

# Mining Engineers' Journal



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MONTHLY

April - 2023



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*Eco-Friendly Miner*

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

**Dear Members,**

Greetings...

I wish to put forth the activities undertaken by our Association in the preceding month.

At the outset, I would like to congratulate all the mines that received 5-Star Rating Awards during "***Khanij Diwas Ceremony***" on 1<sup>st</sup> March 2023 on the occasion of 75<sup>th</sup> Foundation day of Indian Bureau of Mines (IBM) at Nagpur. We all know such recognitions cannot be achieved overnight and requires a lot of dedication from all the team members involved. I salute the winning teams that have shown a high level of commitment, dedication and hard work in accomplishing the prestigious award.

During my Nagpur visit, I met our Nagpur Chapter members and discussed the chapter activities. I also took the opportunity to meet Shri. M.M. Abdulla, Director (Production & Planning) MOIL and apprised about the ongoing MEAI activities and sought MOIL's support to the activities of MEAI.

I am extremely happy to share the news that DGMS has granted approval for opening MEAI – First Aid Training Centre at MEAI – Headquarters, Hyderabad and impart First Aid Training to issue certificates. The Chief Guest & Past President of MEAI Shri VS Rao inaugurated First Aid Training Centre in presence of Guests of Honour Shri. B.R.V. Susheel Kumar - Director, Govt. of Telangana and Shri. Md. Fasihuddin, Past President – MEAI at MEAI HQs Hyderabad on 24-03-2023. In the First Batch, 25 candidates approached for seeking training. After completion of training, the candidates will be evaluated and the successful ones will be awarded with First Aid Certificates.

I visited the Visakhapatnam Chapter on 10-03-2023, met the members and discussed the activities being undertaken by the Chapter. During this short visit, I got an opportunity to interact with the postgraduate students of the Geology department of Andhra University. I understood from the Students, that they were not getting enough training and Job opportunities. I appeal to our members/ organisations to accommodate the students wherever possible to nurture their career/ life.

I have been observing for many months and it actually has been a matter of great satisfaction that all the Chapters are organizing events with an aim of fulfilling the objectives of the Association. Some highlights of such efforts taken up recently are...

- Bangalore chapter in association with the Department of Mines and Geology, Government of Karnataka had organized a National Seminar on ***MINING SCENARIO - POST REFORMS*** at Bangalore on 25<sup>th</sup> March 2023. The response received from various stakeholders was overwhelming.
- Tamilnadu chapter had organized an ***International Mining & Mines Safety Expo-Symposium*** on 17 -19 March 2023 at Coimbatore in association with Tamilnadu Safety Association and Stone Quarry, Crusher & Lorry Owners Association. It has been a very successful program and has benefited many persons directly and indirectly connected to our fraternity.
- Further, kindly take a note of the change of venue of 7<sup>th</sup> Council meeting. Now it is scheduled on 14<sup>th</sup> April 2023 at Noamundi, Tata Steel. I request the Council members to take note of the change in venue as earlier it was planned to be held at Jodhpur. On the day following the Council meeting i.e on 15 April 2023, a one-day conference has been scheduled.

I appeal to all the Council members to participate actively and make this event meaningful and more successful.

Regards,

**K. MADHUSUDHANA**  
President



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## EDITOR'S DESK



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

In an article, entitled 'Ten mining challenges technology could solve' published in AusIMM Bulletin, the views well-articulated by Richard Price, MAusIMM are shared below for the benefit of our readers.

The resources sector is making great gains in automation and digitalization. However, there are still critical challenges facing the industry that, for the most part, could be solved by innovative professionals and technology.

1. *The liquefaction of tailings*: One of the most serious challenges of recent times has been tailings dam failures. While there are many underlying causes, one of the most pertinent is the fact that the waste products from the mineral processing are liquefied. Addressing this challenge will involve an as-yet undiscovered technological solution.

2. *Communicating to ever-deeper mines*: Around the world, mines are getting deeper and there are ever-present challenges of ongoing communications to assess stress damage, squeezing ground and rock bursts. Mining methods and support systems have evolved slowly to improve the management of excavation damage and safety of personnel, but damage still occurs, and personnel still are injured. Two-way communication, particularly with personnel, remains a challenge in such deep mines.

3. *Extracting minerals from lower grades*: In the past, it was commonly accepted that unless you were mining ten grams per tonne of contained gold, you were not making any money. Times have changed! Gold grades, for example, have decreased, as has the cut-off grades for all minerals. Technology will drive such cut-off grades even lower, by lowering exploration and exploitation costs. Increased plant automation and data analytics are already being applied to mineral processing and starting to achieve positive results.

4. *Small footprint mining*: Technology will continue to automate machinery, which will drive down onsite operational personnel required. The reduction in onsite operational personnel requirement will then reduce the environmental footprint that the mining industry currently has. The extractive operations of the future will be operated from remote places, whereby the machinery is driven by 3D CAD files that guide the drilling, blasting, loading and hauling unit activities. Mines will continue to require people, but their roles will change from operators to maintainers (still with managerial staff onsite), with an increased focus on data and IT skills needed.

5. *The 'home-away-from-home' challenge*: The promotion and protection of good mental health for fly-in, fly-out (FIFO) workers is beginning to be addressed. Although many mining companies now provide free telephony and WiFi onsite, it can remain an issue to communicate with loved ones during the time away. One possible future could involve holographic imagery and virtual or augmented reality – imagine being able to sit down to dinner with your loved one to eat the same meal, even though you are thousands of kilometers away!

6. *Discovering orebodies undercover*: It is well known that the Western Mining Corporation took around six years to discover the massive Olympic Dam orebody, which was covered under some 300 m of barren rocks. The orebodies that we have historically mined were literally walked over by rock kickers, but today the finds are much more difficult. Technology is already allowing us to analyze rock structures in more detail than ever before, thereby increasing confidence prior to drilling a discovery hole. The tools available to geologists will only get better as computers become more powerful and more data is harnessed in exploration.

7. *Underground coal mining and coal workers pneumoconiosis*: Coal dust and methane explosions still provide real and dangerous risks to underground coalmine workers. While the issue is complex and requires input from many professions and experts, the technology that solves these insidious issues will save lives.

8. *Water management*: Water – both supply and usage – is a big societal issue and it's one that presents an incredible opportunity for sensitive mine operators and innovators. Most mining operations utilize a significant amount of water from local suppliers in their extractive treatment plants. Reducing a site's overall water usage through various technologies, including recycling and reuse following sequestration, could be one of the major ways a company could gain a significant competitive advantage moving forward.

9. *Finding good people*: The search for the best professionals remains an ongoing challenge for the mining industry. We all know someone who has been approached by a company because of their online presence, such as through LinkedIn. Technology tools and sophisticated social networking and recruitment tools are likely to assist the resources industry in finding the best people – even if their current role is outside the sector.

10. *Social Licence to operate*: As resources professionals, we all understand the need for social license to operate. Technology can assist us in achieving this, especially in a world where public opposition to mining can delay and even deter new projects. Online platforms provide some two-way communication and, when used smartly, can be used to build reputation. In the future, we are likely to be able to use virtual reality to visually inspect reclaimed lands, or roving autonomous drone technology with onboard cameras to do that same activity – thereby making rehabilitation easier and demonstrating to communities our industry's commitment to successful rehabilitation.

- Editor

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## NEWS FROM THE MINING WORLD

### ► **NMDC hikes iron ore lump rate by Rs 100/tonne; fines Rs 200 per tonne**

The prices are effective from Tuesday and exclude royalty, district mineral fund (DMF), National Mineral Exploration Trust (DMET), cess, forest permit fee and other taxes, the company said.

State-owned NMDC on Tuesday said it has hiked price of iron ore lumps by Rs 100 to Rs 4,500 per tonne with immediate effect.

The country's largest iron ore miner has also increased rate of iron ore fines by Rs 200 to Rs 4,110/tonne, NMDC said in a regulatory filing.

The prices are effective from Tuesday and exclude royalty, district mineral fund (DMF), National Mineral Exploration Trust (DMET), cess, forest permit fee and other taxes, the company said.

Lump ore or high-grade iron ore contains 65.53 per cent Fe (iron), while fines are inferior grade ore with 64 per cent and less Fe content.

In the last price revision announced on February 2, NMDC fixed the rate of the lump at Rs 4,400 per tonne and that of fines at Rs 3,910 a tonne with immediate effect.

Iron ore is one of the key raw materials used in manufacturing of steel, and any movement in its prices has a direct impact on rates of steel, an alloy widely used in segments such as construction, infrastructure, automobile and railways.

Hyderabad-based NMDC (formerly known as National Mineral Development Corporation) under Ministry of Steel contributes over 17 per cent to India's total iron ore production.

*Press Trust of India, New Delhi | March 21, 2023*

### ► **Explainer: Why has power demand in India surged post Covid-19 recovery?**

Power demand jumps 10% in the first two months of 2023 from a year ago

Surging power demand in India poses a challenge for a country where solar power is growing rapidly but generation capacity is stretched when the sun goes down.

In 2022, India's power demand grew about 8% - or at nearly double the pace of the Asia Pacific region

- to more than 149.7 terawatt-hours (TWh) from the previous year.

And in the first two months of 2023, demand jumped 10% from a year ago.

Following are the factors behind the rapid growth in demand.

#### WHERE IS DEMAND GROWTH COMING FROM?

In absolute terms, the states with the strongest growth in demand in 2022 were the northwestern desert state Rajasthan and the western states of Gujarat and Maharashtra, where many of the country's industries are concentrated, a Reuters analysis of government data showed.

The eastern state of Chhattisgarh, known for extensive mining activity, had 16.6% growth in the five months since the monsoon ended in 2022, while Rajasthan's power demand grew 15.1% in the same period.

Growth rates were also high in Punjab in the north, where agricultural demand makes up the lion's share of total power use, and Madhya Pradesh, Telangana and Bihar - where residential demand has historically accounted for most of the load.

#### WHY IS DEMAND GROWING?

India's Prime Minister Narendra Modi and Finance Minister Nirmala Sitharaman have previously linked increased power demand to higher economic activity.

Industrial and commercial activity account for more than half of India's annual power use. Homes account for a fourth, while agriculture has accounted for over a sixth in the recent years.

Consumption patterns vary wildly by state and season.

A heatwave and easing of COVID-19 curbs drove power demand higher in the first half of 2022. Erratic weather and a jump in agricultural activity were among the most prominent reasons behind the high growth in the second half of last year, according to a federal power ministry presentation reviewed by Reuters.

In northern Haryana and Telangana in the south, unexpected dry spells contributed to higher demand from agricultural consumers of electricity during November and December, according to the presentation, which was based on assessments by grid operators in different states.

Higher demand from industry in Andhra Pradesh and tech employees returning to office in India's silicon valley Bengaluru in Karnataka state also drove power use up.

In the football-crazy, southern state of Kerala, the live streaming of World Cup matches potentially contributed to a 4.1% hike in peak demand, a power ministry official said in the presentation.

In Punjab, a policy to provide free power to some consumers boosted demand, while a decision to increase hours of power supply to agricultural consumers in Rajasthan resulted in a 22% rise in November and 15% rise in power demand in December, according to the presentation.

#### WHAT'S NEXT?

Officials are scrambling to ensure India does not face power outages this summer, when demand typically peaks.

India faces high risks of nighttime blackouts this summer, following years of neglect in adding new coal and hydropower capacity, needed particularly at night when solar capacity is unavailable.

*Reuters, NEW DELHI/SINGAPORE | March 9, 2023*

#### ► **Government successfully bids out 29 coal blocks for commercial mining**

The ministry launched the auction of coal reserves for commercial mining in the sixth round and second attempt of fifth round on November 3, 2022

The 29 coal blocks which have been successfully bid out for commercial mining by the government are expected to enhance the average dry fuel output by an additional 7 per cent in the next two years, as the combined peak rated capacity (PRC) of these reserves is around 91 million tonnes.

The 91 million tonnes PRC of 29 coal blocks which have been bid out, would be an additional 7 per cent of the present national average PRC of coal reserves, sources said.

The Coal Ministry had put up 29 reserves on auction for commercial mining last month, all of which have been bid out, sources informed. The last of the 29 mines was bid out successfully earlier in the day, they added.

With all the 29 mines expected to begin production by 2024-25, i.e. by the next two years, the government is hoping that all these coal mines put together will

enhance the overall national average output by an additional 7 per cent.

The ministry launched the auction of coal reserves for commercial mining in the sixth round and second attempt of fifth round on November 3, 2022.

Forward auctions for these mines had started on February 27.

PRC pertains to the maximum production capacity of a coal mine, or in other words, the maximum quantity of coal which can be mined from it annually.

Commercial mining allows the private sector to mine coal commercially without placing any end-use restrictions. Private firms will have the option of either gasification of the coal or exporting it. They can also use it in their own end-use plants or sell them in the markets.

*IANS, New Delhi | March 9, 2023*

#### ► **Union minister urges mining sector to contribute 2.5% in GDP by 2026-27**

Addressing entrepreneurs and representatives of the mining sector, Joshi said the Indian Bureau of Mines, government and private mining entities should work towards this goal

Union minister Pralhad Joshi on Wednesday urged all stakeholders from the mining industry to take the sector's contribution to GDP to 2.5 per cent by 2026-27 and said that the government will come up with investor-and industry-friendly norms.

Joshi, who holds the portfolios of Parliamentary affairs, coal and mines, was speaking at the 75<sup>th</sup> foundation day of the Nagpur-based Indian Bureau of Mines, a multi-disciplinary government organisation.

The minister said many sectors in India are transforming and the country's mining businesses can achieve the target of a 2.5 per cent contribution to the country's Gross Domestic Product (GDP) by 2026-27.

Addressing entrepreneurs and representatives of the mining sector, Joshi said the Indian Bureau of Mines, government and private mining entities should work towards this goal.

Joshi said the government has brought in many changes in the sector and would be introducing more investor-and industry-friendly norms in future, most probably in the coming budget session.

The minister appealed to the industry to improve production in a sustainable manner. He said, There is a huge opportunity and potential for growth and so many needs of the world have to be fulfilled by India now. Be it raw material, finished products or service sector.

He said businesses are now exiting from the world factory that is China and they feel that India under the leadership of Prime Minister Narendra Modi is a safe haven for them.

Joshi asked people from the mining industry to hold talks with state governments to operationalise the mines that have already been auctioned. He said minerals are the sources of revenue for states.

Joshi pitched for the use of technology, global best practices and artificial intelligence in exploration and mining and talked about the government's initiative to bring down to zero the import of thermal coal.

India's coal production this year will be nearly 900 million tonnes and will touch a billion tonnes next year, he said. The government is helping the private sector with liberal policies towards making India Atma Nirbhar (self-reliant), he added.

*Press Trust of India, Nagpur | March 1, 2023*

### ► **China to step up deep sea mining efforts**



A polymetallic nodule is captured on a seamount deep in the North Atlantic Ocean during the 2021 North Atlantic Stepping Stones expedition. Credit: U.S. Geological Survey and NOAA Ocean Exploration.

China Daily reports that the country will make renewed efforts to join the race to mine the deep sea for critical minerals.

The English language government-run paper says China lags behind the West in terms of research, technology and hardware for seabed mining which it calls “a new frontier for international competition.”

Ye Cong of Wuxi-based China Ship Scientific Research Center, a subsidiary of the China State Shipbuilding

Corp, said mining the metals found in nodules on the seafloor – mainly nickel, copper, cobalt and manganese – will “help us reduce the heavy reliance on foreign suppliers”.

Ye is a member of the 14<sup>th</sup> National Committee of the Chinese People's Political Consultative Conference, a policy shaping body, that was held last week. China Daily reports the state shipbuilding company is known for its deep sea submersibles like the Jiaolong (Sea Dragon) and the Shenhai Yongshi (Deep Sea Warrior).

### **Mining exemption**

Last week the United Nations agreed to the first ever High Seas Treaty after more than a decade of negotiations by member states. The treaty aims to set aside for conservation around 30% of the world's international waters and provide rules for its exploitation.

Climate Change News reports deep sea mining is exempted from environmental impact assessment (EIA) regulations established under the UN treaty, which will remain the remit of the International Seabed Authority.

ISA has been working on a framework for deep sea mining since 2014 and is set to issue its approved mining code within months.

CCN notes that the ISA accelerated the pace of negotiations after the island state of Nauru “triggered an obscure provision forcing approval by July 2023,” adding that should the agency miss the deadline, “companies could submit a request to begin full-scale mining, even without any rules in place.”

The nodules are found on abyssal plain sediments at about 3,500–6,000m water depths and the USGS expects that about 35–45% of the demand for critical metals will come from deep-ocean mines by 2065.

*Frik Els, Mining.Com | March 14, 2023*

### ► **Canada faces pressure to ban deep-sea mining**



*The Metals Co, formerly known as DeepGreen, intends to produce metals from polymetallic rocks, found in deep oceans. (Image courtesy of The Metals Company.)*

Canada is facing mounting pressure to declare a moratorium on deep-sea mining exploration and extraction as the country hosts an international marine conservation summit starting Friday in Vancouver.

Leading to the the fifth International Marine Protected Area Congress (IMPAC5), international scientists and environmental organizations have called on Ottawa to ban the activity.

They want Canada to join a growing numbers of countries including Germany, France, Spain, Chile, Costa Rica, New Zealand and Panama among others, which have asked the United Nations-affiliated International Seabed Authority (ISA) to not rush into enacting mining regulations by July 2023 — a deadline that was set in 2021.

Other nations such as Brazil, the Netherlands, Portugal, Singapore and Switzerland have indicated they would not approve any mining contracts until sufficient environmental protections for the seabed are in place, regardless of the deadline set to adopt regulations.

Google and automakers BMW, Renault, Volkswagen and Volvo have pledged not to use deep-sea metals for the time being, and 704 marine scientists and policy experts from 44 countries have endorsed a petition advocating a pause in seabed mining.

The United Nations Convention on the Law of the Sea treaty established the ISA in 1994 to regulate mining in international waters while at the same time ensuring the protection of the marine environment.

At the time, the deep sea was considered a muddy, lifeless abyss, albeit one rich in cobalt, nickel and other metals potentially worth trillions of dollars. Scientists now believe that mining the seabed for minerals and metals needed for the world's energy transition could destroy undiscovered species, with a role in the global climate that remains little understood.



Targeted areas are believed to have low biodiversity. (Image of an ocean floor cleaning mission by U.S. Marine Corps Photo | Lance Cpl. Nicole Rogge.)

Oceans cover more than 70% of the planet, but only 5% of that area has been explored and charted by humans.

“Canada has made commitments to reverse biodiversity loss, fight climate change, and to foster equity and transparency in both environmental initiatives and international governance,” Susanna Fuller, vice-president of operations and projects at non-profit Oceans North, said last year. “None of those things are compatible with deep seabed mining.”

Since 2001, the ISA has issued exploration contracts to state-backed enterprises, government agencies and private companies to prospect for minerals over more than 500,000 square miles of the seabed in the Atlantic, Indian and Pacific oceans.

Once it sets mining regulations, potentially in five months, those contractors will be able to apply for an exploitation license to start mining.

Each mining contractor must be sponsored by an ISA member nation and pay it and the ISA royalties on the minerals mined.

#### **Almost half of all critical metals needed**

The U.S. Geological Survey found last year that deep-ocean mines could provide up to 45% of all the world's critical metal needs by 2065.

One of the miners that has advanced the most in the past years is The Metals Company (NASDAQ: TMC), formerly Deep Green Metals.

The Canadian battery metals start-up recently lifted 3,000 tonnes of nodules from the Clarion–Clipperton Zone, a valuable stretch of ocean floor between Mexico and Hawaii.

The miner says its two exploration contracts in the the Clarion Clipperton Zone (CCZ) of the Pacific Ocean comprise enough in situ metal for 280 million electric vehicles.

The polymetallic nodule fields in the CCZ of the Pacific represent the largest known, undeveloped nickel resource on the planet.

Last week, Norway announced it had discovered a “substantial” amount metals and minerals ranging from copper to rare earth metals on the seabed of its extended continental shelf.

The resources estimate, covering remote areas in the Norwegian Sea and Greenland Sea, indicates that there are 38 million tonnes of copper, almost twice the volume mined globally each year, and 45 million tonnes of zinc accumulated in polymetallic sulphides.

*MINING.COM Editor | February 3, 2023*

► **America's timeline for development of domestic battery metal supply chain may be unrealistic – research**



*Evaporating ponds at Albemarle's Silver Peak lithium mine in Nevada. (Reference image by Ken Lund, Flickr).*

By 2027, for an EV to be tax-credit eligible in the US, 80% of the market value of critical minerals in its battery must be extracted or processed domestically or by US free-trade partners (FTP), Northwestern University researchers say.

In a commentary published in the journal *Nature Sustainability*, Jennifer Dunn and Jenna Trost wrote that while this goal – part of the 2022 Inflation Reduction Act – is well-intended, there are reasons to believe the mandate is unreachable and could create new problems.

According to Dunn and Trost, the 80%- target could be achievable for some types of batteries for plug-in hybrid vehicles, but meeting demand for fully electric vehicles with batteries that meet IRA criteria would be challenging. Instead, a mass-based target could avoid some of the challenges posed by a market-value target, such as pinning down a consistent market value for each mineral when market prices are volatile.

The researchers also concluded that the approach taken by the IRA discounts the environmental effects of mining, non-critical minerals supply, and definitions that avoid gamesmanship.

In their view, to meet the demands of the bill, a steep increase in domestic mining would be needed. This could pose environmental issues, including water pollution,

in addition to creating greenhouse gas emissions from burning fuel to operate mining equipment.

Building mines also takes time. Permitting processes to protect the environment and worker safety can create delays and extend that timeline. Communities may also resist new mines because of the potential environmental impact. This means that establishing a domestic supply of minerals is unlikely to meet the IRA's aggressive timeline.

"There's a lot of interesting social and political dynamics. Some people don't want new or expanded mines, and others welcome the economic activity and the opportunity to become more energy independent by building out a domestic minerals supply chain," said Dunn, who is the director of the Center for Engineering Sustainability and Resilience. "It's fascinating to watch how this is going to play out."

She believes that much of the mineral supply chain will continue to be international. As a result, there's also the issue of labour laws in countries that are not FTPs, raising the question of responsible sourcing.

The researcher pointed to Argentina as a case study. The South American nation is a non-FTP country that provided 59% of the 2,618 tons of lithium mineral the US imported in 2019. Argentina does not offer the labour and environmental protections the US requires of FTP partners, but any minerals acquired from the country would still count if they were processed domestically.

Dunn and Trost argue that guidance should be provided regarding what constitutes processing, and what are allowable sources for the minerals that would be processed in the US or an FTP.

"We have ostensibly good labor protections for miners, but that's not the case everywhere. What are the ethical implications of using minerals from other places?" Dunn pointed out. "And then, are we going to be really serious about recycling? because we're clearly not with plastics. We have to be really serious. Investment in battery recycling is growing, but it still needs to be larger."

#### **Market value target**

Dunn and Trost also raised concerns about the use of a market value-based target.

A market value-based target can be met before all the critical minerals in a battery are acquired from a secure source such as the US or an FTP, depending on the battery chemistry.

The environmental effects of critical minerals acquisition are physically tied to the amount of mineral produced rather than its market value.

Market values fluctuate. The researchers noted that prices for cobalt and nickel, for example, have increased by about \$13,000 and \$4,000 per metric ton, respectively, since 2019.

Many non-critical minerals central to batteries are mainly produced outside the US, raising supply risks.

Instead, the authors suggested using a mass-based standard. Using a mass-based target, they wrote, would reduce uncertainty and hold all automakers to the same standard in the interpretation of market value.

“Given the fluctuations in mineral market values, using a mass-based target in the policy could improve its transparency but may not incentivize production of high-value minerals domestically, which is important for mineral security,” Dunn and Trost said.

*Staff Writer, Mining.Com | March 19, 2023*

► **EU tags copper and nickel as strategic, but industry wants more**



*Credit: Boliden*

The European metals sector welcomed a move by the EU on Thursday to include copper and nickel as strategic materials for the first time and ensure speedier permits and easier access to capital, but said more could be done to secure supplies.

The Critical Raw Materials Act (CRMA) unveiled by the European Union adds the two major industrial metals to a list that had previously focused on more niche minerals such as cobalt, lithium and rare earths.

Copper is used in renewable energy systems and for wiring in electric vehicles (EVs) while nickel is a major component in many EV batteries.

Mining and metals companies, including Sweden’s Boliden, cheered EU plans in the CRMA to provide

streamlined permits and access to financing for projects pegged as strategic.

However, to ensure a supply of materials needed for the green transition, other industrial metals such as aluminium should be included while fair competition with China also needs to be addressed, industry groups and firms said.

The VDM Association of German Metal Traders and Recyclers was among those pushing for aluminium and zinc to be included.

“These areas of the metal industry also need fast approval procedures and, above all, competitive energy prices,” the group said in a statement.

The EU already produces about 15% of its needs for copper, well above the overall 10% target set by the EU for strategic minerals, but the situation could deteriorate, the CEO of Aurubis, Europe’s biggest refined copper producer, said.

“Every mine gets depleted therefore it is time to act now to ensure that new mining projects, which will take years to develop, are being approved in time,” Roland Harings told Reuters in an interview.

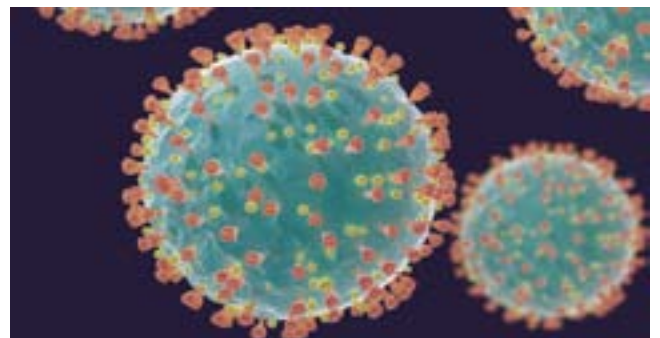
Harings also said the EU must ensure fair competition with China and other countries so the metals recycling industry can thrive.

“We have absolutely no problem in being in competition if there’s a level playing field. If everybody has to respect minimum environmental, labour and other standards.”

Aurubis sees recycling as a huge growth area with new plants being built and has the intention in the longer term to also move into recycling of electric vehicle batteries.

*Reuters | March 16, 2023*

► **How silicon, gold, copper help destroy covid-19 virus**



*Computer-generated representation of SARS-CoV-2 under electron microscope. (Image by Felipe Esquivel Reed, Wikimedia Commons).*

*(Continued on Page 39)*

# BENCHMARKING – A PRAGMATIC INDICATOR FOR IMPROVING MINING OPERATIONAL PERFORMANCE

SURYANSHU CHOUDHURY

## *Abstract*

*With today's competitive global economy, all the manufacturing sectors are very much concerned about continuous improvement through operational excellence and the Mining industry is nowhere exception to that. Also, there is lot of emphasis in the mining industry on improvements in cost of production, productivity, safety and efficiency etc. Benchmarking is one such tool for this continuous improvement exercise which not only compares the internal performance but with competitors and best performing industries. Benchmarking is an important lever of Operational excellence, based upon which companies can improve their internal performance continuously. The contents of this paper are based upon concepts and the importance of Benchmarking for improving the mine operational performance.*

*Key words: Benchmarking, Optimisation, Productivity.*

## 1. INTRODUCTION

Mining industry is associated with numerous interdependent tasks starting from land acquisition to mine operation followed by mine closure. Mining projects being high capital intensive, Maximising shareholder value is of utmost importance and accordingly strategic goals of the company are aligned. Miners are price takers, not price makers, and the markets upon which their revenues depend are cyclical. Therefore, it is not surprising that as an industry we focus on the reduction of costs to alleviate margin pressure that naturally arises due to this variation. At this juncture, Benchmarking studies are useful to provide an opportunity to obtain an independent view of site performance unencumbered by the dogma and politics that sometimes influences internal reviews. Despite the widely accepted importance of shareholder value, the minerals industry is often accused of providing relatively poor returns when compared to other industries. Historically, it has been observed that many mining companies have failed to deliver value to their shareholders.

Benchmarking was established in the late 1970s, through a study conducted by Xerox Corporation, as a philosophy to identify, understand and reproduce the best practices that help the company to maximize its performance. In the context of production and manufacturing, it is defined as the comparison of two or more firms against the firm that is doing well, or that is regarded as the best in terms of their operations and their services. According to Bhutta and Huq (1999), benchmarking is the process of identifying the highest standards of excellence for products, services, processes, or practices and then taking the necessary actions to achieve those standards. There are numerous business improvement initiatives employed within the mining industry to assist mine operators for improving performance

and efficiency. Some are more effective at creating value than others. Benchmarking is one such technique that is commonly used to identify performance gaps and prioritise opportunities for improvement. Benchmarking is a tool used in organisations to compare best industry practices with the purpose of improving on the procedures used. A benchmark can be used as a scale or scope of referral in an organization to pinpoint areas that need to be improved or monitored closely for better performance (Boyer, 2015).

## 1. BENCHMARKING PROCESS

Benchmarking process has proved to be the best practice for getting people to focus on the customer and for achieving significant improvement in customer satisfaction. It is very much useful for any company because it brings awareness about the present operating condition and then highlights areas of improvement. This is possible because the company would have the opportunity to be compared with other companies that are operating within the same sector. In addition, benchmarking is a valuable tool for setting goals; it is something that is necessary in order to remain competitive and for learning new ideas (Balm, 1996).

To be successful, benchmarking must adhere to a detailed, structured process and typically comprising of the following main components (Fig:1):

- Information gathering and Identifying KPIs (Key Performance Indicators)
- Data analysis and Interpretation
- Reporting of results,
- Implementation and ongoing monitoring.

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*Head-Mine Planning, Gujarat Mineral Development Corporation Ltd., Ahmedabad*



Figure-1

For the purpose of assessment, Benchmarking study is conducted with the objective of how the process is performing compared to a group of its peers. The study should look at the fundamental drivers of overall performance and how these aggregate to high level value metrics. It needs to be an in-depth analysis of the operating and capital cost structure as well as the revenue and productivities achieved. Benchmarking is the starting point to the process of operational excellence.

## 2. TYPES OF BENCHMARKING

Benchmarking is the systematic process of searching for best practices, innovative ideas and highly effective procedures that lead to superior performance. Benchmarking is considered as part and parcel of Total Quality Management (TQM) program, as the process is mainly about finding best ways that have been used before in terms of the standard of manufactured products compared to specifications, the service delivery of the product, the financial aspects of manufacturing the product, and the systems in place that present the processes of manufacturing the product (Evans, 2015). Broadly the process of benchmarking is categorised into following three types.

### A - Process benchmarking

Process benchmarking deals with processes and the methods people used to carry out at respective industries effectively. Typically, Process benchmarking focuses on the day-to-day operations of the organization (Bogan & English, 1994). Some examples of work processes that could utilize process benchmarking are the customer complaint process, the billing process, the order fulfilment process, and the recruitment process etc. All of these processes are applicable to all levels of the organization. By making improvements at these levels, performance improvements can be realized quickly. Process benchmarking results in quick improvement of work towards the organization.

### B - Performance benchmarking

Performance benchmarking emphasizes on measuring competitive positions by comparing the products and services of other competitors (Bogan & English, 1994). It is a comparison of performance measures for the purpose of determining how good the company is, as compared to others. It provides a competitive situation of the organization through product and service characteristic comparison. When dealing with performance benchmarking, organizations want to look at where their products or services are in relation to their competitors', based on factors such as reliability, quality, speed, and other product or service characteristics. Performance benchmarking aims at how a whole operation brought together their management, production, engineering and maintenance personnel in a successful overall operation. Generally, performance benchmarking would study how the organization successfully implemented best industry practices, new innovations etc.

### C - Strategic benchmarking

Strategic benchmarking deals with top management. It deals with long-term results. Strategic benchmarking focuses on how companies compete to achieve the target. This form of benchmarking looks at "what strategies the organizations are using to become successful" (Asrofah, Zailani, & Fernando, 2010). This is the type of benchmarking technique mostly used by Japanese firms (Bogan & English, 1994). This is because the Japanese focus on long-term results.

## 3. BENEFITS OF BENCHMARKING

The benefits of benchmarking are a better understanding of strengths and weaknesses of processes, improved cycle time, improved supplier's management, reduced production costs, etc. The number of manufacturers using benchmarking techniques has been increasing dramatically. However, due to the lack of a complete understanding of benchmarking, not all organizations find it easy to employ the tools effectively. The idea of learning from other's good ideas or benefiting from their successful experiences as well as avoiding their mistakes is a philosophy of long standing.

There are three major benefits derived from benchmarking:

- Cultural change - Benchmarking causes people to realize that what others do things differently and why they are motivated to find out the alternatives. In this process they find out that doing things differently may also be a better way of performing.
- Performance improvement – In this process, gaps in performance are identified and personnel are motivated to develop doing things in a better way through brainstorming sessions.
- Human resources – This reflects that people can see the gaps between what they are doing and what others have accomplished the same followed by training to help them to close the gaps.



Benchmarking is a comparison of pertinent practices, not a contrast of performance. Thus, the 'model' that an organization aspires to must be reasonably similar. But, at the same time be aware that benchmarking with dissimilar organizations can yield ideas of value as well. For example, a process for stock control in an unmanned warehouse of a mail order house had direct applicability to a food processing plant maintaining forklifts in five different warehouse locations. But, since the main concern is improving maintenance, the starting point should be other maintenance organizations.

#### 4. BENCHMARKING STEPS

Strategic benchmarking process explores how to adopt a culture based upon which a successful industrial campaign will have a significant impact on the existing system. Strategic benchmarking might, for example, inquire how Japan became a world leader in electronics even though the US led the industry until the early 1980's. Benchmarking should be part of an overall improvement process. It should be thought of as an integral activity of the improvement activity, not a one-time 'look - see' to satisfy those curious about what others are doing. Specific steps should be established to ensure that the benchmarking process is worthwhile and that satisfies specific needs for improvement (Figure-2).

Step 1 - Establish continuous improvement as a policy. Management should include any useful method that will contribute to improvements. Benchmarking is such an activity and the more formally it is approached the more effective the results will be.

Step 2 - Adopt benchmarking as an integral part of continuous improvement. With this approach, benchmarking becomes part of the planning to achieve improvements of each and every activity of the process.

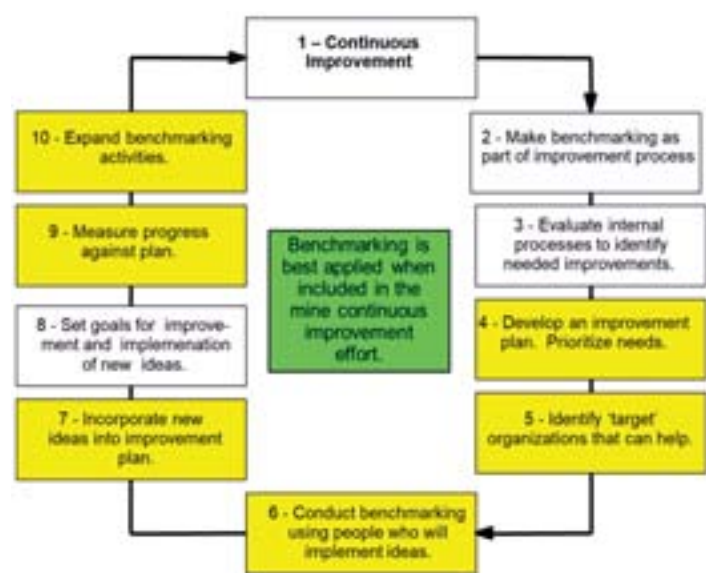


Figure-2

Step 3 - Establish an internal evaluation system to access the current performance level and determine improvement needs. The first step of any improvement action is to establish the 'as is' performance status of the organization and identify its improvement needs. This step is critical to the benchmarking process. Without it, one does not know where to begin much less what will help and what won't.

Step 4 - Generate an improvement plan then classify and prioritize improvement needs. The benchmarking exercise can be a big waste of time if there is no overall plan of action to guide benchmarking personnel. Make a plan for improvement based on the evaluation results. Then fit into that plan the procedures for benchmarking and the specific things that are being sought after through benchmarking. This will guide those doing the benchmarking and guide them in fitting the results into a bigger improvement requirement.

Step 5 - Identify 'target' organizations that can help. Look in your own organization. Then, look in your own industry. Finally, look for the best. But, don't overlook other organizations that may be doing other things. After all, it is what people do and how they do it that is the central value of benchmarking.

Step 6 - Conducting benchmarking exercise using personnel who will ultimately implement improvements including the ideas derived from benchmarking. Direct participation by those who will implement the new ideas means that they start to formulate actions on how the ideas can be used.

Step 7 - Incorporation of the new ideas developed from benchmarking into the improvement plan. New ideas should be related to the initial needs established at the time of the internal evaluation. In this way, more impetus is added to the initial need. Benchmarkers know they have potential immediate solutions to improvement requirements.

Step 8 - Setting goals for improvement and incorporation of new ideas developed from benchmarking. The combination of the action plan from the early evaluation plus the new ideas from benchmarking will suggest a new priority setting action to update the improvement plan. This is the time to add emphasis to the improvements with a time table, goals and targets. It gives managers an opportunity to reinforce the initial plan and acknowledge the work of the benchmarking team.

Step 9 - Measuring progress against goals and the overall improvement plan. With the revised plan of action and renewed enthusiasm for improvement, establish goals to keep everyone apprised of progress. More importantly, provide a means of encouraging forward progress with regular 'report cards'.

Step 10 - Expand benchmarking to other industries or activities. Cast the net wider now that benchmarking is established and considered an integral, important aspect of continuous improvement. Empower employees to go forward on their own to seek new ways to improve.

### 5. BENCHMARKING IN MINING INDUSTRY

Mine management can utilise benchmarking throughout the project life cycle to evaluate various aspects of their operation in relation to best practice. It can be used throughout the project life cycle from the conceptual mine planning stage to mine operations. During the planning stage, benchmarking assists in validation of cost and performance estimates and can identify opportunities to optimise mine designs, equipment selection, manning levels and consumables usage. During the operational phase, benchmarking can be used to provide up-to-date and direct comparisons with similar operations and to identify opportunities for performance and value improvement. While benchmarking studies may be a one-off event, they are generally more effective as a continuous process in which management seeks to compare and challenge their practices on a regular basis. In this way benchmarking becomes an integral part of the continuous improvement process through a process of measurement, comparative analysis, identification of performance gaps, development and implementation of solutions, and ongoing monitoring and reassessment.

Benchmarking assists in measuring and comparing how well each mining activity is performed through the mining process and create value through:

- Understanding the interdependencies between mining activities,
- Understanding the impact that those interdependencies and normal variability have on overall performance, and
- Understanding the mining capacities and ore stocks required to provide a buffer against normal operational variability so that planned performance targets can be more consistently achieved.

Benchmarking process identifies potential areas where performance can be improved and cost of production can be reduced. By comparing performance against peers and best practices, miners can identify opportunities for improvement and implement changes that lead to improved efficiency, safety, sustainability, and profitability. Following are some specific applications of benchmarking in the mining industry:

**Exploration:** Benchmarking is utilised to assess the performance of exploration activities. This can be achieved by comparing the rates of exploratory borehole drills and the costs associated with exploration activities. By identifying areas where exploration performance can be improved, the performance of mining projects can be improved.

**Operational efficiency:** Through the process of Benchmarking various activities of operational parameters of an operating mine against its peers or best practices. One of the key areas of benchmarking in mining is the performance of equipment such as excavators, haul trucks, and crushers. By comparing the availability, utilization, and maintenance costs of equipment against industry standards, mining companies can identify areas for improvement and optimize their operations. This can be achieved by comparing key performance indicators (KPIs) such as production rates, cycle times, equipment utilization, and maintenance costs etc. By identifying areas where the mine is underperforming, improvements can be made to increase efficiency and reduce cost of production (Figure-3). By comparing the productivity against industry benchmarks, mining companies can identify areas where they can improve their processes, equipment, and workforce management efficiency and optimize processes.

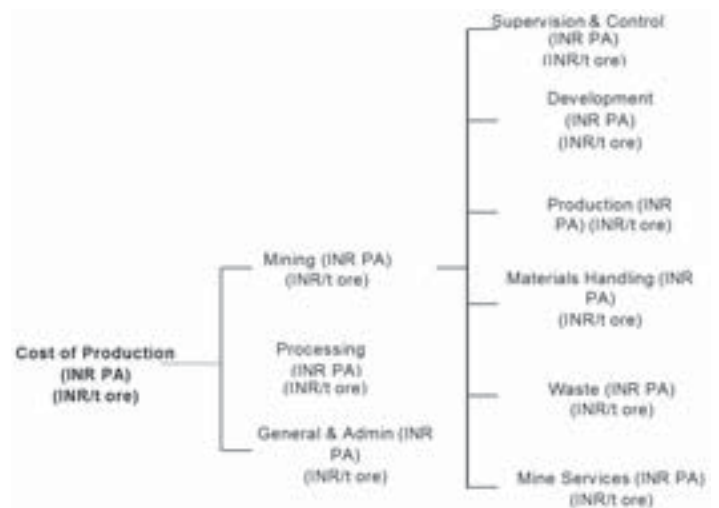


Figure-3

**Safety:** Safety is a critical aspect of mining operations, and benchmarking can help identify best practices and areas for improvement. By comparing their safety performance against industry standards, mining companies can identify areas where they need to focus on training, equipment upgrades, or process improvements. The process of Benchmarking is used to improve safety performance in mines. By comparing safety metrics such as injury rates, lost-time incidents, and near-miss reports, mines can identify areas where safety performance can be improved. This can lead to a reduction in accidents and injuries and improve overall safety culture.

**Sustainability:** Mining operations have a significant impact on the environment, and benchmarking of factors quantifying the environment impact and remedial measures with reference to the industry peers assist in identifying best practices for reducing their environmental footprint. By comparing their environmental performance to industry

standards, mining companies can identify areas where they can improve their carbon footprint, waste management, energy efficiency, land restoration followed by biodiversity and water usage etc. This can be achieved by comparing environmental metrics such as water consumption, energy consumption, and greenhouse gas emissions. By identifying areas where the mine can reduce its environmental impact, the mine can improve its sustainability performance and reduce costs. Benchmarking is very much important to assess the sustainability performance of a mine.

**Supply chain:** Benchmarking can be used to assess the performance of a mine's supply chain. This can be achieved by comparing key metrics such as procurement costs, lead times, and delivery reliability. By identifying areas where the supply chain can be improved, the mine can reduce costs and improve operational performance.

**Cost management:** Mining is a highly competitive industry, and effective cost management is essential to profitability. Benchmarking identifies areas where costs can be reduced, such as individual cost of various primary activities like Drilling, Blasting, Loading, Hauling etc. In addition, the cost of the processes of downstream lines like procurement, logistics, and maintenance are of immense help.

While adopting the process of benchmarking, it is also very much essential to consider the operating site conditions like Hilly areas, Floor conditions, rock types etc otherwise the benchmarked values may be ambitious or undervalued. For example, as demonstrated through **figure-4**, the data specific fuel consumption data collected from twelve operating sites in India of one particular model of dumper (Model and Carrying capacity exactly same). This Specific fuel consumption varies from 32.1 to 39.9 Lt/Hr. The range of variation is around 8 Lt/Hr and the question still arises which value is to be considered for benchmarking. At this point of juncture, the benchmarking values are arrived at through the process of benchmarking studies considering all the site conditions and other relevant factors.

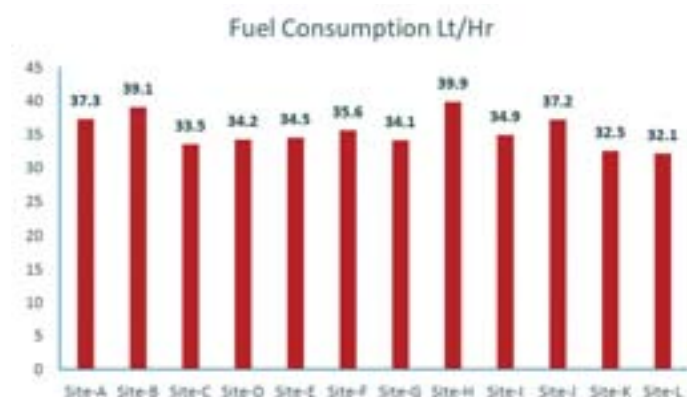


Figure-4

## 6. CONCLUSION

Mining operations are entrusted with the task of delivering their corporate goals. This is not an easy task given the uniquely challenging operating conditions and increasingly competitive global marketplace within which mines operate. However, significant effort is required to ensure that the industry continues to attract investment by realising the inherent value of its resources. However, to be effective, Benchmarking must be used appropriately and result in actions that lead to measurable operational improvement. Benchmarking is a powerful tool that is already in use in the mining industry to improve operational performance, reduce costs, increase efficiency, and enhance safety. It is also important for companies to use benchmarking as a tool to gauge themselves against competitors. Only those companies that use benchmarking can know where they are lacking and seek to improve. Successful benchmarking must be based on actual improvements needed as the result of an evaluation. Otherwise, there is only conjecture as to what could be gained from benchmarking. When benchmarking is used as part of the improvement strategy it gives credence to the overall improvement effort and will yield actual, realistic improvements.

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## MINING ENGINEERS' ASSOCIATION OF INDIA 3<sup>rd</sup> COURSE OF MPDP (MEAI PROFESSIONAL DEVELOPMENT PROGRAM)

Encouraged by the guidance & support of the President MEAI, Sri K. Madhusudhana ji and Enthused by the phenomenal success of the first & second Course of MPDP, MEAI launches the **3<sup>rd</sup> Course** in the month of **May 2023**, Online.

The previous course was successfully held online on **WebEx** platform in the month of **September 2022** on three consecutive week-ends and was well attended by **26** participants from **08** reputed mining organizations including NMDC, Tata Steel, MSPL, HGML, JSW, besides a few independent consultants.

**24 technical sessions** were held by **16** eminent faculties and industry experts covering **20** relevant subjects. Participants were awarded Certificates of participation.

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National Exploration Licensing Policy & National Mineral Policy	Mr Susheel Kumar, Director, Govt of Telangana, Hyderabad
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May 2023: 05<sup>th</sup> (Fri), 06<sup>th</sup> (Sat), 12<sup>th</sup> (Fri), 13<sup>th</sup> (Sat), 19<sup>th</sup> (Fri), 20<sup>th</sup> (Sat) & 21<sup>st</sup> (Sun).

**Sessions:** 09:00 AM /05:15 PM

**Inauguration:** May 05<sup>th</sup> (Fri): 09:30 AM / 10:30 AM

**Participants feedback & Assessment:** May 21<sup>st</sup> (Sun): 10:45 AM (followed by Session-I)

**Valedictory Function:** May 21<sup>st</sup> (Sun): 11:15 AM / 12:15 PM

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~ Deepak Vidyarthi,  
Course Coordinator, MPDP /  
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# LAND RECLAMATION OF MINING SITES THROUGH ORGANIC FARMING: A REVIEW

<sup>1</sup>N.Krithika and <sup>2</sup>Rishabh Jain

## Abstract

Mining has a significant impact on land, both in terms of its physical characteristics and its ecological health. On a physical level, mining can cause land to become unstable and prone to landslides, as well as cause erosion and sedimentation leading to destruction of habitat and displacement of wildlife. Mining can cause habitat destruction, as it can remove large areas of land from the environment causing the loss of biodiversity, leaving a negative impact on human health and environment. Land reclamation through organic farming is an important and effective way to restore land that has been degraded or damaged due to human activities. By using organic farming techniques, the soil can be restored to its original fertility and health. While the government has been taking frequent steps for the management of the mining industry, establishment of an organized management system has not taken place. The paper discusses the adoption of organic farming as a promising method to land reclamation in India.

**Keywords:** Mining, Land Reclamation, Organic Farming

## INTRODUCTION

Only 30% of the world's surface area is available to humans as land. India makes up around 2-3% of the world's land area but is home to more than 16% of the world's people. [1] However, the mineral resources are finite, non-renewable natural resources that are essential to many fundamental and significant businesses as raw materials. Natural mineral extraction frequently results in imbalances that harm the ecosystem. Mining is bad for the environment, the economy, and the workforce. Sedimentation, forest loss, and ecosystem devastation are all effects of mining on the land. [2] Mining can leave a deep-rooted effect on the environment, economy and socio-cultural ecosystem.

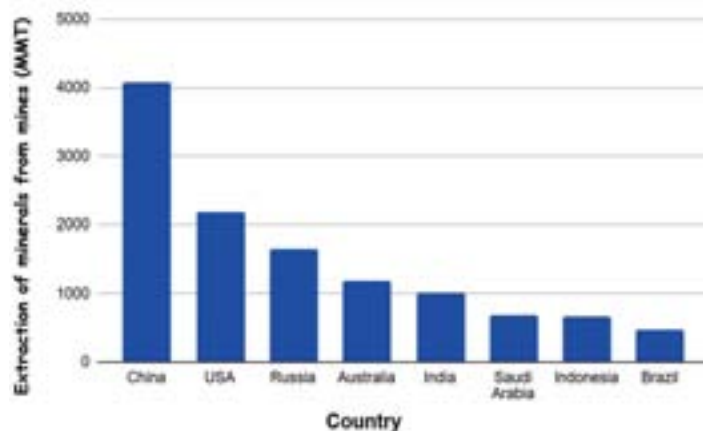


Fig 1: Biggest Miners in the World (2018-19) Source: World Mining Congress

Fig 1 depicts the extraction of minerals from mines (in million metric tons) for 8 countries. The table tells us that China

is the highest mineral extractor, followed by the USA and Russia.

Mining-related land degradation is a significant environmental problem that has existed for generations. Several environmental issues, such as habitat damage, air and water pollution, and land degradation, can be brought on by mining activities. Local communities may be uprooted by mining activities which may lead to cultural heritage sites being destroyed. Moreover, mining operations can pollute the air and water. Dust and other airborne particles can be produced during mining operations, and both; humans and animals may experience respiratory issues. Moreover, mining operations have the potential to leak harmful chemicals into the environment, contaminating drinking water and endangering both people and animals. [3]

Governments and mining companies must take action to mitigate the detrimental effects of their operations. Some of these actions include enacting laws that restrict the release of hazardous chemicals into the environment and safeguarding sites that are considered to be of cultural significance. In order to prevent adverse effects on local populations from mining activities, it is also crucial for governments and mining firms to collaborate with them. To produce crops and cattle, organic farming uses methods and procedures that are nature based. [4]

Organic agricultural methods aim to increase soil fertility by giving the soil vital nutrients. To replenish vital nutrients and strengthen soil structure, organic matter such as compost, green manure, and cover crops is added to the soil. Moreover,

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the addition of these organic materials increases the soil's organic matter content, enhancing soil fertility as well as water penetration and retention. By increasing the quantity of organic matter in the soil, organic farming also aids in the improvement of soil structure. This organic material aids in making the soil structure more porous, which improves water penetration and retention. Also, by reducing soil compaction, this enhanced soil structure also contributes to greater root development and increased crop yields. [5]

Organic farming has been spread to 187 nations with 3.1 million farmers managing 72.3 million hectares of land. (Fig. 2) Australia (35.69 million hectares) has the highest amount of organic land, followed by Argentina (3.63 million hectares) and Spain (2.35 m hectares). All areas have seen a growth in organic agricultural land as well as retail sales. Organic farming is a promising sector which holds immense potential to grow and revolutionize the global agricultural industry. [6]



Fig 2: Global Organic Production in continents (2021) Source: NCOF Report

The aim of this study is to understand the history of land mining in India through scientific literature and highlight the benefits of organic farming as a land reclamation procedure in mining sites. It is a type of sustainable agriculture that works with the natural world to produce a wholesome and fruitful environment. The soil benefits highly from organic farming, including increased soil organic matter, enhanced soil structure, greater water penetration and retention, and improved soil fertility. The ultimate goal is to assess and evaluate the factors which may facilitate the adoption of organic farming for land reclamation due to mining activities.

## METHODOLOGY

### 2.1 RESEARCH AND REVIEW OF LITERATURE

Literature review was carried out based on scientific literature and reports related to mining practices in India. There has been significant damage resulting in water resource depletion and loss of green belt due to mining activities. This section highlights the current mining practices in India and operational land reclamation methods for the mines in the country.

### 2.2 DISCUSSION

The main focus of this section is to discuss the possibilities of organic farming to reclaim the degraded land in mining sites and identify the challenges to land reclamation in India. Current land reclamation methodologies were reviewed to understand the effectiveness of policies in India.

### 2.3 STRATEGIES AND RECOMMENDATIONS

The study concludes with providing a road map and a cause-effect diagram for the adoption of organic farming for land reclamation in mining areas providing an implementation plan strengthening governmental policies and support.

## MINING IN INDIA

Mining is an indispensable sector of the Indian economy which makes up 2.5% of the GDP contribution and 10% to 11% of the industrial sector's GDP. It generates massive employment with over 700,000 people employed in the mining business. In the coming years the metal and mining industry has been predicted to flourish and undergo reforms due to the various initiatives taken up by the government of India such as Make in India, Rural Electrification, Smart City and renewable energy developmental projects. [7]

Mineral	World Production Ranking
Iron Ore	4 <sup>th</sup>
Chromium	4 <sup>th</sup>
Bauxite	5 <sup>th</sup>
Zinc	5 <sup>th</sup>
Manganese	7 <sup>th</sup>
Lead	7 <sup>th</sup>
Sulfur	7 <sup>th</sup>
Titanium	11 <sup>th</sup>
Phosphate	18 <sup>th</sup>
Gypsum	16 <sup>th</sup>
Graphite	5 <sup>th</sup>
Salt	3 <sup>rd</sup>
Uranium	1 <sup>st</sup>

Table 1: India's Position In The World In Terms Of Production Source: Invest India Report

Almost 88 minerals, including metallic, non-metallic, and fuel minerals, are produced in India. (Table 1)

Odisha, Chhattisgarh, Karnataka and Jharkhand are India’s mining riches producing large amounts of valuable minerals such as gold, zinc, chromite, iron ore, aluminum and copper. The states of Odisha, Jharkhand, Chhattisgarh, Maharashtra, Goa, and Karnataka have the majority of the world’s iron ore deposits.

Manganese deposits are mostly found in Maharashtra, Madhya Pradesh, Odisha, Andhra Pradesh, and Karnataka. Jharkhand, Madhya Pradesh, and Rajasthan all have copper deposits. The states of Rajasthan, Andhra Pradesh, Madhya Pradesh, Bihar, and Maharashtra have the majority of the world’s zinc deposits. Odisha, Manipur, Nagaland, Karnataka, Jharkhand, Maharashtra, Tamil Nadu, and Andhra Pradesh all have chromite ore deposits. (refer Table 2) [8].

Name of State	Value of Mineral Production in 2020-21 (Crores)	Total Reported Mines
Orissa	27997	149
Rajasthan	16097	83
Chattisgarh	14441	98
Karnataka	9922	144
Jharkhand	2752	47
Madhya Pradesh	2588	251
Maharashtra	1192	71
Andhra Pradesh	1003	105
Gujarat	643	145
Tamil Nadu	591	92
Telangana	481	36

Table 2: Scenario of Mineral Rich States in India  
Source: MCDR Returns

The following significant minerals have increased in value from November 2021 to November 2022: Diamond (up 87%), Phosphorite (up 68%), Bauxite (up 30%), Iron Ore (up 19%), Coal (up 12%), Limestone (up 8.6%), and Manganese Ore (up 18.5%).

### 3.1 EFFECTS ON LAND DUE TO MINING IN INDIA

Direct and indirect mining activities lead to soil erosion, sinkholes, loss of biodiversity and surface pollution, leaving a long-lasting impact on the environment. Mining activities also release significant carbon emissions impacting climate change and human health. [9]

#### 3.1.1 Erosion

The loose soil, exposed slopes and huge mining dumps can lead to massive erosion resulting in siltation of rivers and streams. Excessive rainfall, poor soil management and chemical exposure from mining causes plant ecology imbalance, climate change and loss of habitats in the wild.

#### 3.1.2 Sinkholes

Failure of a mine roof due to resource extraction results in formation of sinkholes at or near mining sites.

Overburdened cavities at the mining sites cave in to create sinkholes at the surface affecting groundwater resources and displacing large populations in the nearby region.

### 3.2 LAND RECLAMATION METHODS

The most flexible future land use is typically possible with rehabilitations, which even has the lowest cost. Reclamation implies that the land usage prior to and following disturbance are very similar. Restoration is the most expensive and offers little flexibility in terms of land usage. The best objective for land reclamation can be viewed from numerous angles. Reclamation is generally chosen by regulatory agencies, the industry, and many ecologists, whereas rehabilitation is preferred by the industry. Despite having only 2% of the planet’s total surface area, India has 16% of the world’s population.[10] Understandably, the soil occasionally experiences stress that is beyond its capacity. India’s productive resources, especially its agricultural land, are continually degrading to varied degrees and turning into a wasteland. There are 68.35 million hectares of wastelands in India as of right now. These types of non-forest lands makeup nearly 50% of the land area and might be fertilized again with the correct care. [11]

- Organic inputs enhance the soil’s chemical and physical properties, including its ability to absorb nutrients, mobilize them, fix them permanently in stable humic compounds, and provide organic substances.
- Improved soil quality and nitrogen storage provided by organic matter stop nutrient loss due to leaching and erosion.



Fig 3: Land Reclamation Methods in Mining Areas

The primary factors influencing consumer demand for organic food are health consciousness and public willingness to pay more premium organic items. Rich and health-conscious consumers who are motivated by a generous price premium and environmental concerns make up the market for organic products. These unstated advantages are driving conventional farmers to adopt organic farming practices.

### 3.3 POLICY IMPLICATIONS

Mining-related land reclamation in India is a significant problem that requires attention. In India, mining is an important sector that has a big influence on the environment. Land degradation, water pollution, air pollution, and other environmental problems may all be brought on by mining. Land reclamation is therefore required to return the land to its original condition.

The Indian government has taken several actions to address the problem of mining-related land reclamation. To ensure that mining operations are carried out in an ecologically responsible way, the government has put in place several rules and regulations. For instance, before beginning operations, mining enterprises must acquire environmental clearance from the Ministry of Environment and Forests under the Mines and Minerals (Development and Regulation) Act of 1957. This guarantees that mining operations are carried out in an ecologically friendly manner. [12]

The government has also put in place several schemes to encourage land restoration. To encourage land reclamation in regions damaged by mining activities, the National Reclamation Program (NRP) was introduced in 2006. The initiative offers mining corporations financial support for land reclamation efforts. To guarantee that the land is returned to its former condition, this initiative also offers technology to mining businesses. [13]

To encourage land reclamation, the government has carried out several additional measures. For instance, mining corporations are required under the National Mineral Policy of 2008 to reserve a specific portion of their income towards land restoration initiatives. Also, the government gives local towns financial support for land restoration efforts. [14]

## DISCUSSION

### 4.1 CHALLENGES TO LAND RECLAMATION

#### 4.1.1 Government Regulatory Barriers

The planning requirements, guidelines, and administrative restrictions for registering, purchasing, and transferring land have a considerable impact on the equity and profitability of land markets. Even though these guidelines were created by experts, they have failed in several places. For instance, statutory minimum plot sizes usually rely on unrealistic ideals, come with high costs, and make it difficult for many

current homeowners to get approval for a variety of unlawful construction types. [15]

#### 4.1.2 Lack of Proper Land Management

There is a significant lack of planning and management system in the mining sector. The unorganized supply chain has several loopholes in between which restricts efficient restoration of land and other reclamation activities in India.

#### 4.1.3 Property Disputes

Land management discussions are largely affected by economic and political factors. Neoliberalism aims to bring together traditional liberalism with state planning. Notwithstanding the global financial crisis of 2008, land and property remain a major financial asset of choice for those with disposable income, and land has turned into a commodity, significantly decreasing its social value. [16]

The effects of reclamation on ecology have been the focus of several studies in recent years. [17] Scientists have identified several detrimental effects of the lakes' land recovery, including habitat loss, the removal of natural flood protection and buffers, water pollution, and eutrophication caused by agriculture, among other things. To repair and recover the soil while reducing carbon emissions and environmental pollutants, organic farming is used in this situation.

### 4.2 APPLICATION OF ORGANIC FARMING IN LAND RECLAMATION

The goal of organic farming is to produce food without the use of artificial fertilizers, pesticides, or other chemicals. Reclaiming land that has been harmed by conventional agricultural techniques is one of the most significant advantages of organic farming. Land that has been damaged by traditional agricultural techniques can be restored with the aid of organic farming. Synthetic fertilizers and pesticides are frequently used in these procedures, which can cause soil erosion, water pollution, and the loss of natural ecosystems. Farmers may aid in returning the land to its original form by employing organic agricultural techniques. This may involve regenerating soil fertility, enhancing water quality, and establishing animal habitats.

The quantity of land required for farming may be decreased with the use of organic farming. Farmers may grow more food with less land use if they use organic farming practices. This may serve to lessen the amount of land required for farming, which may lessen the amount of land removed from habitats for animals. Reducing the quantity of water and energy required for farming operations is another benefit of organic farming. [18]

To preserve the fertility of the soil, organic farming employs two strategies: maximizing the crops grown on each farm



and making the most of the available organic fertilizing resources. In organic farms, crop rotation practices also help preserve better biodiversity. [19] Organic farming results in soil that is richer in organic matter, biomass, and enzymes, as well as being more stable, percolating faster and retaining more water than conventional agricultural techniques. Fig. 4 explains the myriad ways through which land can be restored through organic farming.

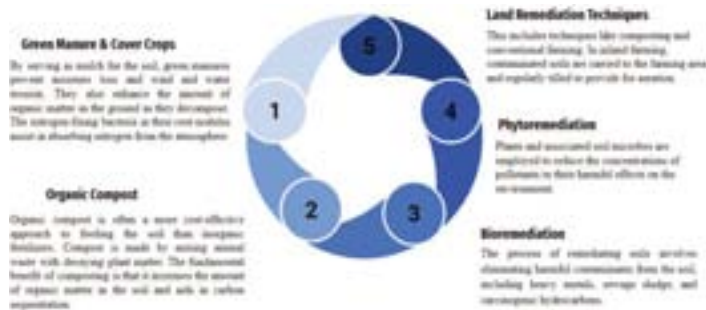


Fig 4: Land Restoration via Organic Farming

**RECOMMENDATIONS & CONCLUSION**

A strategy plan for land reclamation of mines through organic farming in India is shown in Fig. 5. The preliminary environmental evaluation is the initial phase. At this phase, samples (waters, soils, sediments, etc.) from the possibly impacted areas are collected and analyzed. The creation of options for future usage of the land should be constrained by economic and vocational considerations, in addition to advising more thorough investigations (environmental assessments). Organic farming is the second phase in soil restoration. By the creation of both long-term and short-term environmental prospects, this would also aid in boosting the economy. The last stage is to keep an eye on things. By contrasting the analytical data with the outcomes attained during the final verification and continuous monitoring phases, the quality of remediation’s effectiveness is calculated. The final verification and monitoring phases involve ongoing communication with residents and communities, much like the whole restoration process.



Fig 5: Roadmap to land reclamation through organic farming

A solid plan is needed to allow organic farming in mining sites to restore the land. An impacts diagram, shown in Fig.

6, highlights the cause, effect, and impact of using organic farming techniques for land reclamation in mining sites. As a result, the land is revitalized and jobs are created. It also aids in the establishment of research and development facilities and the development of tourist attractions. Moreover, this would help the mining sector build small and medium-sized businesses and a well-organized supply network.

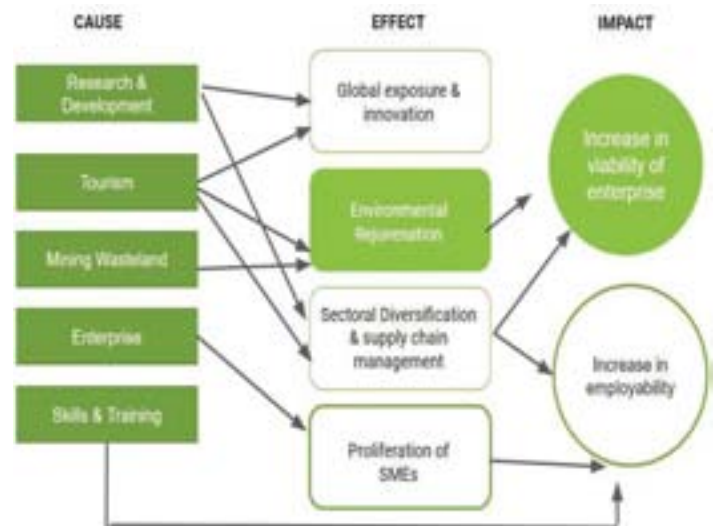


Fig. 6: Effects Diagram showing cause and impact of organic farming practices in land reclamation

Landscape reclamation is being employed in various regions of the world to remedy contaminated and dilapidated areas of deserted mines. This requires time, money and good geological fortune for an effective transformation. Hence constant research and development efforts are required to find out newer and latest technologies and methodology to reclaim the land for better use. A complete system of land market regulation is required, one that combines the state’s capacity for knowledge production with capitalism’s capacity for resource use efficiency to promote growth. Land reclamation via organic farming could be a promising solution to meet the sustainable development goals of the country along with endorsing rural economic development, intensification employment prospects and condense urban rural difference.

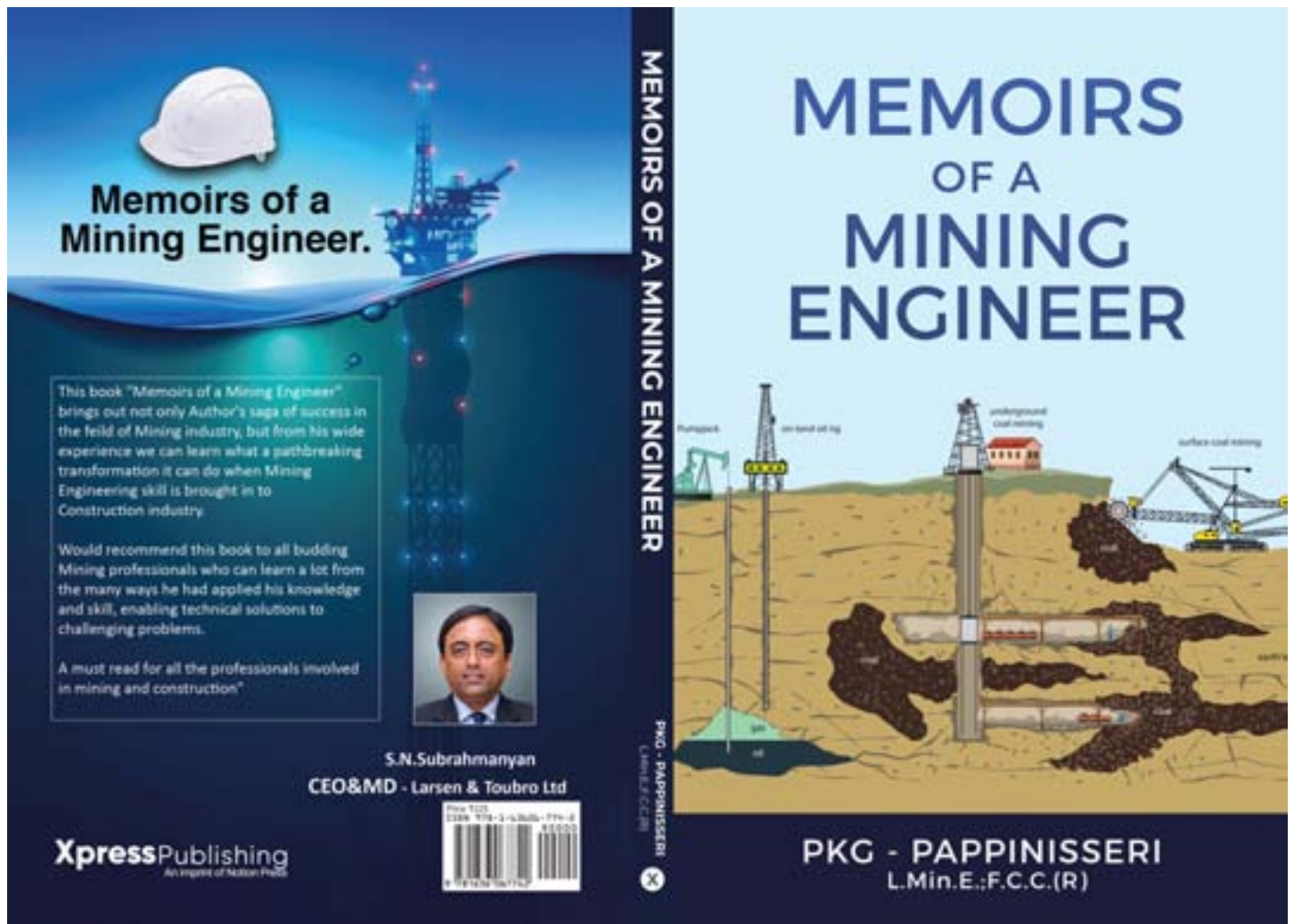
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## 4<sup>th</sup> IN-PERSON PROFESSIONAL TRAINING PROGRAM ON IMIC

24-28 April 2023

MEAI HQs, Hyderabad

Mining Engineers' Association of India (MEAI), the trusted voice of the Indian mineral industry, is the leading Professional Organisation (PO) recognised by the National Committee for Reporting Mineral Resources and Reserves in India (NACRI). MEAI accepts the obligation of offering professional development programs to its members, registering Competent Persons (CP) and supervising their ethical conduct. NACRI is the National Reporting Organisation (NRO) of India recognised by the Committee for Mineral Reserves International Reporting Standards (CRIRSCO).

The earlier three on-line training programs on IMIC were successfully concluded by NACRI in January 2021, April 2021, and April 2022 with the participation of over 25 professionals in each program, representing the mining companies, consulting companies and individuals from across the country and overseas. Most of the participants have successfully completed the training program and more than a third of them have registered as Competent Persons (RCP) with MEAI.

### Prerequisites for registration of CP

RCP has been defined under Clause #9 of IMIC 2019 as follows:

***RCP is a mineral industry professional who is a member of a professional organisation headquartered in India and approved by NACRI or a member of a 'Recognised Professional Organisation' (RPO), as included in a list of similar bodies headquartered outside India available on the NACRI website. These organisations have enforceable disciplinary processes including the powers to suspend or expel a member. An RCP must have a minimum of ten years professional experience, which includes five years relevant experience in the style of mineralisation or type of deposit under consideration, and in the activity which that person is undertaking.***

***In addition to the above minimum professional experience required by the MEAI members for registration as RCP, the NACRI, vide Article 2.2.ii, further specifies that the potential RCP shall obtain at least 40 hours of mandatory professional development credits before making an application for registration and for certificate renewal every year the RCP should obtain at least 8-hour credits through participation in seminars, conferences, workshops, training programs or webinars, recognised by NACRI.***

Accordingly, those eligible mineral industry professionals in India interested in registering as Competent Person under IMIC should be a Life Member of MEAI, attained at least 10 years of professional experience and acquired 40 hours of mandatory professional development credits on IMIC from the NACRI organised training program, at the time of making application to MEAI.

RCP certification shall be valid for a period of one year from the date of issue of the certificate and the same may be renewed thereafter. The annual CP registration as well as the renewal fee has been fixed at Rs 5,000 (Rupees five thousand only + GST @18%) and payable to MEAI.

### Professional Development Program on IMIC

The fee to attend the mandatory IMIC training program may be paid online. The fee chargeable for the 5-day in-person non-residential training program is Rs. 25,000 (Rupees twenty five thousand only) plus applicable GST @18% and payable to:

Account Name: **MEAI-National Core Committee Fund**

Bank Name & Address: **UCO Bank, Abid circle, Hyderabad**

S/B Account No: **14410110037089**

IFSC: **UCBA0001441**

NACRI has formulated a 40-hour (5-day) IMIC in-person non-residential training program, which every prospective RCP must undergo before applying for an RCP certificate. This IMIC training course conducted by domain experts includes sharing of basic knowledge on all relevant aspects of IMIC and Code of ethics, mineral industry Best Practices, and general guidance to the prospective RCP. Key topics articulated in the IMIC training program are:

- Introduction to CRIRSCO/ MEAI/ NACRI Charter/ IMIC/ Code of Ethics
- Scope of IMIC
- Competence and Responsibility
- Reporting Terminology and Standard Definitions
- Reporting of Exploration Results and Exploration Targets
- Classification and Reporting of Mineral Resources
- Classification and Reporting of Mineral Reserves
- Reporting of Coal Exploration Results, Resources and Reserves
- Scoping, Pre-feasibility and Feasibility studies
- Emerging topics covered in CRIRSCO 2019 Template and PERC
- Table 1 (If Not why Not Table) and QA/QC
- Industry Best Practices

Every RCP should have successfully accomplished a 40-hour mandatory training program on IMIC prior to making an application for renewal of RCP. Subsequently, the RCP may renew the certificate by obtaining a minimum of 8-hour professional development credits every year by attending NACRI accredited seminars/ workshops/ conferences/ training programs/ webinars and paying the renewal fee. The MEAI Headquarters shall maintain the records of each trainee/ RCP and provide the same to the MEAI RCP Registration committee.

### Professional development program schedule

The NACRI Core group shall conduct the 40-hour in-person IMIC non-residential training program under the direction of Dr A. Srikant / Mr T.R. Rajasekar, the founder members of NACRI. **The 4<sup>th</sup> IMIC in-person non-residential training program will be held during 24-28 April 2023 in the state-of-the art Conference facilities available at MEAI Headquarters, Hyderabad.** Working lunch, tea & snacks twice a day and cocktail dinner on the inaugural day are included in the course fee.

### Contact details

Interested mineral industry professionals may please contact the Secretary General, MEAI at [meai1957@gmail.com](mailto:meai1957@gmail.com) / Phone no. 040-66339625/ 040-23200510 or **Mr. T.R. Rajasekar** at [shekar.thotapalli1952@gmail.com](mailto:shekar.thotapalli1952@gmail.com) for more details on this training program.

**Dr PV Rao**

Co-Chair NACRI, [editor.mej.meai@gmail.com](mailto:editor.mej.meai@gmail.com)

## MEAI NEWS

### MEAI HEADQUARTERS

#### President visits Nagpur Chapter

Shri. K. Madhusudhana, President – MEAI visited Nagpur on the occasion of IBM 5 Star rating Mines Award function. During his visit, he met members of the Nagpur Chapter. He also met MOIL executive Shri Abdullah, Director (P&P), to increase their involvement in the Chapter activities. He received the suggestion very well and assured to accelerate their support. President along with some members felicitated Shri U.W. Datey and Shri Sangode, Ex COM, IBM by visiting their homes.



The President of the Association also had Meeting with Senior Members of the Nagpur Chapter and discussed our activities. In the meeting, he met Shri P.N. Sharma, Chairman, Dr. Y.G. Kale, Secretary, Dr. Srikanth, NACRI and Shri. Pukhraj Nenival, Chairman of Jabalpur Chapter and others.



#### President visits Visakhapatnam Chapter

Shri. K. Madhusudhana, President – MEAI visited Visakhapatnam Chapter on 8-3-2023 and had a meeting with the members of Visakhapatnam Chapter to know the activities being taken up by the Chapter.

Interactive session with Geology students of Andhra University at Vizag was organised. They have expressed their willingness to form a Student Chapter. During the formal discussions, he learnt that the Mining Students are getting the Job opportunities. He appealed to the members to accommodate Mining Students wherever possible.

He also felicitated some very senior geology professionals. Shri Harikrishna, Shri Venkata Ramana, Shri Ganga Raju, Shri Sharma, Dr Shantharam, Shri Sathya Narayana Reddy, faculty and Students were present in the meeting.



#### First Aid training program inaugurated

DGMS has granted approval to MEAI vide Letter no. DGMS/OH(HQ)/First Aid/02/2023/02/04 for imparting First Aid Training and to Issue certificates.

On 24-03-2023, Chief Guest and Past President of the Association Sri VS Rao, inaugurated the program. Shi Md. Fasihuddin, Past President and Sri BRV Susheel Kumar, Director Government of Telangana addressed the participants as Guests of Honour on this occasion.

In the maiden Batch, 25 candidates joined for seeking First Aid training. After completion of the program, the participants will be evaluated and the successful candidates will be awarded with First Aid Certificates.



*Sri VS Rao delivering his inaugural speech. Others sitting on the dais (L-R): Sri M Narsaiah, Sri BRV Susheel kumar, Sri Md. Fasihuddin, Sri B Mahesh kumar and Dr Naveen*

Sri M Narsaiah, Secretary General, Sri B Mahesh Kumar, Secretary Hyderabad Chapter, and Dr Naveen, First Aid trainer organized the Inaugural Program.



Sri B Mahesh Kumar proposing vote of thanks



First Aid Training (Batch -1) group photo with the Guests

### AHMEDABAD CHAPTER

Kutch Local Centre of Ahmedabad Chapter organized a Knowledge sharing session on 23 January 2023 on the topic “The current trends of Demand for the Rare Earths & Critical Minerals and India’s Position” at GMDC Limited, Lignite Project Mata No Madh. This seminar was also conducted in virtual mode. Around 56 participants have joined the session.

Shri NN Mupkalwar, I /C General Manager (Mines), Lignite Project, Umarsar and executive member of Ahmedabad Chapter presented the welcome address. He briefed about the relevance & importance of the topic.



Inaugural speech by Shri NN Mupkalwar



View of Audience

6 papers on “Current trends of Demand for the Rare Earths & Critical Minerals and India’s Position” were presented by different projects under the Kutch Local center.

- Shri Karnav Patel, Geologist, Shri Yash Kathiriya, AM (Env) GMDC Matanomadh Lignite Mine
- Shri SC Jagrawat, DGM-Mines, Shri PK Swain, Sr. Mgr. Mines, GMDC Umarsar Lignite Mine
- Shri Ishan Sur, Geologist GMDC Panandhro Lignite Mine
- Shri Gaurav Rajpur, (SCW-UTCL) Ultratech Cement Ltd.
- Ms. Prachi Dave, Geologist GMDC Bauxite Project, Gadhsisa
- Shri NK Virmgama, Management Executive GMDC Bauxite Project, Gadhsisa

### Key highlights of the Papers are:

- Rare earth elements are likely to remain an important part of our future- from quantum computing and material sciences, to medical applications and advances in green technology. The growth of wind farms will continue to drive demand for neodymium and dysprosium used in wind turbine motors.
- Ongoing moves away from internal combustion cars to electric vehicles will also increase demand for rare earth magnets and batteries. To cope up with the situation of battery demand & to become self-potential India needs to identify Lithium resources & mining should proceed.
- To meet future demand, mining companies have proposed opening new mines and building new processing plants in many parts of the India. However, these production techniques might become economically viable if a large increase in demand drives up prices or if governments decide to subsidize the costs of production.
- REE metals extraction techniques and facilities have to be pooled and the gap in the areas needs to be identified.
- Need for strengthening exploration expertise with modern concepts and tools including remote sensing capabilities.



- Recycling technologies of REE containing products need to be developed on a commercial scale.
- Need to identify new applications for the REE and use it as a substitute for the scarce or critical rare earths used in various applications.
- Needs to adopt optimized market strategies for a sustainable rare-earth industry.
- Needs to invest in a research and development program.
- India needs to create a new Department for Rare Earths (DRE), which would play the role of a regulator and enabler for businesses in this space.
- India must learn from other advanced economies on how they are planning to secure their mineral needs and attempt to join multinational fora on assuring critical mineral supply chains – or use existing partnerships, such as Quad and BIMSTEC, to foster such dialogues.
- There must also be top-level decision making within the government to strategize on how to create vertically integrated supply chains of green technologies manufacturing, or we may be in serious danger of missing our climate change mitigation targets.

#### Various Developmental works on REE under progress in the country are:

- A small hamlet in Chhota Udepur district with a population of little over 2,000 will soon be on the national map. The Atomic Minerals Directorate for Exploration and Research (AMD), which is working in Ambadungar village at Chhota Udepur district, has discovered a huge chunk of rare earth elements oxide.
- The details of this discovery were made public by the central government in the Rajya Sabha recently. AMD has estimated a quantity of 3.46 lakh tonnes of rare earth elements oxide and 19,546 tonnes of niobium oxide in the Ambadungar area in Chhota Udepur district.
- Rare Earth (RE) Theme Park: Pilot Plants for demonstration of technology in the value chain of Rare Earths, Entrepreneur and Skill development at Bhopal, Madhya Pradesh
- Capacity expansion of Orissa Sands Complex (OSCOM) plant: Increase in capacity from 2.8 to 6.2 lakh tpa of Ilmenite and associated minerals such as Rutile, Zircon, Sillimanite and Garnet. .
- Private Freight Terminal (PFT)- OSCOM: Conversion of IRELS Private railway siding to Private Freight Terminal
- Rare Earth Permanent Magnet Plant (REPM): Setting up of 3000 kg of Rare Earth Permanent Magnet plant for strategic applications at Visakhapatnam based on Indigenous Technology.
- IREL-IDCOL Ltd: Setting up a new mining and mineral separation plant for winning beach sand mineral deposits in Puri District of Odisha.



Presentation by (1) Shri Karnav Patel, Geologist-MNM (2) Shri Yash Kathiriya, AM (Env.-MNM)

The paper presenters and Guests were felicitated with mementoes. Session was concluded with a vote of thanks presented by Shri Dinesh Bhimani and was coordinated by Shri BN Jha, General Manager (MDO-Mata No Madh). The event was sponsored by M/s. Mahalaxmi P.C.Patel Consortium Pvt. Ltd.-MDO-Mata No Madh.



Shri Ishan Sur, Geologist-GMDC Panandhro receiving memento from Shri Mupkalwar



Presentation by (1) Shri S C Jagrawat, DGM-Mines, Umarsar; (2) Shri P K Swain, Sr. Mgr. Mines, Umarsar



Presentation by Shri Gaurav Rajpur, (SCW-UTCL)



Presentation by Ms. Prachi Dave, Geologist, GMDC Gadhsisa



Shri NK Virngama, GMDC Gadhsisa receiving memento from Shri Mupkalwar

### Seminar on Sustainable Mining Practices

The Bhavnagar Local Centre of the Ahmedabad Chapter organized a Seminar on “Sustainable Mining Practices” on 30<sup>th</sup> January 2023 along with a Mine Visit.

This seminar was organized in two sessions:

In the first session, mine visit to Khadsaliya Lignite Mine GHCL Ltd. Bhavnagar was arranged with the members of MEAI and employees of the three mines, Khadsaliya Lignite Mine, GHCL Ltd., Surkha North Lignite Mine, GMDC Ltd. and Ghogha Surka Lignite Mining Project, GPCL.

During the mine visit, the reclamation practices of GHCL were shown to all, which were much appreciated by the members. GHCL has adopted the cooperative approach with involvement of villagers in the plantation. Various activities like land preparation, planting fruit bearing plants, post plantation care, watering, fertilizers, cattle protection etc. are shared along with the produce (fruits). The parcel of land allotted to them is their land, which has been acquired. Mine visit was arranged with the intent to share the best practices with each other.

In the second session, a paper presentation was organized at Khadsaliya Lignite Mine, GHCL on the theme “Sustainable Mining Practices”. It is well evident that mining is crucial in the development of any Nation, but the Impression of the mining industry is often reflected as a “Bad Industry” due to potential impacts on Environment. But sustainable mining practices can change the mindset of public. The involvement of the mining affected population in allied works like transportation, canteen, & other works can develop a sense of inclusion.

Shri Anil Wandkar, MEAI Member of Bhavnagar local center welcomed the audience and narrated the importance of MEAI and the Seminar. Shri B. K. Mahato, Convenor of Bhavnagar Local center, General Manager/Project in charge of Surkha North GMDC Ltd mine delivered the Keynote address. In his address, he narrated the importance & requirement of “Sustainable Mining Practices” for the country. Shri Sanjay Mathur, MEAI member and Mines Manager /DGM GMDC Bhavnagar Lignite Mine, in his address briefed about the sustainable mining practices. Shri Yashwant Kumar Singh, Mines Manager Ghogha Surka Lignite Mine GPCL delivered the speech on the subject matter. In his speech, he focused on mining history.

In the technical session, the following participants presented four papers:

1. Shri Anil Wandkar  
Secretary MEAI Bhavnagar Local Centre and Mines Manager at Khadsaliya Lignite Mine
2. Shri Sanjay Mathur  
MEAI member, DGM/ Mines Manager, GMDC Bhavnagar Lignite Mine
3. Shri Yashwant Kumar Singh  
Mines Manager, Ghogha Surkha Mine, GPCL
4. Shri Chattarpal Singh Gohil  
CSR, Social Mobilizer officer, GMDC Bhavnagar



Mine Visit

More than 55 participants were present in the meet. The session was followed by dinner. Shri Sanjiv Kumar Pandey, Safety Officer, GHCL Ltd. Khadsaliya Lignite Mine delivered the vote of thanks. Program was anchored by Vivek Gupta, HR officer. GHCL Ltd.



Shri B K Mahato Addressing, Seminar



Shri Sanjay Mathur presenting paper



Shri Y.K Singh presenting his views



Shri Anil Wandkar making a presentation



Shri Chattarpal Singh

**HYDERABAD CHAPTER**  
**SCCL Senior Executives felicitated**



Felicitation to Shri NVK Srinivas, Director (Operations) M/S. Singareni Collieries Company Limited by Shri. M. Narsaiah – Secretary General, Shri. M.S. Venkataramayya, Vice Chairman – Hyderabad Chapter and Shri. B. Mahesh, Secretary – Hyderabad Chapter



Felicitation to Shri G. Venkateswara Reddy, Director (Planning & Projects), M/S. Singareni Collieries Company Limited by Shri. M. Narsaiah – Secretary General, Shri. M.S. Venkataramayya, Vice Chairman – Hyderabad Chapter and Shri. B. Mahesh, Secretary – Hyderabad Chapter

## RAJASTHAN CHAPTER-JODHPUR

### Report on Workshop conducted on ‘Mines Safety & Slope Stability in Makarana Marble’

The Rajasthan Chapter - Jodhpur along with Mining Engineering Department, MBM University, Jodhpur had a field excursion cum workshop program in consultation with ME, DMG, Makrana, Rajasthan at Makrana Marble area on dated 24 February 2023. During the field visit the area was preliminary studied by the eminent Mining engineers, Geo-scientist, department professors and subject experts under the guidance of ME, DMG-Makrana. Local mines owners of the area were also associated. In the visit, team had a few observations on litho-unit behaviours of marble, mining methodology, mine safety and further possibility of safe mining in the area at deeper levels in a sustainable manner.

Thereafter, a workshop on ‘Mines Safety & Slope Stability in Makarana Marble’ was conducted wherein members of local marble associations and MLA were present. The Director, DGMS, Ajmer had also made his viewpoints on the subject matter.

Based on the field visit and interaction during the workshop, a few suggestions were given by speakers to overcome the main problems being faced by the miners /mine owners in their mines. Recommendations are made from the Forum to address the issues in a scientific manner for sustainable mining over this world famous deposit.

### Recommendations

Based on the preliminary field observations and the discussions in the workshop, a group of members comprising Prof (Dr.) DM Surana (Mining Engineer), Dr Pramod Rajmeny, Rock Mechanics & Slope stability expert, Prof (Dr.) Ram Prasad, HoD- Mining Engineering department, MBM University, Shri Surjeet Katewa, Director-DGMS, Ajmer region, Shri AK Jaiswal, Geo-scientist & Chapter Chairman, Er PR Dave (Mining Engineer), Er Mahesh Purohit, Mining Engineer-DMG, Rajasthan, Er AK Jain (Mining Engineer) made the following recommendations:

1. Mine owners should rectify section 22(3) imposed by DGMS by observing proper safety aspects during mining, like use of mine safety equipment (“PPE”), proper development of the face, bench mining etc. All local marble associations may lead in the matter and co-ordinate with DGMS Ajmer.

Personal protective equipment, commonly referred to as “PPE”, is equipment worn to minimise exposure to various hazards. PPE in mining include gloves, steel-toed footwear and eye protection, protective hearing devices (earplugs, muffs), hard hats, respirators etc. Hard hats are essential to keep workers safe to protect them from severe injuries: rock fall is a common cause of incidents in the area.

2. Proper fencing of the high rise benches to avoid any accident during movement of man/machineries on the top of the ground surface.
3. Area requires detailed geological & structural mapping by some independent expert agencies/ universities.
4. To assess the bottom of the deposit, some exploratory deeper boreholes (preferable up to 200m) at regular intervals in hanging wall side at 400m intervals alongside of the quarry may be carried out. It will also help to ascertain total resources of the deposit. Independent expert agencies/ state DMG may take up this matter through the RSMET fund.
5. Drone survey of the area, to assess the habitation around the quarry areas- at least 100m on both sides in each range along with determination of the current geometry of the area like size of mined out voids, their geometrical attributes, etc.
6. Director, DGMS, Ajmer may be requested by state DMG to study and if required declare an unsafe zone up to 100m from the pit boundary towards Hanging wall side. This report may be submitted to the government through the Collector for rehabilitation work by vacating habitation in this belt.
7. To ensure stability prime-facie, the subject matter experts using conventional means like prisms and Total Survey Stations to begin with should monitor the hang wall of the mines. The Jodhpur Chapter can take lead and offer its services with financial sharing by local mine owners and their Association. Outcome of the stability monitoring would be shared with DGMS which can pave for relaxing or removing Section 22(3) from the area and restoring the normal mining.
8. Stability of the current configuration of the slope should be assessed scientifically by the subject matter experts. Jodhpur Chapter can take lead and can provide every support in this regard. Nevertheless, it is also expected that local mine owners and their Association should also come forward to bear the financial implication of these investigations.
9. The aforesaid study will also suggest remedial measures like stable configuration of the mine walls, method of marble extraction down below the existing pit bottom.
10. HW side area may be acquired by the government through notification in the interest of the nation or by licensees under suitable modality for removal of OB to allow widening of the pit and recover the valuable mineral resources of the area.
11. The diversification of state highway/district roads may be taken up for proper mine working under DMFT fund utilisation program.
12. The state government may increase lease area dimension and if possible, 3-4 leases/ licensees adjoining areas may be clubbed with suitable modality;

either by cancellation of all leases and re-allotment to them with preferential rights to existing lease holders. If required, the government may draft 'Makrana Marble Khanan Niti' to address this issue.

13. Amalgamation of small leaseholds and mining on co-operative basis may also be an alternative after due consultation with mine owners, government representatives and environmentalists for sustainable development of the mining area.

Based on the above observation and the possible recommendation made under the reference of the Jodhpur chapter is a having a strong group of professors as mentioned above including Prof. Sushil Bhandari, Prof. S. K. Parihar, Dr. P.C. Purohit, Dr. M. R. Sahran, Er. Maheem Kacchhawa and others along with the MBM University who can undertake any scientific study and prepare technical reports. Use of natural resources and their transformation into economically valuable commodities has to be sustainable. Otherwise, the very base of development will be eroded.



Makrana MLA Shri Roopa Ram Addressing the gathering. Seated on the Dias are Prof. R. P. Choudhary, Er. M.P. Purohit, Dr. P.K. Rajmeny, Prof. D.M. Surana, Er. Surjeet Katewa, Shri A.K. Jaiswal, Shri Haroon Rashid Choudhary

Over 75 members and students participated in the one day workshop at Markrana. Shri Roopa Ram Murawatiya, MLA Makrana, Er. Surjeet Katewa, Director DGMS, Ajmer region, Shri A. K. Jaiswal, Chairman, Jodhpur chapter, Prof. D. M. Surana, Er. P.R. Dave, Dr. P. K. Rajmani, Er. M. P. Purohit, ME, DMG, Makrana, Shri Rakesh Acharya, DMG, Prof. R. P. Choudhary, HOD, Mining, MBMU, Mine owners and their representatives Dr. Aalam, Bhagu Ram Anwala, Abdul Gafoor Chouhan, Haroon Rashid Choudhary shared their views during this workshop.



Address by Shri A. K. Jaiswal in workshop at Makrana.chapter Jodhpur



Shri Surjeet Katewa, Director (I/C), DGMS, Ajmer suggesting safety measures for safer mining



Shri M. P. Purohit, ME, DMG Makrana sharing his views



Addressed by Prof. D. M. Surana, on safety and slope stability issues in Makrana

## RAJASTHAN CHAPTER-UDAIPUR

### Felicitations of Shri Gulab Chandra Ji Katarai, Governor, Assam

A Programme to felicitate Shri Gulab Chandra Ji Kataria on becoming the Governor of Assam was organised by Mining Engineers Association of India, Rajasthan Chapter-Udaipur on February 20, 2023.



(L to R) Shri MS Paliwal, Chairman; Dr SK Vashisth, Joint Secretary; Shri Gulab Chandra Ji Kataria, Governor, Assam, Shri AK Kothari & Shri RP Gupta, Past Presidents MEAI



On this occasion, Shri Gulab Chandra Ji Katariya was warmly felicitated by covering him with turban, Uparna and shawl and presented a memento.

On behalf of the Mining Engineers Association of India, Rajasthan Chapter- Udaipur, heartily congratulated Shri Gulab Chandra ji Kataria on being nominated as the Governor of Assam. On this occasion, Shri MS Paliwal, Chairman, MEAI-Udaipur, Former National Presidents of MEAI Shri RP Gupta & Shri AK Kothari and Dr SK Vashisth, Joint Secretary of the Chapter were present on behalf of the Association.

### VERAVAL PORBANDAR CHAPTER

#### Election of New Office bearers and Executive body for 2023-2025

The Annual General Meeting of the Chapter was held on 25.02.2023 at Hotel Pride Divine, Veraval - Girsomnath, Gujarat in the presence of 30 members of the Chapter. The AGM was chaired by Shri Arun Kumar Sharma, Former Chairman of the Chapter and Cement Advisor, GMDC. Shri CM Dwivedi, Chapter Secretary and renowned geologist of the area welcomed the audience and proceeded the program with permission of the Chair. Shri Mayank Shrivastva, Mining Engineer, Tata Chemicals took the responsibility of anchoring the program. Chapter Chairman Ajay Kumar Jain welcomed the Chief Guest Shri Arun Kumar Sharma and all members and put a proposal of AGM for the election of a new Executive body as well as requested for conducting a Seminar for shooting the various problems of mining in the region. Mr Manish Kumar Yadav, Vice Chairman explained the annual activities and future activities for all the members. Shri Mayur Galoriya, Treasurer presented the audited report of accounts which was approved by the house. The election for the new Office bearers and Executive Committee for term 2023-25 was held and the following were unanimously elected:

- Chairman: Shri Manish Kumar Yadav (Mines Head, GHCL, Sutrapada)
- Vice Chairman: Shri MK Jain (Mines Head, Ambuja Cement, Ambujanagar, Kodinar)

- Secretary: Shri CM Dwivedi (Consultant Geologist & Former Mines Head, Tata Chemicals, Porbandar)
- Jt. Secretary: Shri Rohit Gaur (Mines Head, Tata Chemicals)
- Treasurer: Shri Mayur Galoriya (Mines Manager, Ambuja Cement, Ambujanagar, Kodinar)

#### Special Invitees

- Shri Arun Kumar Sharma (Past Chairman, VP Chapter & Cement Advisor in GMDC)
- Shri Ajay Kumar Jain (Past Chairman, VP Chapter & Consultant Geologist & Mines Manager, Nagpur)
- Shri K K Choudhary (Head, Ashapura Minerals, Khambaliya)
- Ms Khushboo (Geologist, GHCL)

#### Executive Members

- Shri Dinker Dashora, Ultratech Kovaya
- Shri RK Goyal, Ultratech, Jafrabad
- Shri Rajiv Ranjan, GSCL, Modasa
- Shri HK Jain, GSCL, Modasa
- Shri Murali Mohan GHCL, Sutrapada
- Shri Arjun Singh, DCW Ltd
- Shri DK Singh, Nirma Ltd, Porbandar
- Shri Mayank Shrivastava, Tata Chemicals, Adityana
- Shri PK Deshpande, Saurashtra Cement, Ranavav
- Shri UC Tiwari, Digvijay Cement
- Shri AK Sahu, CUMI, Bhatia
- Shri SK Kaushik, Dalia Refractory, Khambaliya
- Shri Jitendra Prasad Kumawat, Ambuja Cement

#### Open house deliberation on the following topics

- State or National Seminar, STATE LEVEL
- Bhatia bauxite area
- Revenue land NA
- MOEF & CC and FC Clearances
- Lease extension, IMD Gujarat
- State machinery delays, CGM office
- Lack of high-grade material
- Barda Wildlife sanctuary ESZ outside area
- DILR Coordinates fixing and map authentication verses Digital survey (Drone)
- Lime mud, cement grade limestone

Shri Arun Kumar Sharma in his address congratulated the newly elected Executive body and guided for conducting a Seminar. It was decided to conduct a regional level seminar on the local problems as discussed in house. The venue

of the proposed seminar will be finalized in Rajkot (central place for Saurashtra and well connected with the Capital and rest of India). A Steering Committee consisting of the following members was formed for organising the seminar.

Shri Manish Kumar Yadav, Shri MK Jain, Shri Dinkar Dashora, Shri RK Goyal, Shri Rohit Gaur, Shri Pk Deshpande, Shri AK Sahu



The meeting ended with the Vote of thanks proposed by Shri. CM Dwivedi.

(Continued from Page 14)

Silicon, gold and copper, as well as electric fields, can be used to destroy the spike proteins of SARS-CoV-2, the virus that causes covid-19, according to new research.

“Coronaviruses have spike proteins on their periphery that allow them to penetrate host cells and cause infection and we have found these proteins become stuck to the surface of silicon, gold and copper through a reaction that forms a strong chemical bond,” Nadim Darwish, who led the research at Curtin University, said in a media statement.

“We believe these materials can be used to capture coronaviruses by being used in air filters, as a coating for benches, tables and walls or in the fabric of wipe cloths and face masks.”

In a paper published in the journal *Chemical Science*, Darwish and his colleagues explain that, in addition to the metals, coronaviruses could be detected and destroyed using electrical pulses.

“We discovered that electric current can pass through the spike protein and because of this, the protein can be electrically detected,” PhD candidate Essam Dief said.

In Dief’s view, this finding can be translated into applying a solution to a mouth or nose swab and testing it in a tiny electronic device able to electrically detect the proteins of the virus. This would provide instant, more sensitive and accurate covid testing.

In addition to the prior, by applying electrical pulses, the researchers found that the spike protein’s structure is changed and at a certain magnitude of the pulses, the protein is destroyed. This means that electric fields could deactivate coronaviruses.

“So, by incorporating materials such as copper or silicon in air filters, we can potentially capture and consequently stop the spread of the virus,” Dief said. “Also importantly, by incorporating electric fields through air filters, for example, we also expect this to deactivate the virus.”

For the researchers, this study is quite promising both fundamentally, because it enables a better understanding of the viruses in question, and from an applied perspective as it helps develop tools to fight the transmission of current and future coronaviruses.

*Staff Writer, Mining.Com | March 20, 2023*

### ➡ Rio Tinto has more work to do, cultural heritage audit finds



Juukan Gorge cave sites seen before the destruction. (Screenshot via YouTube.)

Rio Tinto has more work to do to protect Indigenous cultural heritage at its mines around the world,

according to an independent audit of its practices, the world's biggest iron ore miner said on Monday.

Rio Tinto commissioned the audit as part of a pledge to overhaul its practices after it destroyed culturally significant rock shelters at Juukan Gorge in Western Australia for an iron ore mine in 2020.

The report noted improved practices particularly at Rio's iron ore operations but found it needed to more consistently meet best practice standards, which includes co-designing mining plans with affected communities, at its other global sites.

At around half of its sites, Rio Tinto either was missing a cultural heritage plan, its plan was out of date or had critical gaps, the report by sustainability consultancy ERM found.

"Consequently, there is a risk that current and emerging impacts to cultural heritage are not being readily identified and/or appropriately managed," ERM said.

One of the major changes Rio Tinto vowed to make in the wake of the destruction at Juukan Gorge was to ensure project bosses were aware of and responsible for cultural heritage protection on their patch by embedding it into their decision-making process.

The audit also found nearly half of Rio's assets lacked access to appropriately qualified and experienced cultural heritage expertise within the business. Cultural heritage management should not be contracted out because ownership of decisions should reside at Rio Tinto, ERM said.

The global miner needed to improve and make more consistent its cultural heritage planning around water management and around closure of its operations, it added.

The report followed an audit of 37 Rio Tinto assets. The audit was completed throughout 2021 and 2022 across 20 assets in Australia and 17 assets in other countries where Rio Tinto operates including Canada, South Africa, US and Mongolia.

*Reuters | March 20, 2023*

► **Vale scrubs coal from iron ore pellets for first time**  
Brazilian miner Vale produced iron ore pellets on an industrial scale for the first time without adding coal, company executives told Reuters on Wednesday, in a major step toward reducing the company's carbon footprint.



*Image courtesy of Vale SA*

In pellet production, coal is usually mixed with iron ore before being heated in plant furnaces. In Vale's pilot project, conducted in February in Minas Gerais state, the so-called biocarbon obtained from biomass replaced traditional coal, an especially dirty fossil fuel.

Industrial heavyweights like Vale face growing pressure to lower harmful emissions that contribute to global warming, from governments, activists as well as investors.

During Vale's pilot, 15,000 tonnes of coal-free pellets were made with 100% biocarbon from certified supplies, according to the company. Biocarbon is a renewable energy source obtained through biomass carbonization, which results in much lower emissions.

Pellets are typically made by crushing and grinding low-grade iron ore and used as a key ingredient to make steel.

Pellet production is the most carbon-intensive process contributing to Vale's direct emissions, with anthracite coal accounting for about half of its greenhouse gas emissions from making pellets, said Rodrigo Araujo, the miner's head of decarbonization projects.

Overall, making pellets accounts for 30% of the firm's direct emissions.

Vale will carry out further tests this year, aiming to permanently replace all coal used in its pellet plants by 2030.

"It was very important to confirm what we saw in the laboratory, which had no impact on the quality of the pellet, the first barrier we wanted to overcome, and also the entire test in relation to logistics, process, storage, material management and related risks," said Araujo.

The project is part of Vale's strategy to fulfill its commitment to net zero carbon emissions in direct and indirect emissions by 2050.

*Reuters | March 16, 2023*



## 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.

Encourage the EMJ readers to participate in the QUIZ in large numbers and benefit from the enhanced knowledge by reading the Journal from the first to last page.

### Questions based on MEJ March 2023 issue

- 1. Which Indian leading mining company boasts itself as “Eco-friendly Miner”?**  
(a) NMDC Limited (b) Tata Steel  
(c) Coal India Limited (d) NALCO
- 2. How much infrastructure investment deal the DR Congo is looking for from China against the copper cobalt reserves it contributed to the venture?**  
(a) USD 6 billion (b) USD 16 billion  
(c) USD 20 billion (d) USD 26 billion
- 3. The state mining company ‘Gecamines’ belongs to which country?**  
(a) South Africa (b) Mozambique  
(c) Mauritania (d) Dr Congo
- 4. In which coalfield, the disposition of continuous coal mining blocks exhibit a perfect English letter ‘W’?**  
(a) Singrauli (b) Jharia  
(c) Mahanadi (d) Western
- 5. Which Indian Professional body has been recognized as the National Reporting Organisation (NRO) by CRIRSCO?**  
(a) Mining Engineers’ Association of India (MEAI) (b) Society of Geoscientists and Allied Technologists (SGAT)  
(c) Mining, Geological and Metallurgical Institute of India (MGMI) (d) Geological Society of India (GS)

## WINNERS OF RIDDLES PUBLISHED IN THE MEJ MARCH 2023 ISSUE

*Congratulations to proud winners*

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**Mr. Satish Kumar Agrawal**

Mining Engineer, [satish.ag47@gmail.com](mailto:satish.ag47@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.

## INDIA

**14-16 Apr 2023: 4<sup>th</sup> Conference on ADVANCED TECHNOLOGY IN EXPLORATION AND EXPLOITATION OF MINERALS.** Location: Jodhpur. For details, Contact: Mr A.K. Jaiswal on Mob: +91 9414163343, E-mail - ashjais.64@gmail.com, meai\_jodhpur@yahoo.co.in

**24-28 Apr 2023: MEAI-IMIC Training program (in person) by NACRI. A Mandatory training program for registration of Competent Person under IMIC.** Location: MEAI Headquarters Auditorium, Hyderabad. For more details, please contact: Secretary General, MEAI. Mob: 9177045204/ 7382087618. Email: meai1957@gmail.com

**15 -18 May 2023: Mineral Resource Estimation and Applied Geostatistics.** A refresher Course by Dr Abani Samal offered LIVE on CISCO Webex platform. Total 4 sessions of 4 hours each, 8 am to 12 noon (IST). Contact Dr Suman Mandal regarding registration at suman@cgcl.in and Dr Abani Samal for Course related matters at arsamal@geoglobal.co.

**14-15 Jul 2023: International Seminar on Food and Energy Security through Minerals.** Location: Jaipur. For details, Contact – Mr Anil Mathur on Mob 9414119227, E-mail: chairman.jaipur@meai.org & meaijpr2010@gmail.com

**25-27 Aug 2023: International Seminar on Vision – Mining 2047.** Location: Ahmedabad. For details, contact Email - meaiahmedabad@gmail.com

**6-9 Nov 2023: International Mining, Equipment & Minerals Exhibition (IME 2023).** Eco Park, Rajarhat, Kolkata, India. Organised by The Mining, Geological & Metallurgical Institute of India (MGMI). Contact Email ID: miningexpo@tafcon.in

## ABROAD

**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>

**4-5 Mar 2023: International Conference on Mining Intelligence (ICMI 2023).** Rio de Janeiro, Brazil. Website URL: <https://waset.org/mining-intelligence-conference-in-march-2023-in-rio-de-janeiro>; Contact URL: <https://waset.org>

**5-8 Mar 2023: PDAC 2023.** The annual PDAC 2023 Convention – the world's premier mineral exploration and mining convention. Metro Toronto Convention Centre, 222 Bremner Blvd., Toronto, Ontario, M5V 3M9, Canada

**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>

**22-23 Apr 2023: International Conference on Mining and Mineral Technologies (ICMMT 2023),** Tokyo, Japan. Website URL: <https://waset.org/mining-and-mineral-technologies-conference-in-april-2023-in-tokyo>; Contact URL: <https://waset.org>

**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>

**4-5 May 2023: 17 International Conference on Mining Technology and Exploration (ICMTE 2023).** Amsterdam, Netherlands. Web: <https://waset.org/mining-technology-and-exploration-conference>

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

**15-16 Jun 2023: International Conference on Mining and Metallurgical Technologies (ICMMT 2023).** Toronto, Canada. Website URL: <https://waset.org/mining-and-metallurgical-technologies-conference-in-june-2023-in-toronto>; Contact URL: <https://waset.org>

**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)

**16-17 Aug 2023: International Conference on Mine Mechanization and Mining Policies (ICMMMP 2023).** Tokyo, Japan. Website URL: <https://waset.org/mine-mechanization-and-mining-policies-conference-in-august-2023-in-tokyo>; Contact URL: <https://waset.org>

**25 - 28 Oct 2023: China Coal & Mining Expo 2023.** China's 20<sup>th</sup> International Technology Exchange & Equipment Exhibition on coal and mining is the largest international coal and mining exhibition in Asia. New China International Exhibition Center (NCIEC), 88 Yuxiang Road, Tianzhu Airport Industrial Zone, Shun Yi District, Beijing, China

**28-29 Oct 2023: International Conference on Mining Technology and Exploration (ICMTE 2023).** Paris, France. Web: <https://waset.org/mining-technology-and-exploration-conference-in-october-2023-in-paris>

**31 Oct - 2 Nov 2023: International Mining and Resources Conference (IMARC).** Sydney, Australia. Contact: [connect@imarcglobal.com](mailto:connect@imarcglobal.com). Phone: Australia: +61 (0) 3 9008 5946

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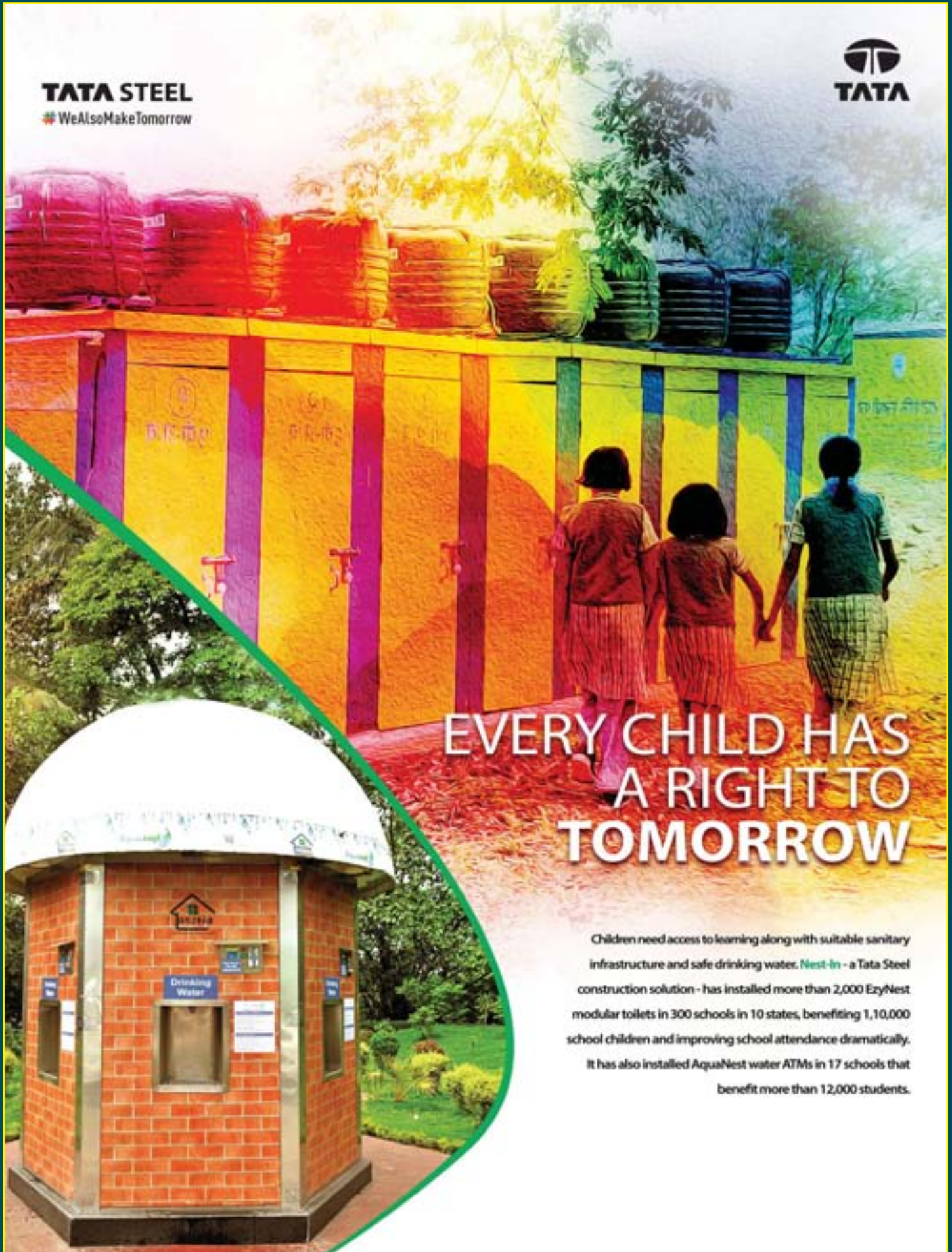


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