology in Turnaround of Mining Industry’, scheduled to be held on 27-28 August 2022 in association with Hindustan Zinc.

(Continued from page 14)

mines and renewable energy and into areas like data centers, airports, digital services, retail and media.

A first-generation entrepreneur with a net worth of about \$100 billion, according to the Bloomberg Billionaires Index, Adani has been looking to transform his company into a multi-sector juggernaut like Mukesh Ambani’s Reliance Industries Ltd. Adani overtook Ambani as Asia — and India’s — richest man earlier this year.

**Adani’s motivation**

The deal for Ambuja will transform Adani Group into a sizable player in the cement sector. Founded in 1983, Ambuja has a cement capacity of 31 million metric tons, and has six integrated manufacturing plants

**DR ABANI R. SAMAL SELECTED AS SME FELLOW**

*Congratulations*

303-948-4220  
Fax: 303-973-2845  
Email: [sme@smeint.org](mailto:sme@smeint.org)  
[www.smeint.org](http://www.smeint.org)  
12969 E. Adam Avenue Circle  
Englewood, CO 80112

May 18, 2022

Abani R. Samal  
GeoGlobal LLC  
3347 W Corsica Dr  
Riverton, UT 84065-5581

Dear Abani:

On behalf of the Society for Mining, Metallurgy & Exploration, it is our pleasure to let you know that you have been selected to receive the designation of SME Fellow, Class of 2023.

SME presents its Fellow Award to a select few who have made sustained and notable contributions to the Society and to their industry. Through an extensive nomination and selection process, you have been chosen as one who meets these qualifications.

We are also pleased to invite you to the SME annual Awards Dinner where we are happy to honor you in person. Please note that to receive this award, it is a requirement that you attend the SME annual Awards Dinner on Wednesday, March 1, at the 2023 MINEXCHANGE SME Annual Conference & Expo in Denver, Colorado.

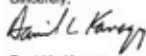
Carol Kiser is your SME point of contact for any questions or concerns you may have regarding the award or the Annual Conference. You may reach her via phone at 303-948-4225 or email at [kiser@smeint.org](mailto:kiser@smeint.org).

For publicity and planning purposes, please do the following via email no later than August 15:

1. Confirm with Carol your ability to attend the dinner and to accept the award.
2. Note that your name will be engraved as **Abani R. Samal** unless you notify Carol otherwise.
3. Send a color photograph—high-resolution jpg (not a picture within a word document).
4. Send a short biography (150 words or less). This will be printed in Mining Engineering.

Carol will contact you with more details regarding the award presentation as the date of the 2023 MINEXCHANGE SME Annual Conference & Expo approaches.

Abani, please accept my personal congratulations to you on being selected as a member of the 2023 Class of SME Fellows. I look forward to celebrating with you in Denver.

Sincerely,  
  
David L. Kanagy  
Executive Director and CEO

and eight cement grinding units in India, its website shows. “Our move into the cement business is yet another validation of our belief in our nation’s growth story,” Adani, chairman of his namesake group, said in Sunday’s statement.

Adani Group’s flagship firm Adani Enterprises Ltd. has two cement subsidiaries. Adani Cementation Ltd. is planning to build an integrated facility in the state of Gujarat, according to a compliance report in November. The group established Adani Cement Industries Ltd. in June 2021. Barclays Plc, Deutsche Bank AG and Standard Chartered Plc worked with Adani on the deal. Holcim led the transaction with its internal deal team supported by BNP Paribas SA, JPMorgan Chase & Co. and Perella Weinberg Partners.

*Bloomberg News | May 15, 2022*



## NACRI NEWS

### Virtual training program on IMIC-PDP-3 held by NACRI & MEAI

The third virtual training program on CRIRSCO approved Indian Mineral Industry Code (IMIC) for reporting Mineral Resources and Reserves was organised by NACRI with the support of MEAI. The program was held during 18 April 2022 and 13 May 2022 and was delivered in 12 sessions of 3 hours each.

This program was aimed at imparting specific knowledge on IMIC and the industry best practices in pertinent areas. This course was held to enable the mineral industry professionals to acquire the requisite mandatory professional development hours to register as Competent Person by MEAI, as outlined in the IMIC. The faculty members for this program included the NACRI Members and external professionals, who volunteered to share their knowledge and expertise applicable to IMIC.

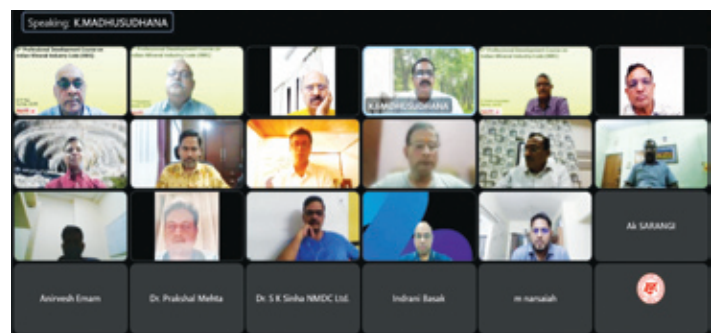
The Indian mineral industry supported this professional development program (PDP) by sponsoring professionals in significant numbers as delegates. 28 professionals occupying different executives' positions in various mineral industries & institutions attended the program. The delegates also included a few Indian mineral industry professionals based in Indonesia and Nigeria.

While the MEAI President Mr K Madhusudhana inaugurated the IMIC-PDP3 with least fanfare on 18-4-2022, the same was befittingly concluded on 13-5-2022 at 7.15 pm with the address of the Chief Guest Mr M. Mohan Reddy, Director Projects and Planning, NCL Limited and the Guest of Honour Mr Arun Kumar Kothari, former President of MEAI and former Co-Chair of NACRI. The NACRI founder Co-Chairs, Mr T Victor, Dr Abani Samal and Dr PV Rao also addressed the audience.

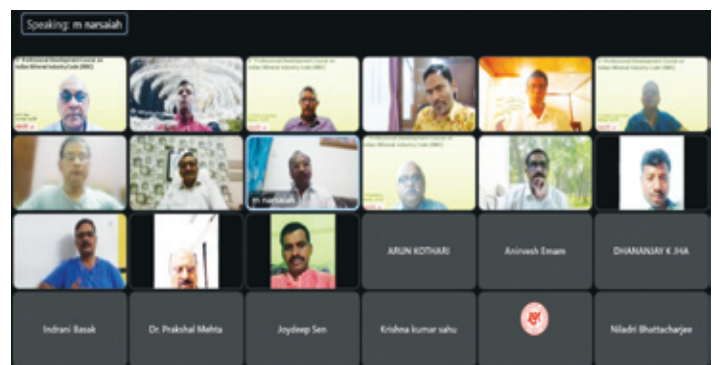
The MEAI President affirmed that the Association is not sparing any effort in attaining the legal recognition of IMIC as the public reporting system to report Exploration Results, Mineral Resources and Mineral Reserves in India from the Government, by approaching the concerned in the Government and stock market Regulators. Dr PV Rao articulated the initiatives undertaken by CRIRSCO by constituting exclusive committees/ subcommittees and engaging with subject experts, to keep abreast with the latest developments happening in the mineral industry

globally and update its International Template. Two such important initiatives to quote are incorporating the ESG (Environmental, Social and Governance) factors and guidance in CRIRSCO Template and Standards/ Codes of its members; and streamlining the system of reciprocity of CPs/ QPs amongst its members to enlarge CPs/ QPs opportunities to work across the geographies. The MEAI National Council recognised the growing association of ESG professionals with the mineral industry, in its last Council meeting held in April 2022, and referred the matter to its Bylaws committee for submitting its proposals to expand the list of educational qualifications to become a member of the Association.

Mr M Narsaiah, Secretary General MEAI, introduced the Chief Guest of the Concluding day program. Dr A Srikant, the NACRI-IMIC PDP Coordinator, conducted the concluding day program. Mr TR Rajasekar, Coordinator of IMIC PDP-3 proposed a formal Vote of Thanks to all the delegates, supporting organisations, MEAI Office bearers, NACRI members, and the faculty members.



Mr K Madhusudhana, President MEAI speaking in the Concluding Session



Mr M Narsaiah, SG, MEAI introducing the Chief Guest



Chief Guest Mr M. Mohan Reddy, Director Projects and Planning, NCL Limited



Participating Mining and Consulting Companies

**NACRI- IMIC- PDP-3 Schedule (18 April to 13 May 2022)**

Date	Unit/ Topic
	<b>1<sup>st</sup> Week (18-22 April 2022)</b>
18-04-2022	Inauguration- by President MEAI
	Introduction to IMIC Course
	1.1 Introduction to MEAI/ NACRI/ IMIC
	1.2 Scope of IMIC and Code of Ethics
	1.3 Competence and Responsibility
20-04-2022	2.1 Concept of RPEEE
	2.2 Reporting of Exploration Targets & Exploration Results
	2.3 Criteria for Sampling Techniques and Data; Reporting of Exploration Results
22-04-2022	B1 Best Practices in Exploration
	B2 Best Practices in Technical Studies - Drilling, Sampling, Storage
	E1 Evaluation Unit 1
	<b>2<sup>nd</sup> week (25 -29 April 2022)</b>
25-04-2022	3.1 Reporting Terminology & Reporting General
	3.2 Criteria for estimation and reporting of mineral resources
	3.3 Reporting of Mineral Resources, Mineral Resource Classes and Selection
27-04-2022	4.1 Appendix 1 - Generic Terms and Equivalent
	4.2 Reporting of Mineral Reserves, Mineral Reserve Classes and Selection
	4.3 Table 2- Study accuracy ranges for Capital and Operating cost estimates
29-04-2022	B3 Best Practices in Mineral Resource Estimation
	B4 Best Practices in Quality Control
	E2 Evaluation Unit 2

	<b>3<sup>rd</sup> Week (2-6 May 2022)</b>
02-05-2022	5.1 Resource plus Reserve and Total Material
	5.2 Reporting of Coal Exploration Results, Resources and Reserves
	5.3 Reporting of Metal Equivalents, Commodity Pricing and Marketing
04-05-2022	6.1 Criteria for estimation and reporting of mineral reserves
	6.2 Technical Studies - Scoping, PFS and FS and Guidelines for Studies
	6.3 Estimating Capital Costs and Operating Costs
06-05-2022	B5 Best Practices in Technical Studies - Mine Design
	B4 Best Practices in Geotechnical Engineering
	E4 Evaluation Unit 3
	<b>4<sup>th</sup> Week (9-13 May 2022)</b>
09-05-2022	7.1 Community and Sustainability Issues; Permitting and Legal Issues
	7.2 Reporting of Mineralized Fill, Pillars, Stockpiles, Dumps and Tailings
	7.3 Reporting for Gemstones, Industrial Minerals and Construction Materials
11-05-2022	8.1 CRIRSCO Template 2019/ PERC 2021 highlights
	8.2 Discussion on UNFC Framework, MEMC Rules and IMIC
	B7 Best Practices in Report Writing
13-05-2022	8.3 Latest Indian Acts, Rules & Regulations related to minerals
	B8 Report Layout and Content
	E4 Evaluation Unit 4
	Concluding day function – address by Chief guest



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Our founder Abheraj Baldota's core operating principle was 'I am not the owner of wealth, but a privileged trustee to serve the community with it'. Thus it is no surprise that ESG practices are ingrained in our corporate ethos, business strategy and operations since our birth in 1961.

We were the first Indian unlisted company to publish a GRI compliant sustainability report way back in 2006. We are a large producer of renewable power in India. We were also the first mining company in India to get certified for OHSAS 18001:1999 and ISO 14001:2004. Across the years, we have invested more than ₹820 Crore in ESG. From building blood banks to adopting villages and combating climate change, we have been practicing ESG long before it became a buzzword.



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## MEJ RIDDLES

Dear Readers of MEJ,

In order to increase the readership of MEJ, which has been felt essential in the interest of our ardent members, the mineral industry professionals as well as the mining sector, the Editorial Board of MEJ has decided to hold a monthly QUIZ. The monthly QUIZ will be designed and printed in MEJ based on the content published in the previous month's MEJ. The MEJ readers will be given five objective questions with multiple choices to choose; and expect them to respond with their correct answer by email to the Editor at [editormejmeai@gmail.com](mailto:editormejmeai@gmail.com) by 20<sup>th</sup> of the current month. If more than three members responded with the correct answers, then the three winners will be decided by draw. Each winner will be issued a certificate of merit and a nominal cash prize of Rs 500.

Request the members to participate in the QUIZ in large numbers and benefit from the enhanced knowledge by reading the Journal from end to end.

### Questions based on MEJ May 2022 issue

- 1. The MEJ May 2022 dedicated the special issue to which company?**  
(a) JSPL (b) Tata Steel  
(c) Vedanta (d) NMDC Limited
- 2. Which city will host the 26<sup>th</sup> World Mining Congress?**  
(a) London (b) Brisbane  
(c) Johannesburg (d) Brasilia
- 3. Which Chapter hosted the 3<sup>rd</sup> National Council Meeting of MEAI?**  
(a) Bangalore (b) New Delhi  
(c) Bhubaneswar (d) Nagpur
- 4. How much incentive (\$ billion) the Indian Government is offering to build battery cells locally?**  
(a) 1.8 (b) 2.0  
(c) 2.2 (d) 2.4
- 5. In principle, how many types of geological lithium deposits are classified?**  
(a) 3 (b) 2  
(c) 4 (d) 1

## WINNERS OF RIDDLES PUBLISHED IN THE MEJ MAY 2022 ISSUE

*Congratulations to proud winners*

**Mr Venkatesh Raju**

Email: [vraju25@gmail.com](mailto:vraju25@gmail.com)

**Mr P. Naveen Kumar**

Dy. Manager (Mining), NMDC LTD, Donimalai

Email: [poli09naveen@gmail.com](mailto:poli09naveen@gmail.com)

**Mr K.C. Bagdi**

Mines Manager, Deojhar site

Email: [kalibesu006@gmail.com](mailto:kalibesu006@gmail.com)

To receive the cash prize of Rs 500, the winners may please contact the Secretary General, MEAI on email at [meai1957@gmail.com](mailto:meai1957@gmail.com) or Mob. 9177045204.

# CONFERENCES, SEMINARS, WORKSHOPS ETC.

## ABROAD

**3-4 Jun 2022: International Conference on Trends in Web Mining**, Information and Knowledge Extraction ICTWMIKE. Rome, Italy. Contact URL: <https://waset.org>. Website URL: <https://waset.org/trends-in-web-mining-information-and-knowledge-extraction-conference-in-june-2022-in-rome>

**29-30 Jun 2022: Mining World Congress**. London, United Kingdom. Website URL: <https://miningconferences.org/>; Program URL: <https://miningconferences.org/agenda/>; Contact URL: <https://miningconferences.org/contact-us/>; Contact E-mail: [info@miningconferences.org](mailto:info@miningconferences.org)

**21-22 Jun 2022: Open Pit Operators Conference 2022 (#openpit2022)**. Perth, Australia and Online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

**18-20 Jul 2022: International Conference on Design Methods in Underground Mining ICDMUM**. Dubai, United Arab Emirates. Website URL: <https://waset.org/design-methods-in-underground-mining-conference-in-july-2022-in-dubai>; Contact URL: <https://waset.org>

**19-20 Jul 2022: International Conference on Land Reclamation in Mining Areas ICLRMA**. Copenhagen, Denmark. Website URL: <https://waset.org/land-reclamation-in-mining-areas-conference-in-july-2022-in-copenhagen>; Contact URL: <https://waset.org>

**9-10 Aug 2022: International Conference on Green Coal Mining Technologies and Techniques ICGCMTT**. New York, United States. Website URL: <https://waset.org/green-coal-mining-technologies-and-techniques-conference-in-august-2022-in-new-york>; Contact URL: <https://waset.org>

**12-13 Aug 2022: International Conference on Mining and Mineral Technologies ICMMT**. Venice, Italy. Contact URL: <https://waset.org>. Website URL: <https://waset.org/mining-and-mineral-technologies-conference-in-august-2022-in-venice>

**21-23 Aug 2022: IMPC Asia-Pacific 2022**. Melbourne, Australia and Online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

**14-15 Sep 2022: Lithium Battery and Energy Metals Conference 2022**. Perth, Australia and Online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

**10-12 Oct 2022: Australian Mine Ventilation Conference 2022**. Gold Coast, Australia and online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

**17-19 Oct 2022: International Mining and Resources Conference. IMARC 2022**. Melbourne, Victoria, Australia and online. Contact: [connect@imarcglobal.com](mailto:connect@imarcglobal.com); Australia: +61 (0) 3 9008 5946

**21-22 Oct 2022: International Conference on Mineral Processing and Mining ICMPPM**. London, United Kingdom. Website URL: <https://waset.org/mineral-processing-and->

[mining-conference-in-october-2022-in-london](https://waset.org/mining-conference-in-october-2022-in-london); Contact URL: <https://waset.org>

**08-09 Nov 2022: International Conference on Underground Mining Methods and Technologies ICUMMT**. Istanbul, Turkey. Website URL: <https://waset.org/underground-mining-methods-and-technologies-conference-in-november-2022-in-istanbul>

**18-19 Nov 2022: International Conference on Underground Mining Methods and Applications (ICUMMA)**. Singapore. Website URL: <https://waset.org/underground-mining-methods-and-applications-conference-in-november-2022-in-singapore>. Program URL: <https://waset.org/conferences-in-november-2022-in-singapore/program>.

**29 Nov - 1 Dec 2022: AusRock Conference 2022**. Melbourne, Australia and Online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

**27-28 Dec 2022: International Conference on Coal Resources and Coal Mining ICCRCM**. Vienna, Austria. Website URL: <https://waset.org/coal-resources-and-coal-mining-conference-in-december-2022-in-vienna>

**29-31 May 2023: MetPlant Conference 2023**. Perth, Australia and online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

**26-29 Jun 2023: 26<sup>th</sup> World Mining Congress**. Resourcing Tomorrow-Creating Value for Society. Brisbane, Queensland, Australia. Contact: Kristina Liska, Event and Registration Coordinator at [registration@wmc2023.org](mailto:registration@wmc2023.org)

**11-12 Jan 2023: International Conference on Land Reclamation in Mining Areas ICLRMA**. Singapore. Website URL: <https://waset.org/land-reclamation-in-mining-areas-conference-in-january-2023-in-singapore>

**18-19 Feb 2023: International Conference on Bauxite Mining and Alumina Refining ICBMAR**. Jeddah, Saudi Arabia. Website URL: <https://waset.org/bauxite-mining-and-alumina-refining-conference-in-february-2023-in-jeddah>

**4-5 Mar 2023: International Conference on Mining and Refining of Metals ICMRM**. Rome, Italy. Website URL: <https://waset.org/mining-and-refining-of-metals-conference-in-march-2023-in-rome>

**22-23 Apr 2023: International Conference on Recent Developments in Mining Technologies ICRDMT**. London, United Kingdom. Website URL: <https://waset.org/recent-developments-in-mining-technologies-conference-in-april-2023-in-london>

**3-4 May 2023: International Conference on Mining Technologies and Sustainable Systems ICMTSS**. Rome, Italy. Website URL: <https://waset.org/mining-technologies-and-sustainable-systems-conference-in-may-2023-in-rome>

**17-19 Jun 2024: Molten 2024**. Brisbane, Australia and Online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

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**TATA STEEL**

**#WeAlsoMakeTomorrow**



**#SteelFact**

Globally, extensive

**afforestation**

programmes are converting mines  
into habitats for local wildlife

Source: World Steel Association

\*Currently, an area of 563 hectares  
is covered via afforestation in  
our mining locations.

*\*Data as on October 2021*

**PLANTING  
DOUBLE THE TREES  
FOR A BETTER TOMORROW**

**BOTANICAL PARK, NOAMUNDI**

We are ensuring that the natural ecosystem in our mining locations is preserved. We have progressively implemented Biodiversity Management Plans at all our raw material locations in order to ensure no net loss in biodiversity.

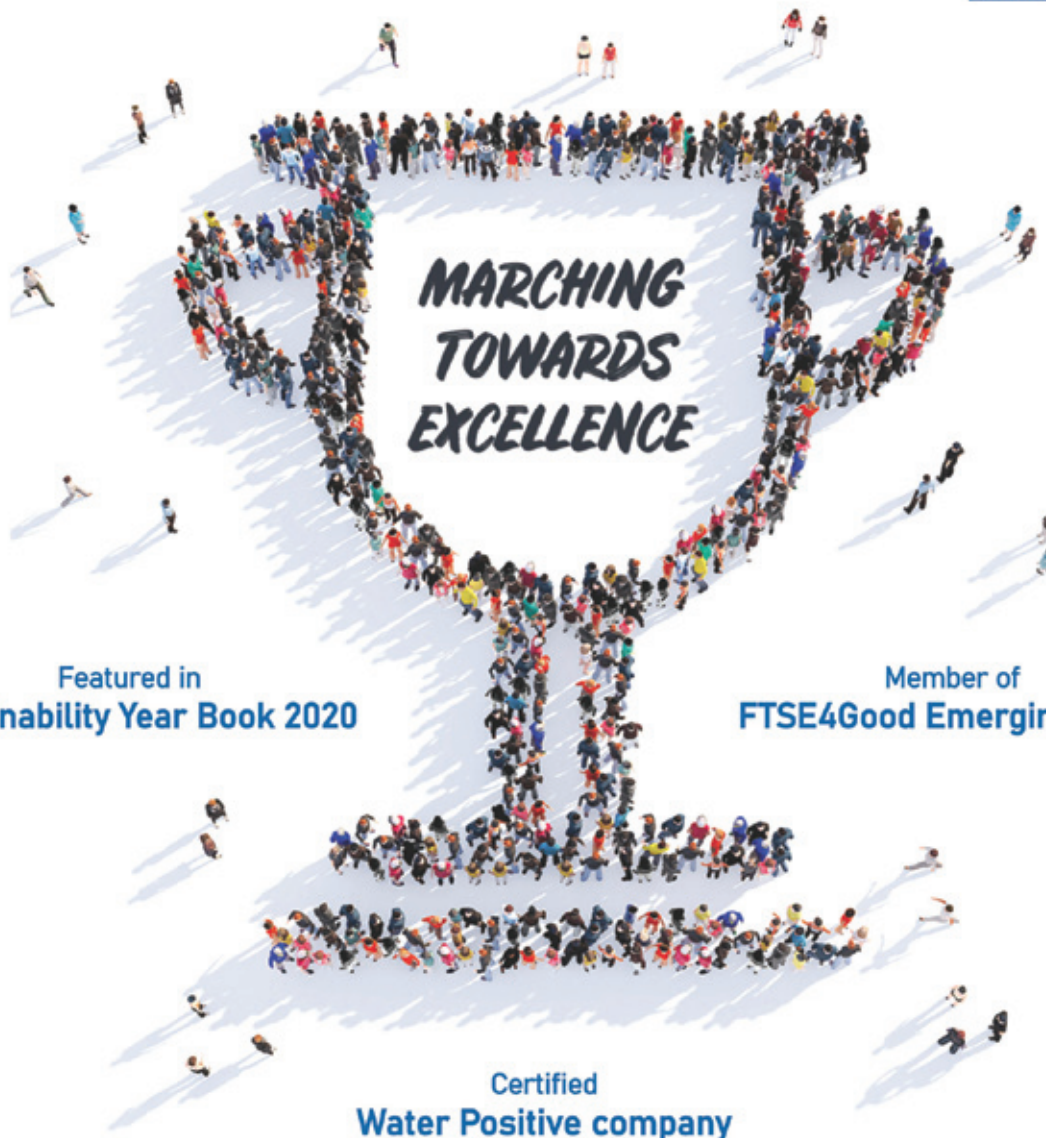
Sure, we make steel.

**But #WeAlsoMakeTomorrow.**

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