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Mining Engineers' Association of India
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this issue contains...

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President's Message.....

Dear members,

Greetings .....

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

Rajasthan Chapter-Jaipur celebrated "The Foundation day of Chapter" in a befitting manner involving all the members and I would like to convey my warm wishes & congratulate all the Members of the Chapter.

Bhubaneswar Chapter conducted a Hybrid Technical Session on 23.02.22 at Sukinda Chromite Mine of M/s Tata Steel Mining Limited.

I am happy to note that all our members have taken precautions & followed the guidelines issued by the government during Covid-19 3rd wave. We all have faced innumerable issues, situations & restrictions that have affected our Physical activities.

Since the Covid-19 pandemic is on decline and the situation is slowly but steadily returning to normalcy, restrictions on movement are being removed. This is a good omen. Our Chapters can now start planning for physical meetings and other activities.

The Bangalore Chapter is conducting a National seminar on "***Safe usage of explosives & winning of Minerals***" on 03.03.2022 and I wish the Seminar a grand success.

The maiden ***MEAI Professional Development Program (MPDP)*** is going to be inaugurated on 04.03.2022 and planned to be conducted online for 6 days, on 4th, 5th, 11th, 12th, 18th and 19th March 2022 and the concluding function will be held on 20.03.2022. Request everyone to attend Inaugural & concluding day functions.

The four weeklong ***3rd Professional Development Program on IMIC has been planned by the NACRI and MEAI*** from 18.4.2022 to 13.5.2022.

It is also my pleasure to note that some of our Chapters are also planning to conduct technical talks and workshops in their respective regions.

Request our Chapters' Chairmen and secretaries to plan for amplified professional activities to serve our fraternity.

Regards,

K. MADHUSUDHANA
President

Mining Engineers' Association of India

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EDITOR'S DESK

Dr. P.V. Rao
Editor, MEJ

In an article published in the December 2021 issue of AusIMM bulletin, the author suggested seven key reasons why Environmental, Social and Governance (ESG) issues present the biggest risk today to the mining companies if they do not adequately invest in digital tools and workforce to manage their ESG capability. Ernst & Young in its Annual report-2021 stated that the mining and minerals executives interviewed between June and September 2021 saw ESG as the number one risk, followed by decarbonisation and license to operate.

Mining is one of the world's most emissions-intensive sectors, responsible for 4 to 7 percent of the world's greenhouse gas emissions. Resources companies are under enormous pressure – from stakeholders, governments, employees and consumers – to reduce power and water consumption, or find alternatives to carbon-fueled energy with green technology, and cut overall greenhouse gas emissions. Presented below are seven key reasons why ESG issues are the biggest risk to the mining and minerals sector.

Urgent and visible pressure on the mining sector to slow climate change: Fifty per cent of the world's industrial greenhouse gas emissions have been traced to just 50 companies in heavy fossil fuel industries, including 20 mining companies. This does not mean the industry is not making great progress. In fact, over 36 per cent of the world's largest mining companies claim to be either carbon neutral already or have set goals to reach net-zero emissions mostly before 2050.

Regulations, compliance and reporting standards/ frameworks are becoming increasingly complex: ESG reporting requirements are moving beyond being loose guidelines to compulsory obligations for individual jurisdictions, and in most countries, reporting on emissions is now mandatory.

Many mining companies lack sophisticated digital reporting tools: While many resources companies have a positive attitude towards digital innovation and a desire for better adoption of digital technologies, the metals and mining industry is 40 percent less digitally mature than comparable industries. For many mining companies, ESG reporting is still done manually or sporadically by third party consultants.

Poor ESG credentials can affect capital and investment: As evidenced by the emergence of the Task Force on TCFD, there is a strong and growing link between a company's ability to track, measure and report its emissions and financial prosperity. Mining companies with higher ESG ratings have an average total shareholder return 10 percent higher than the general market index. A recent McKinsey report suggests that the cost of capital can actually be up to 25 percent higher for mining organisations with the lowest ESG scores. Investors and lenders are gradually focusing on ESG factors while making investment decisions. A number of investment companies have publicly committed to considering ESG ratings when making investment decisions.

Poor ESG performance linked to problems of attracting and retaining talent: The sector's reputation across a range of ESG indicators means it is not particularly enticing to younger people right now. The sector runs the risk of missing skilled, capable workers if it fails to find a way to make mining more attractive to future generations. Fixing the brand of mining by highlighting strong ESG credentials will go a long way in luring more skills and talent to the profession.

Missed process optimization opportunities: Digital solutions can support organisations with their ESG in four key areas: ensuring energy efficiency, yield improvement, reducing greenhouse gas emissions, and driving new, green processes.

Shift in demand for critical minerals: A concerted effort to reach the goals of the Paris Agreement will mean a quadrupling of mineral requirements for clean energy technologies by 2040. An even faster transition to net-zero by 2050 globally requires six times more mineral inputs in 2040 than today. According to the International Energy Agency, clean energy technologies' share of total demand will rise significantly over the next two decades – to over 40 percent for copper and rare earth elements, 60-70 percent for nickel and cobalt, and almost 90 percent for lithium.

To thrive in the future, mining and minerals companies need to be making digital transformation. In addition, there needs to be sufficiently skilled and knowledgeable professionals within the industry to ensure the captured data be effectively interpreted and acted on.

- Editor

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NEWS FROM THE MINING WORLD

** **Blockchain rare earth scheme to certify sustainable output for EVs**

Rare earths are 17 related minerals found widely dispersed in the Earth's crust. Credit: Wikimedia Commons

An EU-funded certification scheme using blockchain is being developed for rare earths as automakers demand proof that materials used to make magnets for electric vehicles (EVs) are not linked to toxic pollution. The system will set global standards and give confidence to consumers demanding sustainable products, two of the organisers told Reuters ahead of an official announcement on Tuesday.

The Circular System for Assessing Rare Earth Sustainability or CSyARES is due to be ready in about three years, the Rare Earth Industry Association (REIA) and Dutch supply chain traceability firm Circularise said.

The EU is funding the project through EIT Raw Materials, an organisation implementing an EU action plan drawn up in 2020 to secure critical minerals for the bloc https://www.reuters.com/article/us-eu-commodities-idUSKBN25U1CQ. The amount of funding was not disclosed.

The scheme is part of Europe's quest to jump start domestic output of super-strong rare earth magnets used in EVs. The system will track rare earths using blockchain tokens, or digital passports, through the complex supply chain from mining to end-of-life, said Teresa Oberhauser of Circularise. Circularise and REIA are two of five partners invlolved in CSyARES. The other three are Germany's BEC, Denmark's Grundfos and London-based Minviro.

Auditing firms already issue certificates for sustainability of mining products including some rare earths. "It is a very manual process," Oberhauser said. "Some of those certificates can even be found on Ebay, it's not really trustworthy." She said that once a token is created for a certain amount of sustainably produced mineral, it cannot be changed on blockchain, a digital ledger.

Rare earths are 17 related minerals, found widely dispersed in the Earth's crust and used for motors in EVs and generators in wind turbines. Processing rare earth ore is a complex operation, involving solvents and toxic waste that needs to be disposed of carefully. Rare earths production is set to spread geographically as the United States and Europe seek to wean themselves off dependence on China, which supplies about 90% of the world's rare earths.

The EU has targeted rare earths as a top priority because 98% of the bloc's permanent magnets, also vital for the defence sector, are imported from China. The Association of Chinese Rare Earths Industries is a member of REIA. When asked whether China would use CSyARES, REIA said: "Members are signatories (to the standards) and they have choice to proceed further in adoption."

Several automakers and their suppliers plan to use the system when it is functional in about three years, said Nabeel Mancheri, secretary general of REIA. He declined to provide names because REIA and the companies had signed confidentiality agreements. Porsche, owned by Volkswagen, has previously used Circularise to certify tractability of plastics, according to the Circularise website. Volkswagen declined to say whether it had agreed to use the CSyARES scheme.

Reuters / February 7, 2022

** **Mining will profit from supporting carbon tax policies, researchers say**

Miners face greater scrutiny from communities at host countries, end consumers and society at large, demanding transparent, ethical supply chains, as well as a lower carbon footprint.

The global mining industry is going to benefit from

from supporting "harmonized" carbon taxation policies, according to a new study released by the University of British Columbia's mining institute. Researchers argue that even though the cost of mining metals required for energy transition would increase due to taxes on carbon emissions, the hike would be small in relation to the value of the commodity and that carbon taxes would also compel other industries to shift to cleaner energy, which would further increase demand for metals.

"The mining stance towards carbon taxation policies has been fractured, some mining companies support the policy, a lot of miners have been lobbying against," Sally Innis, a PhD candidate in mining engineering at UBC who co-wrote the study, told *The Northern Miner*. "We thought it would be really interesting to see where these policies intersect, look at the numbers and see how the industry as a whole is impacted by the carbon taxation policies."

Carbon taxation discourages the release of carbon dioxide into the atmosphere by forcing companies to pay for emissions from their activities. The policy is promoted to fight climate change and limit the rise in global mean temperatures to 2 degrees by 2100, a target set by the 2015 Paris Climate Agreement. Using data from publicly available sources, the researchers calculated the value of 23 commodities per tonne of carbon dioxide required to produce them. They found that the high value of metals and minerals from mining makes carbon emissions look small by comparison. That isn't the case for commodities in the energy and agriculture industries.

For instance, the study showed that more than C$1,500 worth of copper, C$1000 worth of nickel and C$9,400 worth of iron ore can be mined for each tonne of carbon dioxide emitted, but the same emissions yield only C$100 worth of coal or C$200 worth of cheese.

The findings show that given any percentage of taxation tested, most mining industry commodities would not add more than 30% of their present product value, whereas commodities like coal could be taxed at more than 150% of their value, which would accelerate the green transition and demand benefits for mined metals. The researchers used the 2019 prices of the commodities for the study.

Aside from the financial benefit, supporting carbon tax policies can also help the mining industry "find commonalities" with environment activists who have been at "each other's throats" for decades, Innis says. "Every product that can help us reduce the 36 billion tonnes of carbon dioxide we emit every year involves metals," said PhD student Benjamin Cox, the study's lead author said in a press release.

"To get to zero emissions, we need metals. It would be the largest boom the mining industry has seen since the California Gold Rush of 1849. The demand would be infinite."

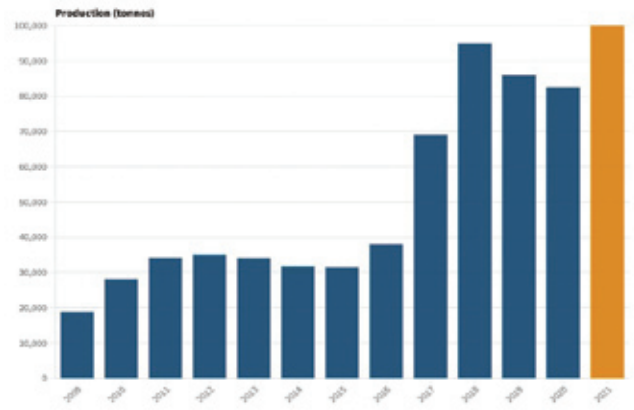
Naimul Karim, Mining.com | February 11, 2022

** **Global lithium production hits record high on electric vehicle demand**

Pastos Grandes project in Argentina. (Image courtesy of Millennial Lithium)

Global mined lithium production hit a record high in 2021 of 100,000 tonnes (excluding the US), a 21% increase over 2020 (82,500 tonnes), according to preliminary data released by the US Geological Survey (USGS). USGS said that production increased in response to strong demand from the lithium-ion battery market and increased prices of lithium. Global consumption of lithium in 2021 was estimated to be 93,000 tonnes, a 33% increase from 70,000 tonnes in 2020.

"Lithium supply security has become a top priority for technology companies in Asia, Europe, and the United States," the USGS said in its latest report.



2021 Production is Estimated. Source: (USGS)

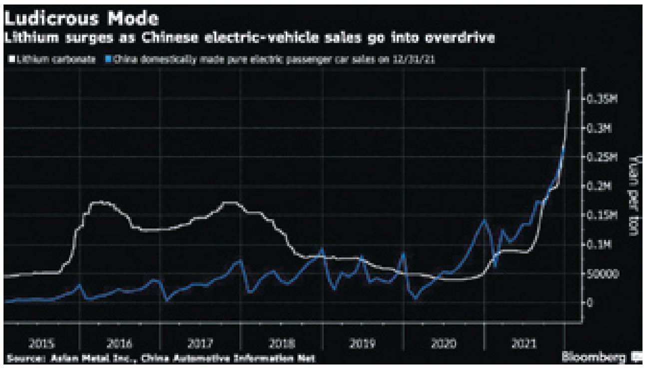
Four mineral operations in Australia, two brine operations each in Argentina and Chile, and two brine

and one mineral operation in China accounted for the majority of world lithium production. Additionally, smaller operations in Brazil, China, Portugal, the United States, and Zimbabwe also contributed to world lithium production.

Lithium prices

Chinese lithium carbonate prices tracked by Asian Metal Inc. rose to a fresh record last month, as data showed a 35% month-on-month jump in electric-vehicle registrations in December.

Nearly 400,000 EVs were registered during the month, according to the China Automotive Technology and Research Center. Tesla supplied about 18% of the total.



Ganfeng Lithium, which signed a long-term supply deal with Tesla in November, said its profits for 2021 will be up as much as 437%, fueled by the "fast development" of the EV industry.

MINING.COM Staff Writer | February 8, 2022

**
RANKED: World's top 10 biggest gold projects

The Pebble mine project in Alaska (Image: Northern Dynasty)

With the US facing its hottest inflation in almost 40 years, all eyes will be on gold in 2022. The precious metal has often played the role of inflation hedge because, unlike paper money, its supply doesn't change much year to year, growing by about 1.8% for over 100 years.

To provide a snapshot of the potential of the world's gold supply, MINING.com and sister company *Miningintelligence* collaborated to provide a ranking of the largest gold projects by resource size. While the ranking is based on the projects' total measured and indicated resources, many companies include proven and probable reserves that can be economically extracted in resource estimates.

	Project	Country	Majority Owner (%)	Development Status	Geology	Total Resources (mozt)
1.	Pebble	United States	Northern Dynasty Minerals (100)	Preliminary Economic Assessment	Porphyry, Supergene Copper	106.54
2.	Kerr-Sulphurets-Mitchell (KSM)	Canada	Seabridge Gold (100)	Prefeasibility	Porphyry, Skarn	104.64
3.	Sukhoi Log	Russia	Polyus (78)	Feasibility	Orogenic Gold	66.37
4.	Norte Abierto	Chile	Barrick Gold (50); Newmont (50)	Preliminary Economic Assessment	Epithermal, Porphyry, Epithermal - High Sulfidation	54.70
5.	Donlin	United States	Barrick Gold (50); Novagold Resources (50)	Permitting	Orogenic Gold	45.04
6.	Tujuh Bukit Porphyry	Indonesia	PT Merdeka Copper Gold Tbk. (100)	Prefeasibility	Porphyry	28.07
7.	Wafi-Golpu	Papua New Guinea	Harmony Gold (50); Newcrest Mining (50)	Feasibility	Porphyry, Epithermal - High Sulfidation	26.71
8.	Treaty Creek	Canada	Tudor (60)	Preliminary Economic Assessment	Porphyry, Volcanic Hosted Massive Sulfide	24.51
9.	Cascabel	Ecuador	SolGold (85)	Prefeasibility	Porphyry	22.44
10.	Casino	Canada	Western Copper (100)	Feasibility	Porphyry	21.32

Note: This ranking excludes stalled projects such as Siembra Minera (Gov't of Venezuela), Reko Diq (Barrick Gold/Antofagasta) and La Colosa (AngloGold Ashanti)

Source: Miningintelligence

mining intelligence data

#1 Pebble

Development status: Preliminary Economic Assessment. Geology: Porphyry, Supergene Copper

Topping the list for a second year is Northern Dynasty Minerals' Pebble project in the Bristol Bay region of Alaska, which contains 106.54 million troy ounces (mozt) of gold.

Pebble has been plagued with controversy and environmental opposition over the years, and it is unclear if the mine will eventually materialize, as the project's key water permit was formally rejected by the US Army Corps of Engineers. The Biden administration said it will relaunch a process that could permanently protect Bristol Bay from development. The decisions are currently being challenged by Northern Dynasty Minerals, and in October 2021 the company released a preliminary economic assessment.

#2 KSM

Development status: Prefeasibility. Geology: Porphyry, Skarn

Seabridge Gold's Kerr-Sulphurets Mitchell (KSM) project in British Columbia is in second place with104.64 mozt. The $5.3 billion project hosts four mineral deposits that will be operated as a combined open-pit and underground mine . Late last year, Seabridge announced its plans to reshape KSM by integrating the Snowfield porphyry deposit, acquired from Pretium Resources in December 2020.

#3 Sukhoi Log

Development status: Feasibility. Geology: Orogenic Gold

The Sukhoi Log deposit is in third place with 66.37 mozt, and is said to be the world's largest by reserves. Russian miner Polyus bought the remaining stake in the giant Sukhoi Log gold deposit in Siberia from its project partner Rostec in a $128 million deal in 2020, and shortly after raised its investment forecast to $3.3 billion for the project that will double its production from 2027

#4 Norte Abierto

Development status: Preliminary Economic Assessment. Geology: Epithermal, Porphyry, Epithermal – High Sulfidation

The Norte Abierto project in Chile, a joint venture between the world's two top gold miners, Newmont and Barrick is in fourth place with 54.70 mozt. A Chilean environmental court last year ordered a new evaluation of the project due to concern that heavy traffic and water usage could disrupt life for the nearby indigenous community

#5 Donlin

Development status: Permitting. Geology: Orogenic Gold

The Donlin project in Alaska is in fifth place with 45.04 mozt. The joint venture between Barrick and Novagold Resources has also seen its share of controversy; in 2020 Novagold announced that it had served short-seller J Capital Research with a civil action lawsuit for defamation after the firm accused managers of "systematically" misleading investors. In December 2021, the owners announced they are working on an updated feasibility study, scheduled for release this year.

#6 Tujuh Bukit

Development status: Prefeasibility. Geology: Porphyry

In sixth place is PT Merdeka's Tujuh Bukit project with 28.07 mozt. Located in East Java, Indonesia, the project uses conventional open-pit mining with heap leach processing to produce up to 90,000 oz gold a year.

#7 Wafi-Golpu

Development status: Feasibility. Geology: Porphyry, Epithermal – High Sulfidation

Harmony Gold and Newcrest's joint venture Wafi-Golpu in Papua New Guinea is seventh on the list with 26.71 mozt. Harmony has said the Wafi-Golpu deposit in PNG could support a $9.8 billion mine, but Wafi-Golpu has been delayed over the issue of how much gold Papua New Guinea gets to keep. Having received its environmental permit, JV is continuing to work with the PNG government to progress the permitting of the project.

#8 Treaty Creek

Development status: Preliminary Economic Assessment. Geology: Porphyry, Volcanic Hosted Massive Sulphide

Coming in at number eight is the Treaty Creek project in British Columbia with 24.51 mozt. Tudor Gold has a 60% interest in Treaty Creek; American Creek Resources and Teuton Resources each hold a 20% interest. The 179-sq.-km property within the famed Golden Triangle borders Seabridge Gold's KSM project to the southwest and Pretium Resources' Brucejack property to the southeast.

#9 Cascabel

Development status: Prefeasibility. Geology: Porphyry

Solgold's Cascabel project in Ecuador is in ninth place with 22.44 mozt. Although Ecuador's Energy Ministry said in 2019 that it "could become the largest underground silver mine, third-largest gold and sixth-largest copper in the world," the company has delayed the release of the pre-feasibility study. SolGold and shareholder Cornerstone ended a two-year standoff that cost the miner's chief executive his post, and have agreed to jointly advance the project.

#10 Casino

Development status: Feasibility. Geology: Porphyry

Western Copper's Casino project in Canada's Yukon territory rounds out the list with 21.32 mozt. Western Copper, through its Casino Mining subsidiary, completed its 2021 exploration drilling program and is moving forward with the feasibility study.

MINING.com Editor| January 28, 2022

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Energy transition saw record investment in 2021 — report

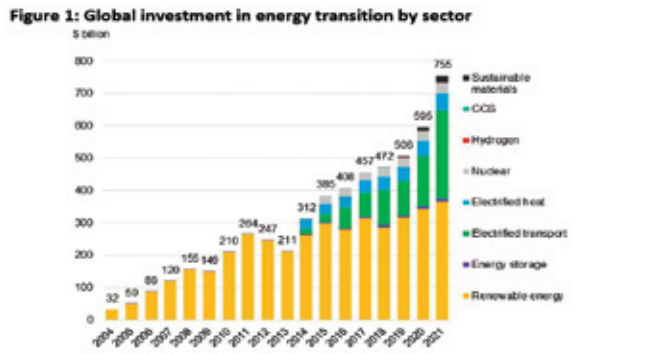
A recent report by BloombergNEF states that global investment in the energy transition totalled $755 billion in 2021 – a new record – off the back of rising climate ambitions and policy action from countries around the world.

According to BNEF, investments rose in almost every sector covered in the report, including renewable energy, energy storage, electrified transport, electrified heat, nuclear, hydrogen and sustainable materials. Only carbon capture and storage recorded a dip in investment, though there were many new projects announced in the year. The report points out that renewable energy remains the largest sector in investment terms, achieving a new record of $366

billion committed in 2021, up 6.5% from the year prior. Electrified transport, which includes spending on electric vehicles and associated infrastructure, was the second-largest sector with $273 billion invested. "With electric vehicle sales surging, this sector grew at a breakneck rate of 77% in 2021 and could overtake renewable energy in dollar terms in 2022," the report reads.

Solar-powered electric vehicle charging station.

Figure 1: Global investment in energy transition by sector



Source: BloombergNEF. Note: start-years differ by sector but all sectors are present from 2019 onwards.

The market researcher's data show that nuclear, energy storage, electrified transport and electrified heat accounted for the vast majority of investment at $731 billion. Hydrogen, carbon capture and storage and sustainable materials made up the rest, totalling $24 billion.

"The global commodities crunch has created new challenges for the clean energy sector, rising input costs for key technologies like solar modules, wind turbines and battery packs. Against this backdrop, a 27% increase in energy transition investment in 2021 is an encouraging sign that investors, governments and businesses are more committed than ever to the low-carbon transition, and see it as part of the solution for the current turmoil in energy markets," Albert Cheung, head of analysis at BloombergNEF, wrote in the report.

Cheung pointed out that Asia Pacific was both the largest region for investment at $368 billion, or nearly half the global total, and the region with the highest growth at 38% in 2021. Europe, the Middle East and Africa grew by 16% in 2021, reaching $236 billion, while the Americas saw investments grow by 21% to $150 billion.

"China was again the largest single country for energy transition investment, committing $266 billion in 2021," the dossier notes. "The United States was in second place with $114 billion, though EU member states as a bloc committed more at $154 billion. Germany, the UK and France rounded out the top five countries for energy transition investment in 2021. Asia-Pacific countries now hold four of the top 10 places in terms of energy transition investment levels, with India and South Korea joining China and Japan."

Future scenarios

Despite the record growth toward energy transition, BNEF's experts believe investment levels need to roughly triple, such that they average $2.1 trillion per annum between 2022-2025, in order to get on track with any of the three alternative scenarios the firm has outlined to reach global net-zero by 2050, in line with 1.75 degrees of global warming.

Once they triple, investments will need to double again to an average of $4.2 trillion between 2026 and 2030 to meet the goals of the Paris Agreement.

BNEF's figures show that, however, at current growth rates, the electrified transport sector is the only one that has the best chance of getting on track for such investment levels.

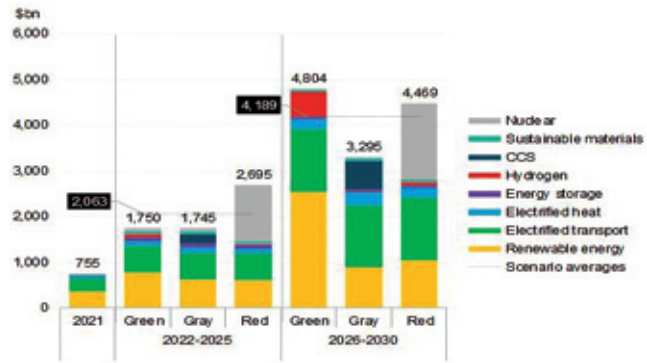


Figure 2: Comparison - 2021 energy transition investment versus required annual investment in 2022-25 and 2026-30 in NEO 2021 net-zero scenarios

Source: BloombergNEF. Note: Future values are from the New Energy Outlook 2021, except electrified transport, which is from the Electric Vehicle Outlook 2021 Net-Zero Scenario. Please consult the latter for a description of the Net-Zero Scenario and the New Energy Outlook for the Green, Gray and Red scenarios. All three 'color' scenarios target global net zero by 2050 in line with 1.75 degrees Celsius of warming.

MINING.COM Staff Writer / January 30, 2022

CONTROLLED BLASTING AND MONITORING OF BLAST VIBRATIONS IN MINES FEW CASE STUDIES

Deepak Vidyarthi

Abstract

Blasting is the most important activity in the mining industry, the world over. It is a well known fact that only part of the explosive energy gets utilized in causing the actual rock fragmentation. The rest of it gets converted into blast-induced ground vibrations and noise. Though blast vibrations cannot be totally eliminated, it is possible to minimize them by optimization of blast parameters. This paper highlights various in-house efforts put forth by the author towards site specific blast optimization and the monitoring of blast vibrations. It also deals with the prediction curves developed by regular regression analysis for the prediction of 'blast vibrations', 'peak particle velocity', 'safe charge' for various blasts.

Key Words: *Explosive energy, blast vibrations, prediction, blast optimization, peak particle velocity.*

1.0 Introduction

The impact of Explosives on rocks is an extremely violent process; spending the explosive energy in overcoming the Compressive Strength of the rock, and causing the ultimate rock failure.

Experience shows that when a blast is conducted, only 30% - 40% of the explosive energy really gets utilized in causing rock fragmentation. Rest of the energy gets wasted out in throw, noise (Air Blast) and dissipation through earth in the form of ground vibrations, resulting in damage to nearby structures.

"Optimization" of Blast Design in this direction is an important step and helps a great deal in cutting down the explosive cost besides environmental improvement by way of reduction in Noise & Vibrations.

'Regression Analysis' and "prediction" of blast vibrations gain significance particularly while carrying out blasting activities in the vicinity of important industrial or domestic structures or any other sensitive areas that need to be protected from blast damages.

2.0 Blast Induced Ground Vibrations

When an explosive charge is detonated in a blast hole, the rock surrounding the charge is fractured, split apart and displaced.

At a certain distance from the blast hole, the explosive energy decreases to a level that causes no further shattering, but continues to travel through the rock as an elastic ground vibration.

Whenever large blasts are conducted in a mine, ground vibrations are generated, emanating outward from the blast area and if not controlled, can cause severe damage to the neighboring domestic / industrial structures.

The vibrations radiating from the blast hole while passing through surface structures induce vibrations in the structure, causing resonance.

Resonance is caused in the structures when the 'frequency' of ground vibrations coincides with the 'natural frequency' of the structures.

This causes the deformity.

However, damage to the structure depends upon the "frequency" of ground vibration. Ground vibration is generally a combination of many frequencies. But if the predominant frequency matches with the 'natural frequency' of the structure, the structure will resonate. When the structure resonates, it experiences "amplified vibration". Most of the single / double storied buildings have their natural frequency in the range of 4 Hz – 24 Hz.

Ground vibrations consist of three different kinds of waves:

- Compressional (P)
- Shear (S)
- Rayleigh (R)

The rock / earth through which this wave travels, is considered to be elastic medium, composed of millions of individual particles.

As the disturbance due to blast occurs, these particles are set into a random oscillatory motion. A wave-form gets generated as each particle transmits energy to the next

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adjacent particle, and with each transmission, loss of energy takes place till it diminishes in intensity and the particles return to their rest position.

Ground vibrations generating from a blast is a seismic wave motion spreading outwards from the blast site, as water ripples spread out when a stone is dropped in a water pond.

The blast induced ground vibrations have three main components, mutually perpendicular to each other. They are**: L** (longitudinal), **T** (transverse), and **V** (vertical). The 'L&T' components are in the horizontal plane, while 'V' is in the vertical plane.

3.0 Monitoring of Blast Vibrations: A Case Study

As a case study, a large, heavily mechanized Iron Ore Mine is presented where the author had developed and implemented a software package on blast design optimization which had yielded tangible results in terms of cost economy, reduction in explosive consumption, attenuation of blast vibrations and noise levels (air blasts) besides prediction of blast vibrations.

Designed for an annual production of about 22.5 million tons of production, the mine had an annual consumption of Explosives of the order of about 5000 - 5500 tons of Site mix Slurry and Site mix Emulsion.

4.0 Rock Characteristics

The ore body at the mine was a Pre - Cambrian Iron ore formation belonging to Dharwar system and composed of thin layers of Magnetite and Quartzite.

Iron and silica occurred as alternating bands in the magnetite quartzite. There was a series of asymmetrically overturned folds in the deposit. The strike direction of bands varied from "North-South" to "NNW-SSE", with the dip ranging from 35º to 85º due East.

The uppermost layer that was highly weathered contained magnetite that was partly oxidized to hematite. The average depth of the weathered ore was 50 mtrs. Below the weathered ore lies a hard and compact zone of BMQ called fresh ore in which the magnetite remained almost un-oxidized. The Ore body ran over a length of 6 KMs and had an average width of 0.8 KMs extending in depth up to 400 meters; and covering an area of about 4.8 Sq. Km.

4.1 Rock Characteristics

The compressive strength of the rock formations varied from 190 MPa to 225 MPa. Depending on the 'Fe' content of the Ore, the ore – density varied between 1.8 t / m^3 and 2.2 t/ m^3.

For Rock fragmentation by blasting in the above formations, the technique employed was Split Charge, by creating Mid-Column Air - Deck with the use of Gas Bags.

For blasting purposes, the type of Explosives used were:

- Site-mix-Slurry Explosive
- Site-mix-Emulsion Explosive

5.0 Blasting Activities

The frequency of blasting at the mine was almost one per week each blast consisting of firing about 100 – 150 blast holes with a diameter of 315 mm and 17.0 meters of depth. The holes were loaded with approximately 50.0 – 60.0 tonnes of bulk explosive and the blast yielded about 4.0 – 5.0 lakh tonnes of ore.

During each of the blasts, entire mine used to come to a stand still and radio sets used to fall silent as no communication other than that with the blasting crew or in case of any emergency, was ever permitted.

When an Explosive Charge is detonated in a blast hole, the rock surrounding the charge gets fractured and displaced. After a certain distance from the blast hole the explosive energy decreases to such a level that it does not cause any further shattering or displacement; but it continues to travel through the rock as an elastic ground vibration.

6.0 Blast Improvements

It is creditable to note that after the development and implementation of the software package on Blast Optimization, the level of Blast Vibrations came down from 30.0 – 40.0 mm/sec to 4.0 – 5.0 mm/sec while the Noise levels were brought down from the level of 130 – 140 dB to 80 - 90 dB.

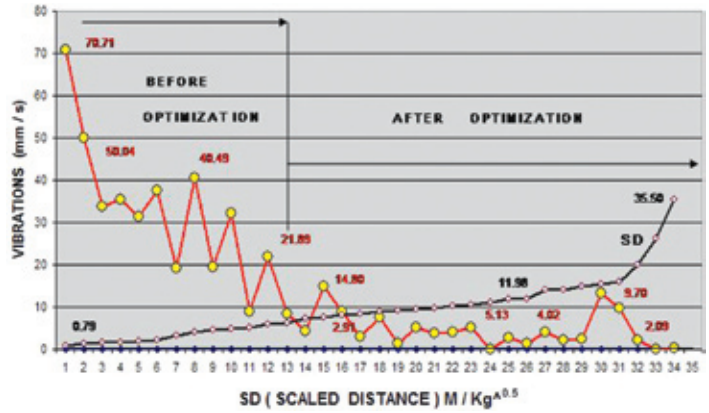


Fig. 1: *Resultant vibrations – before & after Optimization*

7.0 Important structures in the Mine

Few important industrial structures in the mine within a stretch of 6.0 kms along Strike and about 400 meters along

Dip had to be protected against the effects of blasting. They consisted mainly of Three Crusher buildings housing 4000 TPH gyratory crushers, Conveyor Duct (3.6 m x 4.9 m in cross section and 348.0 m in length), Covered Stock pile (3.0 lakh tones capacity), Mine Control Building, Aggregate Plant (210 TPH), Mine Canteen situated adjacent to the mine control building, Electrical Transfer Tower housing major electrical equipment for power supply to the mine, workshops and crushers

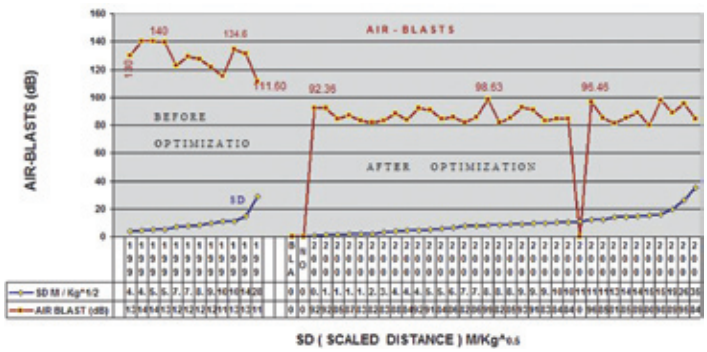


Fig. 2: *Blast overpressures-before & after Optimization*

The Conveyor duct being the main nerve centre of the mine for the entire production activity, any damage / misalignment on account of blasting could have brought the mine production to a grinding halt.

Utmost care was, therefore, taken while conducting blasts around the tunnel.

8.0 PPV

The PPV (Peak Particle Velocity) is the maximum velocity measured in any one of the directions - L, T or V. Measurement is always taken on the ground close to the structure to be protected.

However, damage to the structure depends upon the "frequency" of ground vibration. Ground vibration is generally a combination of many frequencies. But if the predominant frequency matches with the 'natural frequency' of the structure, the structure will resonate. When the structure resonates, it experiences "amplified vibration". Most of the single / double storied buildings have their natural frequency in the range of 4 Hz – 24 Hz.

Therefore, a safe limit of vibrations involves both – PPV as well as the predominant frequency recorded with the Vibrometer.

The following factors affect the particle velocity of ground vibrations:

- Distance from the blast.
- MCD (Maximum explosive charge per delay).
- Frequency of Vibrations.
- Blast Geometry.
- Physical properties of the rock.

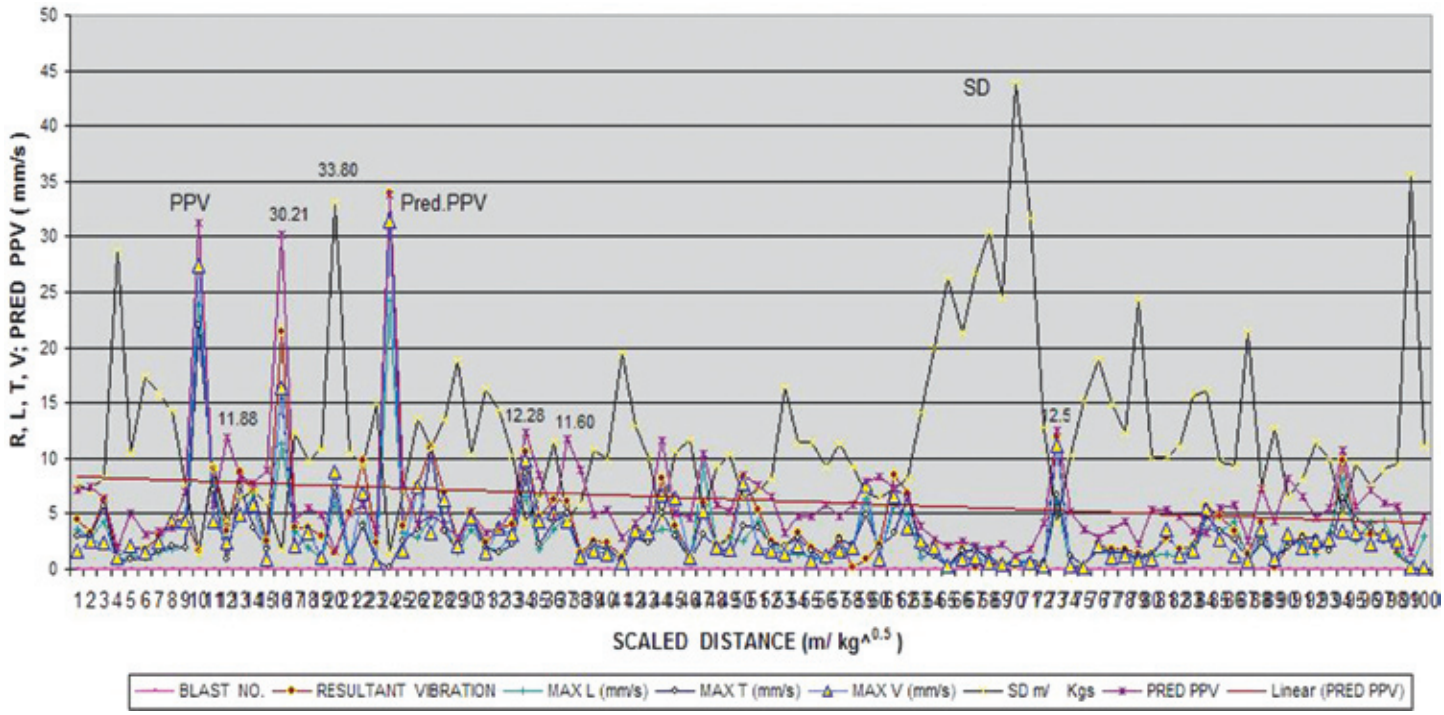


Fig. 3: *Peak particle velocity*

Fig.3 depicts the 'Peak Particle Velocity' as computed after Regression Analysis at the mine, and plotted against the Scaled Distance (scaled distance is obtained by dividing the distance in meters by the square root of the MCD; and is used as an index to compare various blast results).

8.1 Predictor Equation

The most universally accepted index of blast induced ground vibrations is the "Peak Particle Velocity". Its relationship is given by the following equation:

$V = K \times (D / \sqrt{Q})^{-r}$; where, (*Vidyarthi D, ISEE, 2007*)

V : PPV in mm / s

K & r: Rock constants

D : Distance in meters from the site of blast.

Q : MCD in kgs.

"$D / \sqrt{Q}$" is called the Scaled Distance.

Taking logarithm on both sides of equation,

$\text{Log } V = \text{Log } K + m \text{ Log } (D / \sqrt{Q})$.

If $Y = \text{Log } V$, $X = \text{Log } (D / \sqrt{Q})$ and $C = \text{Log } K$;
the above equation would represent a *straight line* in the following form:

"**Y= C + m X**"; where 'm' is the slope and 'C' is the intercept.

To determine the rock constants, 'K' and 'r'; the "PPV" is measured and plotted against the scaled distance ($D / \sqrt{Q}$) on a graph.

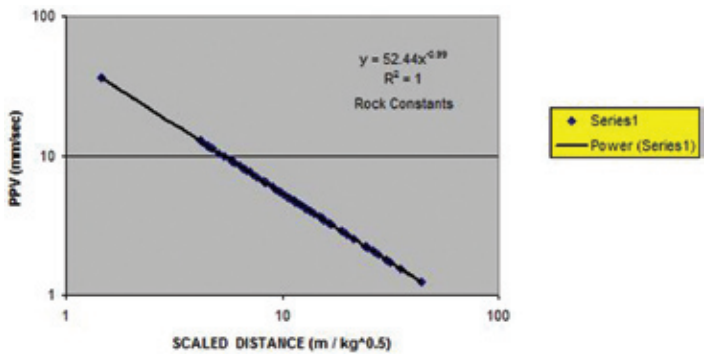


Fig. 4: *Regression analysis*

Fig. 4 represents the **'Regression Analysis'** carried out at the mine and indicates the values of rock constants which are applicable to local site conditions.

9.0 Air – Blast

As mentioned in the foregoing paras, only part of the explosive energy is utilized in causing rock – failure and the rest gets wasted out in the form of Vibrations.

Part of the explosive energy escapes into the atmosphere and produces 'Air Blast'!

At any given point the Air Blast is same in all three directions i.e. L, T, and V.

The air blast so produced is transmitted from the site of the blast in the form of a wave, which travels at the speed of 'Sound Pressure Wave'. The higher frequency (20 Hz to 20000 Hz) portion becomes audible sound while lower frequency (less than 20 Hz) is not audible. It excites the structures and causes rattling of window pans etc.

The measurement of audible Air Blast is in terms of decibels (dB).

10.0 Prediction of Blast Vibrations

The need to predict the blast vibrations arises particularly when blasting activities are carried out in the vicinity of any residential area, or close to industrial structures or other sensitive areas which need to be protected from potential damage blasting can cause to them.

It suffices if the following parameters are predicted well in advance to ensure adequate protection:

- Peak Particle Velocity
- Blast Over pressure (Air Blasts)
- Safe Charge of Explosives

In either case it is necessary to carry out "Regression Analysis" based on actual field measurements of couple of blasts using a Vibrometer and determination of rock constants.

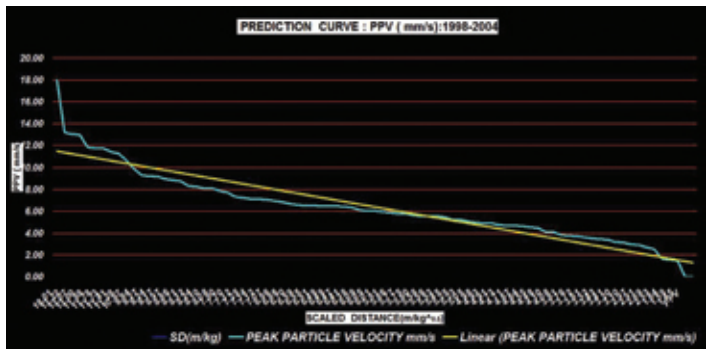


Fig. 5: *Prediction curve (PPV)*

Regression analysis is carried out and the rock constants determined with the help of Predictor Equation. This has helped in developing the following information:

- **Table 1** showing the computed "safe charge" against varying distances and PPVs.
- Prediction Curve for PPVs. **(Fig. 5)**
- Resultant Vibrations – before & after Blast Design Optimization. **(Fig. 1)**

- Blast Overpressures – before & after Blast Design Optimization. **(Fig. 2)**

11.0 Safe Charge Calculations

In the predictor equation if we substitute the value of 'V' while 'K & r' have been determined exponentially, for a given distance, we get the maximum safe charge of explosive per delay **(Table 1)**.

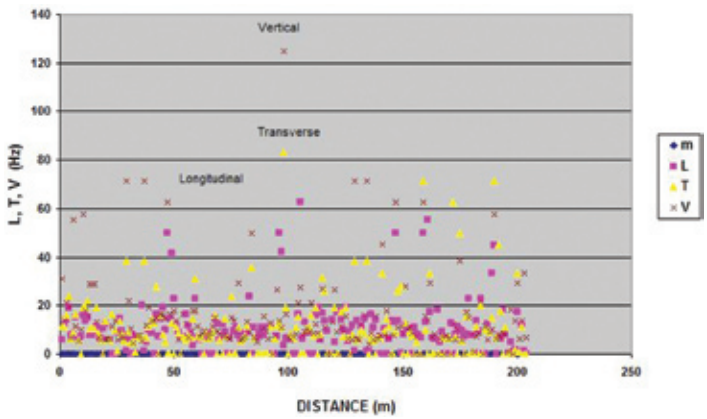


Fig. 6: *Frequencies (Blast Vibrations)*

Pertaining to the site conditions / rock characteristics, the frequencies for longitudinal, transverse, and vertical components of blast vibrations, are plotted against the distances as indicated in **Fig.6**. It may be noted that a major portion of frequencies is in the range of 5 Hz to 25 Hz. The safe PPV, therefore, as per statutory stipulations, would be around 25 mm/s, which is taken into account while computing the safe charge.

12.0 Attenuation of Blast Vibrations

The following are the general methods of attenuation of blast vibrations:

- Minimize the Explosive charge per delay. As may be noted from the predictor equation, the PPV is directly proportional to the MCD;

  V α **(**$\sqrt{}$**Q) ^{r}, or Q $^{r/2}$ (***Vidyarthi D, ENTMS, 2002*)
- The distance from the site of blast generally influences the magnitude of vibrations. PPV is inversely proportional to distance.

  The effect of distance on ground vibrations is due to the dilution of high frequency waves as earth itself acts as a filter. Thus, at long distances the ground vibrations have more energy at low frequencies.
- Since the direction of blasting greatly influences ground vibrations, the free face and delay patterns should be so arranged that blasting should progress away from the structure to be protected.

  Maximum vibrations are felt behind the blast.
- To reduce the intensity of vibrations, proper blast design is essential, which should optimize on burden, spacing, sub-drilling, bottom charge, column charge etc.

12.1 Blast Design Optimization

Development of site-specific software package on 'Blast Design Optimization' would make significant contribution towards minimizing the level of blast vibrations as well as Noise levels (Air Blast) caused by blasting. Please see Fig. 1 & 2 for a comparison between Resultant Vibrations and Air Blasts – "before" & "after" the introduction of the software package on Blast Optimization. (*Vidyarthi D, TEP on Explosives, 2001*)

12.2 Mid – Column Air – Deck

Based on "Melnikov Effect" the technology of creating a 'Split Charge' in the Explosive Column with the use of Gas Bags was successfully implemented at the mine. (*Vidyarthi D, Opencast-98, 1998*)

The use of Gas Bags results in overall reduction of Explosive Consumption; which in turn reduces the Blast – Vibrations as well as Air Blasts.

12.3 Use of Non - Electric Initiation System

'Non–electric initiation system' with the use of 'shock tubes' helps in ensuring true bottom initiation apart from improving the fragmentation and controlling the throw of the blast.

Although it is costlier compared to the use of "Detonating Fuse", it has a distinct advantage of lower Noise levels (Air–Blasts) as well as less Vibrations.

13.0 Controlled Blasting

Controlled blasting is used to reduce over break & minimize fracturing of rock at the boundary of an excavation. While the technique involves the following number of methods like Line drilling, Pre splitting, Cushion blasting, Smooth blasting, Cast blasting etc, a few case studies are discussed here:

13.1 Blasts in the vicinity of a Conveyor duct (CB-02)

Number of blasts had to be conducted in close proximity of **CB-02** gallery during peak production in the middle portion of the mine for about five years.

Utmost care was taken to protect the gallery from the impacts of blasting and regular monitoring of blast vibrations was carried out, besides predictions of PPV.

Blast 'A'

Fig. 7 depicts a 170 hole blast, 30 meters (98 feet) above CB-02 gallery. Twenty holes drilled to full depth of 17 meters (56 feet) were not loaded with explosive and were treated as **'pre split holes'** to dampen blast vibrations.

Table – 1 gives details of typical blasts conducted around the tunnel over a period of time. (*Vidyarthi D, ISEE, 2008*)

Typical blasts conducted in the proximity of CB - 02 tunnel									
Blast No	No of Holes	Explosive Quantity (Tones)	PPV		INSTRUMENT			Firing Pattern	Remarks
			mm /sec	inch/ sec	Location	Distance			
						meters	feet		
1	138	44.27	36.73	1.45	CB-02	35	115	V-Cut	No damage
2	23	13.18	18.99	0.75	CB-02	51	167	Serial	No damage; Hole to hole - 50 ms delay
3	123	30.77	2.37	0.10	CB-02	250	820	Trapezoidal	No damage; Each hole fired independently
4	150	86.76	2.29	0.09	CB-02	320	1050	Trapezoidal	No damage; Hole to hole - 50 ms delay
5	62	27.59	2.04	0.08	CB-02	285	935	V-Cut	No damage; 50 ms relays on alternate holes
6	72	46.59	1.33	0.05	CB-02	475	1558	V-Cut	No damage; 50 ms relays on alternate holes
7	48	28.53	1.56	0.61	CB-02	341	1119	V-Cut	No damage; Hole to hole - 50 ms delay
8	138	99.75	8.98	0.354	CB-02	111	364	V-Cut	No damage; Hole to hole - 50 ms delay
9	28	19.36	1.57	0.06	CB-02	390	1280	V-Cut	No damage
10	26	14.482	21.88	0.86	CB-02	46	151	V-Cut	No damage; Each hole fired independently

A few blasts are illustrated below:

Blast vibrations were recorded inside the tunnel and '*cube root analysis*' was carried out for computation of scaled distance and prediction of PPV.

Total quantity of explosive (site-mix slurry) was 44.27 tons and the recorded peak particle velocity was 36.73 mm /sec (1.45 inch/sec) measured inside **CB-02** gallery at a distance of 35 meters (115 feet) from the blast site. (*Vidyarthi D, ISEE, 2008*)

Blast 'B'

Fig. 8 depicts another special blast conducted within 24 meters (78.74 feet) horizontal distance from CB-02 gallery and 25 meters (82 feet) from the crusher building. The inclined distance between the nearest blast hole and CB-02 gallery was 35 meters (115 feet).

The blast being in very close proximity of the gallery and the depth being **less than 30 meters (98 feet)**, the **MCD** was restricted to less than 600 kilograms of non-aluminized, site-mix slurry explosive.

The firing pattern was so designed that each hole had fired independently.

The blast was successfully conducted yielding 72,000 tons of ore without causing any damage / misalignment either to the tunnel or to the crusher.

The blast vibrations recorded, were as follows –

Description	Permissible Limit	Actual as per Measurement	Noise (dB)	Instrument Location
Blast Vibrations	50.0 mm / sec (1.97 inch/ sec)	1.43 mm / sec (0.06 inch/ sec)	<80.0	250 meters (820 feet) from CB-02

Blast 'C'

It was a 54-hole blast using 21 tons of site-mix slurry explosive, yielding 1,13,000 tones of crude ore. It was conducted at a distance of 30 meters (98 feet) from **CB-02 gallery** and 20 meters (66 feet) from the crusher.

The blast recorded a vibration level of 19.23 mm /second (0.76 inch/second) and Noise measuring <80.0 dB. It did not cause any disturbance / damage/ misalignment to the conveyor gallery or to the crusher.

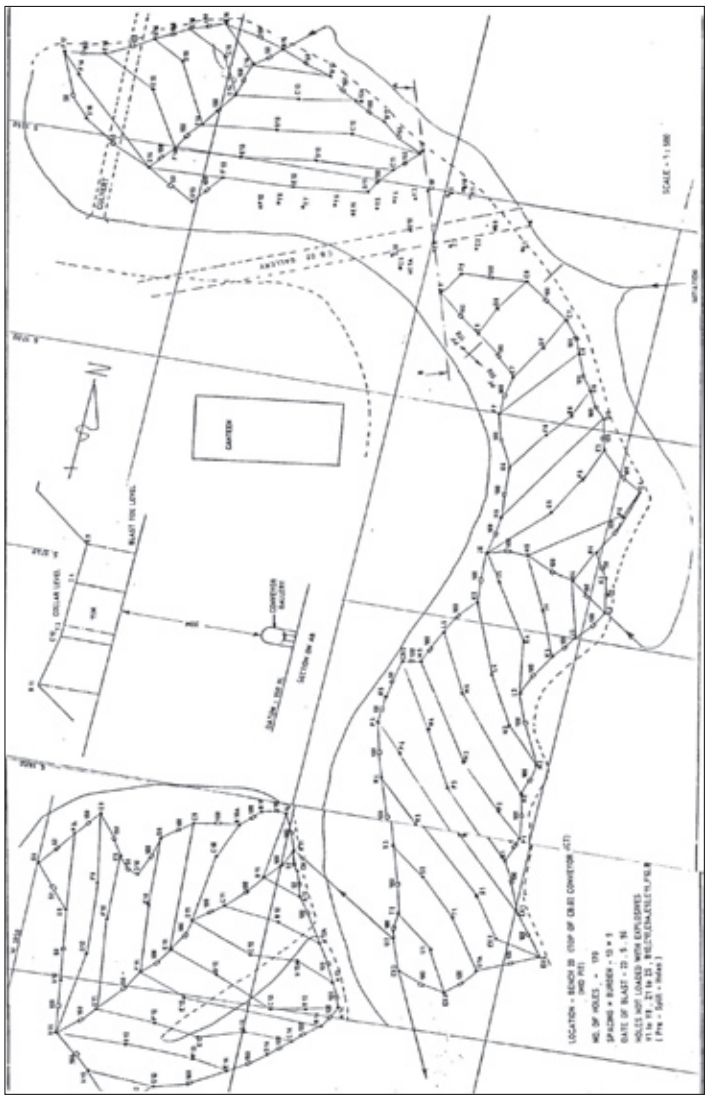
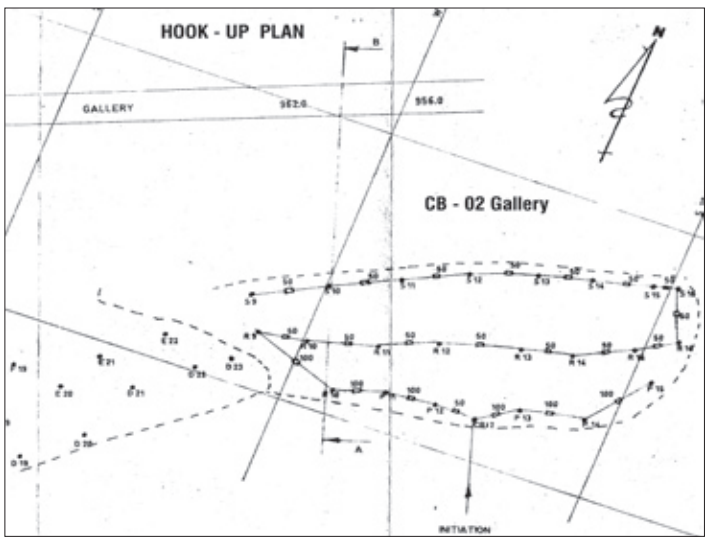


Fig. 7: *Hook up plan of 170 hole blast in the proximity of CB-02 gallery. On visual inspection of the tunnel after the blast, it was found to be intact with no damage / crack / misalignment.*



No of Holes	**.**	**22**
Hole Depth	**..**	**17 meters (56 feet)**
Spacing x Burden	**..**	**10 x 10 m (33 x 33 feet)**
MCD	**..**	**599 Kilograms**
Firing Time	**..**	**1100 milli - seconds**
Explosive Used	**..**	**Non - Aluminized (Site mix Slurry)**

Fig. 8: *Hook up plan of blast at an inclined distance of 35 meters (115 feet) from the toe level of the last hole and the top of CB-02 gallery*

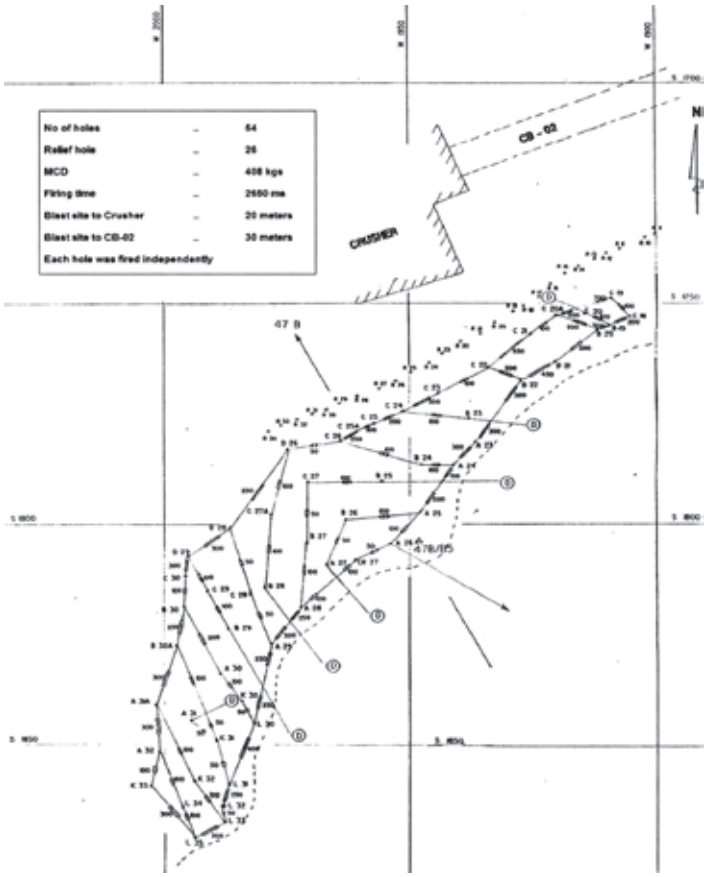


Fig. 9: *Hook-up plan of a typical blast in the vicinity of CB-02 gallery. 26 relief holes were drilled south of the crusher but not loaded with explosives. Each hole was fired independently.*

CONCLUSION

Monitoring and prediction of Blast Vibrations is gaining significance particularly for environmental protection from the impacts of mining, more so with growing awareness about environment and ecology.

Attenuation of vibrations and noise levels is much desirable and most sought-after activity in the mining industry today.

The most important step in this regard is the Optimization of Blast Design parameters.

(Continued on Page 28)

SILT BOG MANAGEMENT & QUICK WATER RECOVERY A VISIONARY, SOLUTION FOR ENTREPRENEURS

Chand Chandna

Abstract

Manufactured sand is now taking place, using as an alternate of river sand. As river sand mining is mostly prohibited by the government. Such M. sand (manufactured Sand) is obtain by the stone crushing units, crushing the ore minerals associated with over burden & callous materials. The useable quality m. sand is –5 mesh pass to retain 100 mesh should be free from clay particles. So it is a usual trained to wash the produced sand by mechanical system to remove fines to obtain a quality sand. Operating big plants for higher production of sand producing silt bog while remove the fines and clay particles, discharging the fines in the form of sludge with water. To meet out the high demand of sand the discharging of large sludge silt at low level areas by the stone crushing & washing plants without its any proper management, are sparred in large areas. It may entrap any unfamiliar person or animal in such silt marsh causing life in dangerous situation in increasing such mud pollution. Also the muddy water contain in the silt bog is not properly recovered and such huge water in it is going waste. So to recover the thick sand and quick separation of water a perfact safe economic management process is derived to maintain pollution free process. Such process is also much helpful in quick recovering of water from discharging slurry while polishing & cutting of Marble, Kota Stone, Sand Stone and Granite etc.

***Key Words**:- Silt Bog, sludge, muddy water, M. sand, ultra-fine, slurry, Pebbles,*

Introduction

Many big stone crushing plants are in operation producing M. sand (manufactured Sand) as a substitute of river sand to meat out the huge demand for constriction works of the country. These big plant established big washing sand unit to remove the ultra -fines (-) 150 microns from the crushed sand , producing quality sand 100 to 200 tons per hour, discharging in flowing 5 to 8 % ultra-fine sand in the form of slurry as a reject. These washing units are popularly manufactured by the following organization to produce the washed quality sand in large quantity. The CDE Asia combo eco- friendly technology to produce superior manufactured sand are largely in operation in Rajasthan.

(1) *CDE Asia sand washing Units Combo ranges 30 to 200*

(2) *Proman – Ortner remove Excess Fines*

(3) *Puzzolana Hydro Cyclone type Classifier*

(4) *Propel Sand Washe*

Many others popular sand washing Plant's manufacturer are in the competition but none have design the perfact management of recovering water and sand in discharging the slurry while operating the plants, thus spreading the silt bog pollution . Some of them suggested to use some chemical like alum to sediment the clay to get free water but the process is time taking & not perfect and also not economical. The discharged slurry in open field spread land pollution and may entrap the unfamiliar person or animals incidentally on walking on it which may cause life in danger. As such an economical and perfectly feasible design has been derived to obtain quick recovery of water and thick sludge to be taken out, with eco-friendly environmental process

Recovery Principle

The recovery of fine sand and water is based on the principle of Filtration. Water from the slurry is recovered by passing the slurry solution on the developed sand screen to filter the water and retain the clay and sand, discharging water separately through it.

Construction Design for Recovery

The construction design is based on simple construction of two tanks. (1) One required for the producing capacity to receive discharging slurry (2) second for receiving water with a system of filtration. If discharging slurry in larger percentage then one more slurry tank with increasing filtration area, system is added by which water quality will also be better recovered.

Construction of Slurry Tank (i)

The first tank is constructed with a capacity of holding the slurry, discharged by the established plant in a shift, which may be 8 to 10 % of the shift production of sand.

Life Member MEAI, Retired CEO (Mines), Bundi Silica Group

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While operating the washing plant, the generating waste slurry is discharge in a receiver small tank, constructed at the upper edge of the (i) tank to spread the dis charging slurry along the full width of slurry tank (i) as shown in the fig. It passed under and over along a round pipe in a thin layer, which slow down the flowing velocity of the discharging slurry in to the (i) tank and converting direction of sand particles to settled down in to the tank. Using alum at the receiving tank will add help in settling down the sand particles at the (i) slurry tank. The first (i) tank have a gentle slope to words the closed end of retaining wall causes seeping, water flow action. Before this closed wall of the tank a 3 meter wide drain below at this close end along the width of the tank in one meter depth is constructed. This drain is covered along the same bottom in sloping level of the tank with thick R.C.C. putting conical holes keeping narrow mouth of the holes to -words the bottom of the drain to filter water along its length as shown in fig as (a b c d).The taper holes are first bit filled with courser pebbles, then with 20 mesh size sand. It acts as a filter to filter below water as shown separately in fig . The filtered water carried through slopping bottom drain to join the water tank (ii) discharging water in it as shown in fig.

The drain area (a b c d) may can also be covered by the thick RCC blocks keeping their all upper four edges sloped and in rest area of the blocks possessing taper holes keeping the taper mouth of the hole towards the bottom of drain to act as a filter. The blocs placed keeping very narrow space in between them, in level of the floor of the tank. The tapper part of the blocks first filled with courser pebbles, then 20 mesh size sand to act as a filter to filter water as shown in the fig. Similarly the tapered holes are charged with courser pebbles in bottom and then 20 mesh sand along the rest length of the hole to filter water. This system of covering the drain area is more suitable to filter containing water in the slurry retain in the tank (i) providing large screening area.

The discharging slurry is accumulating in the tank (i) retaining by the end retaining wall of the tank. Further discharging slurry accumulation will over flow on the filtration area at the end wall of the first tank. This wall is perfectly leveled to over flow the accumulating slurry along its whole length to filter water retaining the fine sand in its first (i) tank.

Construction of Water Tank (ii)

This water tank is constructed below the bottom level of first slurry tank keeping a gap of 1.5 meter in between them. The first wall of this tank is constructed up to a height 0.5metre more than the height of first (i) tank retaining wall. It is constructed keeping a gap (efgh) of 0.30 meters as shown in the fig. below the bottom level of first tank to let discharge the filtered water in to the water tank (ii). The gap of 1.50 meter between the two walls is joined and the upper end (mnop) is kept bit sloped by keeping the last retaining wall of first tank bit lower to start filtration on increasing layer to layer wise.

This gap is used as a filter by filling boulders in bottom layer, then layered 10 mm gravel, then 5mm courser canker pebbles and then 16 to 20 mesh sand at upper layer end as shown in fig.. These layers allowing filtration of water along the depth of layers below. Practically the upper layer of 20 mesh filter water and retains the fines containing in the slurry. The other layers of courser canker, pebbles and boulders are successively support the successive upper layers to stand and to allow the water passing through them. For better filtration the thickness of the upper layer of 20 mesh is kept increased. The discharging slurry filled the first tank and then over flow into the gap area where the water start seeping by filtration and the fine sand retained in the first tank. It gives the quick recovery of water separating the fine sand to be settled down in slurry tank. The water filtered along the length of managed filter and discharge through the bottom gap (efgh) into the second (ii) water tank. The accumulating increasing layer of slurry will be spread with increasing layers on the sloped filtration area (mnop) and successively filtered. Thus accumulating water in the tank will be ready to recycle.

Function of wiper

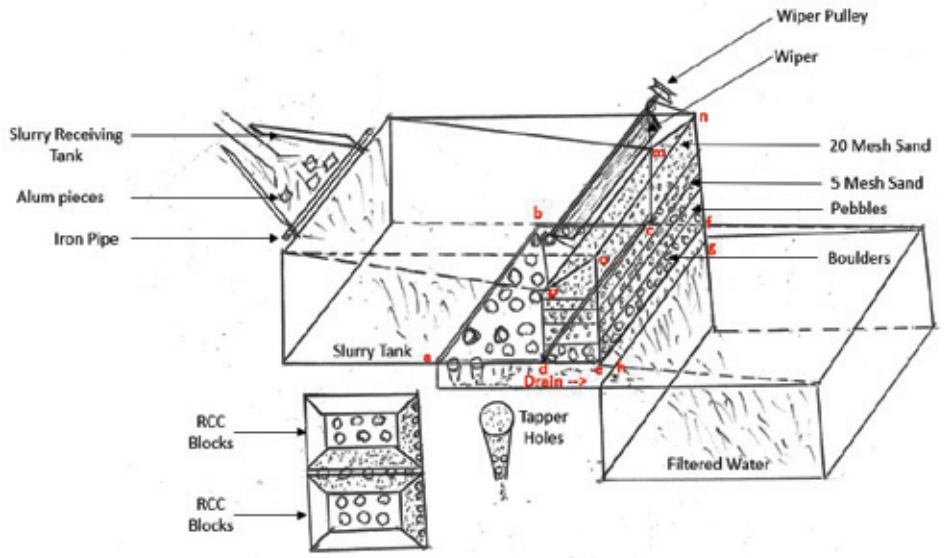
Keeping the filtration mouth sloped helps to filter the increasing successive layers and clean & slip down the retaining fine sand depositing on filtration area. The settling down fine mesh sand at the mouth of filtration obstruct the filtration. It is wiped by operating the rubber wiper designed to wipe time to time by pushing button of vibrating motor for keeping the continue filtration uninterrupted. The filtration mouth (mnop) may also be wiped manually on the sloped area easily time to time to keep the better filtration continuously. The filtration layers material may be changed or replaced time to time if observed chocking filtration after long period of uses.

Function of Conical holes & designed Blocks

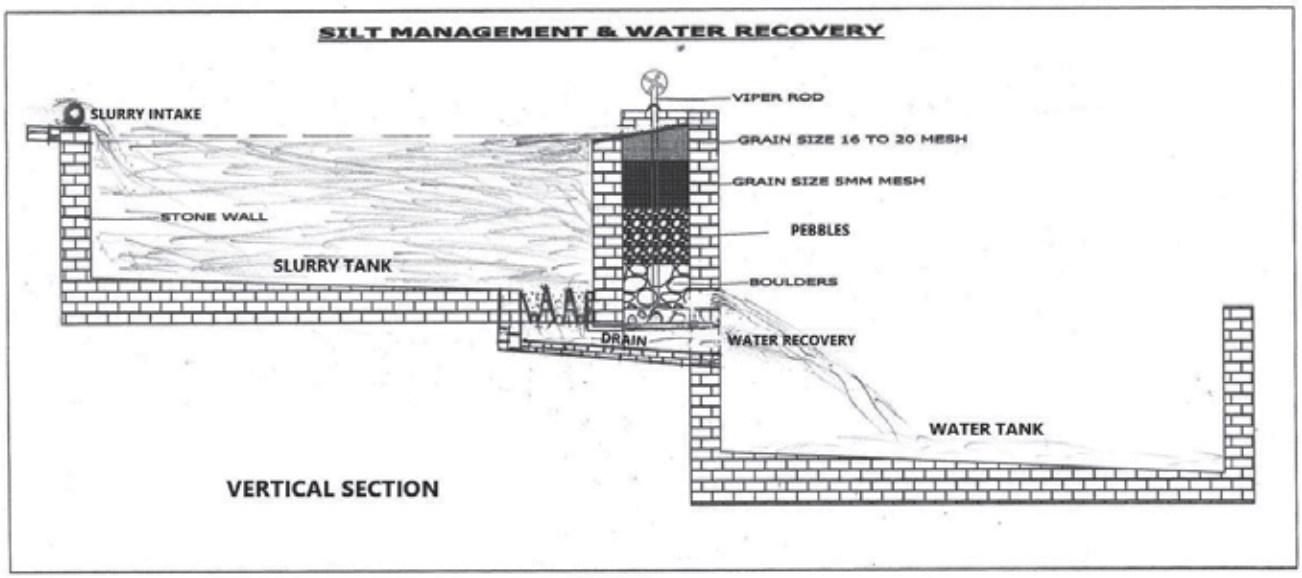
For quick settling the sand, alum or alum based chemicals may be added at upper slurry discharging tank passing the slurry over it to slurry tank (i) It promotes the settling process of sand clay and quick settling results will be observed.

The bottom filtration through the conical holes or designed blocks in the first tank (i) functions to filter the water of the tank by seeping action and convert the slurry in thick wet mass in short time to get the recovery of fine thick sand which can easily be loaded to vacate the tank and gives fast recovery of water.

In vertical section plan the flowsheet of the slurry is shown. The slurry is discharged in first tank. Then it overflow in the gap portion where a filtration system arranged, so that the filtered water discharge through the gap (efgh) of the walls left in second tank wall. Also the bottom filtered water in first tank joins to second water tank through a drain and let precipitate the sand in first slurry tank.



Slurry Filtration & water Recovery plant



Sectional View of Filtration

Increasing such bottom filtration area will be more helpful to convert the bog quick in moist sand. Such moist sand is easily taken out of tank and safely stored for other uses like the filling works or use in making bricks etc. This way there is total utilization of crushed mineral and recovery of water with no wastage.

If the possibilities of discharging slurry is in large than it is better to add a one more slurry tank with filtration system to get better recovery of water and fine sand.

Kota Stone & marble polishing Units

In cutting and polishing of marble, Granite, Kota stone, Sand stone and chittod stone etc., water and sand are used as a cutting and polishing agent. The slurry mixed with cuttings of the stone, water and sand are discharged through a drain. In present usual practice, this slurry mixed fine sand and water discharged while in process of polishing and cutting is collected in first tank and then over flowed to the successive next second tank. In such transfer the heavier sand particles and stone cutting are settled down in the tanks and the rest

soluble fine sand slurry drained out flowing and spreading, creating pollution in the field. It is a general practice to drain the slurry water in the low level areas. The accumulated thick slurry in the tanks is taken out after the operation work is stopped to let precipitate the sand in the tanks and let the limpid water come up. Then the water is drained (drain)out and precipitated sand in tanks is taken out. This way polluted water is fully drained, spreading pollution & wasting water. Thus, the draining slurry water is spreading pollution followed in drains and spread in low level areas.

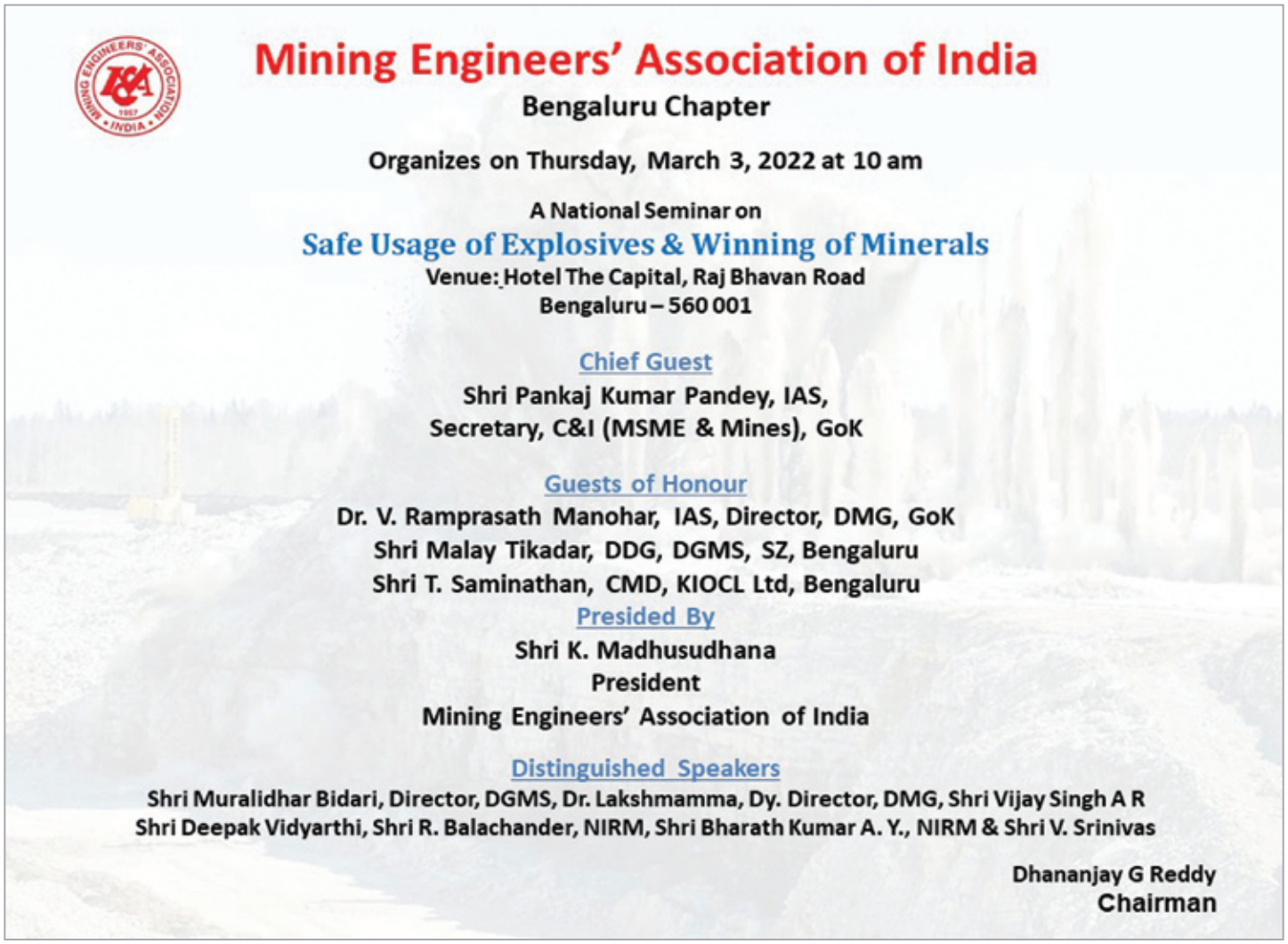
As if the two tanks introduced filtration system in between as suggested will be a working of free land pollution with recovery of clear water to recycle and thick layer of sand to be easily taken out. The existing tanks can be modified with nominal changes by constructing the filtration system in between the tanks to filter the water and retain slurry in the first tank as suggested in the paper. This way the thick moist soil and water can be separated and used. Thus such spreading pollution can be economically well controlled and managed in operating of small polishing and cutting units.

Conclusion

1. Such silt bog management and quick recovery of water is very economical to be managed & controlled on the spreading pollution.
2. Water used in washing the sand is mostly recovered and thus there will be no wastage of water.
3. Such system of management avoid any risk of trapping of unfamiliar person or animals in silt bog.
4. The system thus obeys the pollution control & safety rulings promoting controls on hazards.
5. In this system sand and water both are separately recovered which may be used separately in other like works and prove full utilization of mineral & water.

Acknowledgement

Thanks to M/s Bundi silica group of mines where I worked for 24 years and developed the innovative controls to extract fine mesh sand and manage the recovery of water to recycle for washing sand.



MEAI NEWS

BELGAUM CHAPTER

Report on Signing of MoU between Belgaum Chapter and BVVS Science College, Bagalkote

Mining Engineers Association of India, Belgaum Chapter has signed a Memorandum of Understanding with BVVS Science College, Bagalkote on 28th January 2022. The college is one of the well-known colleges in Bagalkote, belonging to BVVS organization which has more than 100 educational institutions, from LKG to all kinds of Professional Courses. The MoU was initiated by Shri Rachappa, Council member of MEAI and Vice President, Doddannavar Group of Mines, Bagalkote along with Prof. Gaonkar of BVVS College. As per the MoU, both the organizations will jointly conduct various programs including seminars, symposia and training activities related to Mining Engineering, Geology and allied Sciences. The MoU was signed by Dr. Purandara Bekal Chairman, Belgaum chapter and Former Scientist G, National Institute of Hydrology, MoJS, Govt. of India; and Shri Bhoosnurmath, Principal, Science College of BVVS, Bagalkote. The MoU was signed in the presence of Shri Rachappa, Dr. Pramod Hanamgond, Head, Dept. of Geology, GSS College, Belagavi and MEAI Council member, Shri D. S Malkai (Retd. Senior Geologist, Mines and Geology, Govt. Of Karnataka), former Chairman, Belgaum Chapter and Shri HG Shreepada, Mine Owner and Industrialist of Bagalkote. All Heads of the Dept. of Science College, IQAC Committee and Management Committee members graced the occasion.

Dr B K Purandara signing the MoU. Others present are (from left to right) Shri H.G. Shreepada, Shri S Rachappa, Principal Bhusnoormath and Dr Gaonkar

Principal Bhusnoormath signing the MoU

GSS College students received training from the experts of the Belgaum Chapter in Mining and related works. Thanks to Shri Murthy, Shri Shripad and Dr. Pramod, who exposed the students to mining aspects. Congrats to the mining experts and the faculty of GSS college.

INDEPENDENCE DAY CELEBRATIONS
BELLARY – HOSPET CHAPTER

Mining Engineers' Association of India, Ballary-Hospet Chapter Celebrated the 73rd Republic Day of India on 26th January 2022.

Shri. K. Madhusudhana, President, MEAI & Sri. K. Prabhakara Reddy, Chairman, MEAI BH Chapter

73rd Republic Day of India on 26th January 2022 is celebrated at the M/s SUMS Office. The occasion was graced by Sri. K.

Madhusudhana, President of MEAI. The President hoisted the national flag and spoken on the importance of the Republic day celebration and wished the gathering on the occasion. Sri. K. Prabhakara Reddy, Chairman-MEAI BH Chapter & CEO, SUMS, Hosapete also conveyed his best wishes to all.

Gathering at the Republic Day Celebrations at SUMS Office, Hosapete.

RAJASTHAN CHAPTER-JAIPUR

National Flag was unfurled at Mining Welfare Centre by Prof: M. K. Pandit, Secretary, Rajasthan Chapter-Jaipur

RAJASTHAN CHAPTER-UDAIPUR

Celebrating 73rd Republic day at HZL-HO, Udaipur

(Continued from Page 21)

With the development of blast optimization package and through regular monitoring of Blast Vibrations and Regression Analysis, it is possible to carry out the activities of Drilling & Blasting in any type of Rock Formation; maintaining the levels of the following parameters at a bare minimum:

- Blast Induced Ground Vibrations in mm / sec.
- Noise Levels (Air Blasts) in dB.

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*D.Vidyarthi, **"Explosive Energy in Blast Design Optimization"** (ISEE, 2006)*

*D.Vidyarthi, **"Monitoring & Prediction of Blast Vibrations"** (ISEE, 2007)*

*D.Vidyarthi, **"Cee Bee Zero Two-Construction to Destruction"** (ISEE, 2008)*

OBITUARY

Dr. B. Varadendra
(26.6.1960 – 1.2.2022)
MEAI regretfully announces the sad demise of Dr. B. Varadendra (LM-4978/BAN), Consulting Geologist based in Bengaluru, on 1st February 2022.
He was affiliated to the Bangalore Chapter and used to take keen interest in all the activities of the Chapter.

Dr. Varadendra was graduated from Gulbarga University in Geology in the year 1984 and did his post graduation with distinction from the same University in 1986. He was awarded a doctoral degree for his research on "Geology and Geochemistry of Gold and Scheelite bearing Meta acidic and Associated Rocks of the Hutti Mining Area, Raichur, Karnataka", in 1994. He had served Hutti Gold Mines Ltd., Gem Granites Group, and Soma Granites Private Limited. Dr. Varadendra had worked on gold exploration projects in Tanzania, Guinea, Mali and Sudan; on gemstones and gold projects in Madagascar, and on an investment proposal in mineral sector in Turkey. As an RQP he had prepared a number of reports for various clients.

Dr. Varadendra was an amiable person and had a large number of friends. MEAI members condole his untimely demise and convey their condolences to the bereaved members of his family.

OBITUARY

Shri. A. Palchoudry
LM No. 14, Kolkata chapter

Shri Palchoudry expired on 1.2.2022 at his residence in Kolkata. At the age of 92 years. He worked in Bolani Iron ore mines of Barbil Area, prior to taken over by SAIL and continued with it thereafter. He was a very active member of MEAI.

MEAI expresses its heartfelt condolences to the bereaved family members and pray for his soul rest in peace.

OBITUARY

Dr. Ajay Kumar
(LM.no. 992 –
Tamilnadu Chapter)
Very sorry to inform that Professor Dr. Ajay Kumar (Retd), Dept. of Mining Engg., Anna University,

Chennai has passed away at 12.55 pm on 3-2-2022 due to post COVID and respiratory issues.

Prof L Ajay Kumar was Life member (Membership no. 992) of Tamilnadu Chapter. He has also served as Tamilnadu Chapter Chairman.

He started his career in Singareni Collieries as a Mining Engineer and later moved to Anna University, Chennai.

He was also an Independent Director of TAMIN (Tamilnadu Minerals Ltd.) and TANMAG (Tamilnadu Magnesite Limited) for a long period. Further, he was Chairman of Non-Coal Mining Committee - II for issuing Environment Clearance (EC) under Impact Assessment Division, MoEF&CC between 2010 & 2013.

Members of the MEAI express their Heartfelt Condolences to his family members. May his soul to rest in peace.

OBITUARY

Shri Soni Vallabhdas Kantilal Adesara
(4.4.1949 - 3.2.2022)
Shri Soni Vallabhdas Kantilal Adesara (LM 702) was a Life member from Ahmedabad Chapter. He departed for the heavenly abode on 03.02.2022 at his hometown Vadodara, Gujarat.
He has served GMDC Ltd. as Manager Maintenance. Untimely demise of Shri Vallabhdas is a great loss to the Mining Industry. He was a sincere, disciplined, hard working professional and a caring person of his family.

The members of MEAI pray for the departed soul to rest in peace and express their profound condolences to the bereaved family members.

NOMINATIONS FOR MEAI AWARDS 2022

The Mining Engineers' Association of India presents awards sponsored by the Industry/individuals during Annual General Meeting in June -July every year. Nominations for the following Awards are invited in the prescribed form, so as to reach the Secretary General by **15th of March 2022**. Nomination can be made by one member for one award only.

1. **MEAI - Sitaram Rungta Memorial Award** for the best paper on Mining related issues during the year 2021.
2. **MEAI NMDC Award** for significant contribution to Iron Ore Industry during the year 2021.
3. **MEAI Simminds Award** for significant contribution to limestone industry during the year 2021.
4. **MEAI Smt. Bala Tandon Memorial Award** in recognition of contribution to Mining Industry for improving ecology, environment and a forestation during the year 2021.
5. **MEAI Abheraj Baldota Memorial Gold Medal Award** (Mining Engineer of the year 2021) in recognition of significant contribution to Mining Industry by a Mining Engineer with 20 years of experience in the Industry.
6. **MEAI Abheraj Baldota Memorial Gold Medal Award** (Young Mining Engineer of the years 2021) in recognition of significant service to Mining Industry by an Young Mining Engineer who has not completed 35 years of age as on 2020.
7. **MEAI-SRG Informational Technology Award** for the year 2021, In recognition of significant contribution to Mining Industry adopting Information Technology during the year 2021.
8. **MEAI-Smt. Gullapalli Saraladevi Memorial Award** (Lifetime Achievement by a Mining Engineer) during the year 2021.
9. **MEAI Master Tanay Chadha Memorial Geologist Award** for the year 2021 in recognition of significant contribution by a geologist in the field of Mineral Exploration, quality control and production, mine planning etc. during the year.
10. **MEAI- Smt Veena Roonwal Memorial Award** for the year 2021 to a Mining Engineer/Geologist/a qualified person involved with Mining Industry with 10 years experience for presenting a paper during the year in a seminar/ symposium workshop organized by MEAI on "Water Management in and around a working mine" or "Implementation of New/Latest Technology in Mining and allied subjects.
11. **MEAI- Smt Kiran Devi Singhal Memorial Award** for the year 2021 only to a person (MEAI Member/Non member- need not necessarily be from mining discipline) for his/her contribution in the field of "Development and Conversation of Minerals and Environment" in and around Metalliferous mines (excluding Coal and oil) during the year 2021.
12. **MEAI Award to a best paper in Mining Journal** Published in the Mining Engineers' Journal in the year 2021.
13. **MEAI-SCCL Coal Award** for the year 2021 to a Mining Engineer, a Geologist, a Mechanical Engineer and a Foreman/Over man for meritorious contribution to the Coal Industry.

For detailed guidelines please visit website **www.meai.org**
or memorandum of association and rules and regulations (as on 01.03.2018)

Applications and Guidelines

Application must be supported by at least two council members and must reach MEAI NHQ in Prescribed Format at Hyderabad before **15th March 2022**.

Applications are to be sent along with enclosed soft copies in (PDF format) with subject MEAI Awards 2022 to email - **meai1957@gmail.com**.

3RD TRAINING PROGRAM ON IMIC BY NACRI

Mining Engineers' Association of India (MEAI) rolled out the registration of Competent Person (RCP) under Indian Mineral Industry Code (IMIC). MEAI is a Professional Organisation (PO) in India, recognised by National Committee for Reporting Mineral Resources and Reserves in India (NACRI), with the obligation to offer professional development programs to its members, register CPs and oversee the ethical behaviour of RCPs. NACRI is the National Reporting Organisation (NRO) recognised by the Committee for Mineral Reserves International Reporting Standards (CRIRSCO).

The previous two training programs on IMIC were successfully held by NACRI in January 2021 and April 2021 with around 25 participants in each program, representing the mining companies, consulting companies and individuals. All the participants, barring a few, have successfully completed the training program.

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 PO 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 professional development credits every year through participation in seminars, conferences, workshops, training programs or webinars, recognised by it.

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 professional development credits recognised by NACRI, 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 renewed annually thereafter. The annual CP registration 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 for this mandatory IMIC training program, to register as CP under IMIC, may be paid online. The fee chargeable for the 40-hour training program is Rs. 10,000 (Rupees ten thousand only that includes 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 IMIC online training program, which every prospective RCP must undergo before applying for RCP certificate. This IMIC training course includes basic knowledge sharing on all aspects of IMIC and mineral industry best practices; and general guidance to the prospective RCP. The programs contents include:

- Introduction to MEAI/ NACRI Charter/ IMIC/ Code of Ethics
- Scope of IMIC
- Competence and Responsibility
- Reporting Terminology
- Reporting of Exploration Results
- Reporting of Mineral Resources
- Reporting of Mineral Reserves
- Reporting of Coal Exploration Results, Resources and Reserves
- Technical studies
- Other topics including CRIRSCO 2019
- Table 1 and QA/QC
- Industry best practices

Every RCP should attend an 8-hour mandatory refresher program on IMIC prior to making an application for renewal of RCP. The RCPs may acquire additional professional development credits by attending NACRI accredited seminars/ workshops/ conferences/ training programs/ webinars. 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 online IMIC training program in four weeks with the topics scheduled thrice a week, and each session not exceeding 3 hours at a stretch. The NACRI Core Group will be responsible for conducting the training program under the guidance of Mr T.R. Rajasekar and Dr A. Srikant. **The 3rd IMIC training program will be held from 18th April to 13th May 2022.**

Contact details

Interested mineral industry professionals may please contact the Secretary General, MEAI at meai1957@gmail.com / Phone no. 040-66339625/ 040-23200510 or Dr PV Rao, Co-Chair NACRI at drpvrao@gmail.com for more details on this training program.

Dr PV Rao, Co-Chair NACRI

MEAI PROFESSIONAL DEVELOPMENT PROGRAMME (MPDP)

The Mining Engineers' Association of India (MEAI), as a part of Technical Competence Building Mission in the country with focus on Training in Mining, Geology, Exploration, New mineral laws, DMF, NMET, Blast Design, Safety management, Mine Environment etc. wishes to develop the requisite knowledge and competence of all professionals working in Mining, Geology, Exploration and Mineral based industries.

In this direction, MEAI wishes to organize its first series of Professional Development Programmes online.

The key objective of the MPDP is to enhance technical competence through imparting knowledge of various techniques and know-how of Mining Engineering, Mineral Exploration, Mine Safety Management etc. for Mining Professionals working in various organizations. The content of the training programme will encompass emerging issues of Mining Engineering and Geological Exploration. Resource persons will be drawn from various organizations who are renowned and have excelled in their own areas of expertise to train the participating Mining Engineers & Geologists in the field.

MPDP will comprise of theoretical lectures backed with practical case studies, group tasks and discussions.

Course Duration (Online mode)

- Six (6) days with two days in a week (Fri & Sat)
- Four (4) Sessions per day
- 90 minutes per session
- Important Dates: 4th March 2022 (Fri), 5th March 2022 (Sat)
  11th March 2022 (Fri), 12th March 2022 (Sat)
  18th March 2022 (Fri), 19th March 2022 (Sat)

Chairman

MEAI Training, Development & Program Committee
(vidyarthikud@hotmail.com; meai1957@gmail.com) Mobile: +91-8105250113

The credits obtained from the MPDP will be eligible for the mandatory 40-hour credits required by the RCPs to renew their RCP status under IMIC, by the MEAI-NACRI CP Registration Committee.

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 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 by 20th of the current month. If more than three members responded with the correct answers, then the three winners will be decided by draw. Each winner will be issued a certificate of merit and a nominal cash prize of Rs 500.

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

Questions based on MEJ February 2022 issue

1. Which Chapter organized a webinar on "SMART MINING- Mining 4.0 – A step towards lower carbon footprint"?

(a) Hutti-Kalabuargi (b) Goa
(c) Jabalpur (d) Raipur

2. By which year India's Prime Minister targets to become Indian economy carbon neutral?

(a) 2070 (b) 2060
(c) 2050 (d) 2040

3. In which year the latest National Mineral Policy of India was announced?

(a) 2019 (b) 2018
(c) 2015 (d) 2021

4. What is the Fe% content in BHQ on which the beneficiations studies were conducted by MSPL?

(a) 35 (b) 25
(c) 30 (d) 40

5. What is the name of MEAI Annual award that is awarded for the best paper on mining related issues?

(a) MEAI-Sitaram Rungta Memorial Award (b) MEAI-NMDC Award
(c) MEAI Award to a best paper in mining journal (d) MEAI-SCCL Coal Award

WINNERS OF RIDDLES PUBLISHED IN THE MEJ FEBRUARY 2022 ISSUE

Congratulations to proud winners:

Mr Sanjeev Soni
ACC Limited, India, Mob: 91-9771423629

Mr AY Bahrat Kumar
Sientist C, NIRM, Bengaluru, India, Mob: 9482375143

To receive the cash prize of Rs 500, the winners are requested to please contact the Secretary General, MEAI by email at **meai1957@gmail.com** or Mob. 9177045204.

CONFERENCES, SEMINARS, WORKSHOPS ETC.

INDIA

2-4 Mar 2022: **International Mineral Development Conference and Exhibition (Mbd-2022)**. Nagpur, India. For details contact: Website: http://www.mineralinfo.net; E-mail: mineralinfoindia@gmail.com; mbd.info2021@gmail.com; Cell No./ WhatsApp +91 9823015772

3 Mar 2022: **National seminar on Safe usage of explosives and winning of minerals**. Organised by Mining Engineers' Association of India, Bangalore Chapter at Hotel the Capital, Raj Bhavan Road, Bengaluru 560001. For more details please contact Chairman, Bangalore Chapter a +91 94498 42341.

ABROAD

4-5 Mar 2022: **International Conference on Mining Geology and Resource Estimation ICMGRE**. Conducted by World Academy of Science, Engineering and Technology. Rome, Italy

4-5 Mar 2022: **International Conference on Mining Intelligence ICMI**. Rio de Janeiro, Brazil. Organised by World Academy of Science, Engineering and Technology. Contact URL: https://waset.org

22-23 Mar 2022: **International Mining Geology Conference 2022**. Brisbane, Australia and Online. Contact: Ph. 1800 657 985 or +61 3 9658 6100

25-26 Mar 2022: **International Conference on Mining Geology and Ore Treatment ICMGOT** in Madrid, Spain. Website URL: https://waset.org/mining-geology-and-ore-treatment-conference-in-march-2022-in-madrid; Contact URL: https://waset.org

1-2 Apr 2022: **International Conference on Sustainable Water Management (ICSWM)**. Cebu City, Philippines. Website URL: http://conferencefora.org/Conference/30610/ICSWM/

15-16 Apr 2022: **International Conference on Mining Geology and Rock Excavation ICMGRE** in Cape Town, South Africa. Website URL: https://waset.org/mining-geology-and-rock-excavation-conference-in-april-2022-in-cape-town; Contact URL: https://waset.org

19-20 Apr 2022: **International Conference on Exploration and Mining Geology ICEMG**. Paris, France. Website URL: https://waset.org/exploration-and-mining-geology-conference-in-april-2022-in-paris

22-23 Apr 2022: **International Conference on Mining and Mineral Technologies ICMMT**. Tokyo, Japan. Website URL:https://waset.org/mining-and-mineral-technologies-conference-in-april-2022-in-tokyo; Contact URL: https://waset.org

3-4 May 2022: **International Conference on Mining Technologies and Sustainable Systems ICMTSS**. Rome, Italy. Website URL: https://waset.org/mining-technologies-and-sustainable-systems-conference-in-may-2022-in-rome; Contact URL: https://waset.org

20-21 May 2022: **International Conference on Recent Advances in Mining Technologies ICRAMT**. Berlin, Germany. Website URL: https://waset.org/recent-advances-in-mining-technologies-conference-in-may-2022-in-berlin; Contact URL: https://waset.org

24-25 May 2022: **International Conference on Mining and Mineral Processing ICMMP**. Montreal, Canada. Contact URL: https://waset.org. Website URL: https://waset.org/mining-and-mineral-processing-conference-in-may-2022-in-montreal

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

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

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

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

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

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

21-22 Oct 2022: **International Conference on Mineral Processing and Mining ICMPM**. London, United Kingdom. Website URL: https://waset.org/mineral-processing-and-mining-conference-in-october-2022-in-london; Contact URL: https://waset.org

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TATA STEEL

#WeAlsoMakeTomorrow

TATA

#SteelFact

Globally, extensive

afforestation

programmes are converting mines into habitats for local wildlife

Source: World Steel Association

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

*Data as on October 2021

We are ensuring that the natural ecosystem in our mining locations is preserved. We have progressively implemented Biodiversity Management Plans at all our raw material locations in order to ensure no net loss in biodiversity.
Sure, we make steel.
But #WeAlsoMakeTomorrow.

www.wealsomaketomorrow.com | | www.tatasteel.com

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