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September - 2025



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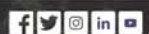


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President's Message.....

Dear members..

It gives me immense satisfaction to see the recent initiatives undertaken by various chapters of MEAI, exemplifying the collective drive of our fraternity to strengthen knowledge sharing, technological adoption, and sustainable practices in the mining sector. The past months have been marked by highly impactful seminars, conferences, and training programs, which reflect our unwavering commitment to innovation, sustainability, and professional excellence.

The Bhubaneswar-Sukinda Chapter organized a seminar on “**Contribution of Mining & Allied Industry for Viksit Odisha 2036**” emphasizing the need for innovative approaches and best practices, while the Nagpur Chapter’s National Seminar on “**Indian Mining – Present Scenario and Future Perspective**”, witnessed active participation of over 300 delegates, the objectives of organizing this two-day’s National Seminar was set to deliberate, discuss and debate on the future of the Indian Mining Sector post amendments of the acts and rules and the recent policy and legislative reforms in the mineral sector for the vision 2047.

The Rajasthan-Jodhpur Chapter, along with MBM Engineering College Alumni Association, convened a National conference on **Applications, Promises and Challenges of Artificial Intelligence in Mining Industry**, attracting nearly 700 delegates. This landmark event showcased the growing applications of AI in exploration, operations, environmental monitoring, and regulatory compliance—underscoring its role as a transformative force for a competitive and sustainable mining future.

Complementing these efforts, the Rajasthan-Jaipur Chapter is conducting a 5-day training program on **3D Modelling and Resource Estimation** in collaboration with Datamine, equipping professionals and students alike with practical, industry-relevant skills.

Together, these initiatives reinforce MEAI’s role as a catalyst for innovation, capacity building, and responsible growth, aligned with our mission to support a progressive and sustainable mining industry in India.

The passage of the Mines and Minerals (Development and Regulation) Amendment Bill, 2025 by the Union Parliament (Lok Sabha: August 12; Rajya Sabha: August 19, 2025) heralds a transformative era for the sector. Key highlights of the Bill include:

- Empowerment of leaseholders to extract critical minerals (lithium, cobalt, nickel, gold, silver) with royalty incentives.
- Expansion of the National Mineral Exploration and Development Trust, raising lessee royalty contributions to 3% (previously 2%), thereby strengthening mineral development funding.
- Removal of legacy restrictions/caps on captive mines, allowing freer trade in mineral production and sales, including mineral dumps within lease areas.
- Flexibility in lease area extensions: up to 30% for composite licences and 10% for deep-seated mineral leases, unlocking new exploration frontiers.
- Introduction of a mineral exchanges platform to boost transparency and market efficiency in mineral trading

With the above progressive reforms, I am sure the Mining Industry would take a big leap towards Atma Nirbhar Bharat.

Thank you,

D.B. Sundara Ramam
President



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Dr. P.V. Rao
Chief Editor, MEJ

Securing India's Critical Minerals: From Vision to Accountability

In 2024–25, the Government of India took a step with profound strategic implications: it formally identified and notified 30 critical minerals essential to national growth, security, and technological leadership. This list - including lithium, cobalt, rare earths, tungsten, copper, titanium, and nickel - is foundational to the clean energy transition, advanced manufacturing, and strategic sectors such as defence and electronics. The classification is forward-looking: it focuses less on what India has mined historically and more on anticipating future needs, securing supply chains, and reducing vulnerabilities in an era of intensifying global competition for resources.

These minerals are the industrial DNA of a modern economy. Without them, battery storage, renewable energy systems, precision manufacturing, and semiconductor fabrication would pause. Yet the hard truth remains: India imports most of these minerals. The real challenge now is not recognition, but execution - translating policy declarations into measurable results.

Over the past two decades - with greater urgency in the early 2020s - India has sought to reduce import dependence through a multi-pronged policy drive. Landmark reforms include amendments to the Mines and Minerals (Development and Regulation) Act, 1957, enabling the auction of critical mineral blocks; the launch of the National Critical Mineral Mission (NCMM) to strengthen supply chain resilience; and the establishment of the Centre of Excellence for Critical Minerals (CECM) to advise on policy, research, and R&D priorities.

The government also created Khanij Bidesh India Limited (KABIL) to secure overseas mining assets, recognising that domestic expansion must be complemented by a global presence. Other measures include customs duty reductions, incentives for domestic processing, recycling targets, international partnerships for diversified sourcing, and strategic stockpiling. On paper, these measures could cut import dependence by up to 40% by 2035 - but ambition and reality remain far apart.

Exploration of new deposits is limited, processing capacity is inadequate, investment flows are inconsistent, and auction timelines are often delayed. Policy still leans heavily toward downstream manufacturing, while the upstream extraction and refining ecosystem - the foundation of supply security - remains underdeveloped.

Environmental sensitivities, procedural delays, and volatile geopolitics add further complexity. In an age where supply chains can be weaponised, these weaknesses become strategic risks. Without faster, disciplined action, India risks being strategically exposed just as global demand peaks. India's critical minerals agenda must be approached as a marathon, not a sprint. A sound policy framework is essential, but without hard accountability mechanisms, even the best-designed initiatives can stagnate.

The centrepiece should be a monitoring architecture anchored in clear, enforceable Key Performance Indicators (KPIs) that track measurable progress across the supply chain: number of new quality deposits explored and mapped; auctions completed on schedule; domestic output and processing volumes; percentage reduction in imports; recycling and circular economy integration rates; overseas asset acquisitions; infrastructure development milestones; and compliance with environmental and sustainability standards.

These KPIs must be binding - embedded in law or official directives - not token numbers buried in obscure reports. Parliament should receive mandatory progress reviews, and the results should be public. Funding and promotions in relevant agencies could be linked to performance, and chronic underperformance must trigger decisive corrective measures, including leadership changes.

Accountability cannot rest solely with the executive. Independent expert bodies, insulated from political interventions, should review data in real time, flag risks, and recommend course corrections. Transparency will deter complacency and ensure taxpayer funds deliver tangible outcomes instead of financing endless committees and conferences.

Critical minerals in the 21st century are to national power what coal and steel were in the industrial age. They will determine leadership in renewable energy, advanced manufacturing, and emerging technologies - and who commands geopolitical leverage in a resource-constrained future.

For India, securing these resources is not merely an economic priority; it is a strategic necessity. The policy framework and institutions are in place. What is needed now is relentless execution, rigorous monitoring, and political will to hold every executor - public and private - to account. Without this, the vision of self-reliance in critical minerals risks becoming yet another well-intentioned but unrealised ambition.

- Chief Editor

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ANALYSIS AND IMPACT OF THE NINE JUDGE BENCH JUDGEMENT OF THE HON'BLE SUPREME COURT OF INDIA IN THE CASE OF MINERAL AREA DEVELOPMENT AUTHORITY (MADA) & ANR. VS. M/S STEEL AUTHORITY OF INDIA (SAIL) & ANR. ETC. IN CIVIL APPEAL NOS. 4056 - 4064 OF 1999, DATED JULY 25, 2024 & AUGUST 14, 2024 ON THE MINING INDUSTRY AND WAY FORWARD

Vijay Singh A R

(Part 2 of 2, continued from June 2025 Issue)

7. INTER-RELATIONSHIP BETWEEN ENTRY 50 OF LIST II AND ENTRY 54 OF LIST I.

Exact wordings of Entry 54 of List I is already mentioned above. The text of Entry 50 of List II is as under:

“Taxes on mineral rights subject to any limitations imposed by Parliament by law relating to mineral development.”

- As already explained above, Entry 50 is a taxing entry and not a regular or general legislative entry. Meaning thereby that if taxes on mineral rights have to be levied, it shall be levied only by the State Government/s and not by the Central Governments, of course subject to any limitations imposed by Parliament by law relating to mineral development i.e. MMDR Act, 1957.
- Before dwelling on other aspects of taxes on mineral rights, the Hon'ble Supreme Court in para 173 of the majority judgement, referred to the Black Law's dictionary meaning of mineral rights, wherein it defines “mineral right” as “an interest in minerals in land, with or without ownership of the surface of the land; a right to take minerals or a right to receive royalty.”
- It also referred to its earlier decision in the case of Thressiamma Jacob vs. Geologist, Department of Mining & Geology, ((2013) 9 SCC 725) and held that in the context of land, it is well-established that the ownership of land includes the ownership of underlying minerals, unless the right to minerals has been expressly reserved by law.
- In Para 259 of the majority judgement, the Hon'ble Supreme Court in Raja Anand Brahma Shah vs. State of U P (1966 SCC OnLine SC 89 [13]) a Constitution Bench accepted that the English system of ownership of lands applied in India, observing that the owner of the surface of land is entitled ex-jure to everything beneath the land. It was further observed that a transfer of the right to the surface conveys the right to the minerals underneath unless there is an express or implied reservation in the grant of land.

- **Ownership of Minerals – Entry 18 in List II.** The Hon'ble Supreme Court took cognisance of the legislative power of States to enact land legislation that can be traced to Entry 18 of List II which empowers the State legislatures to legislate with respect to matters dealing with “land, that is to say, rights in or over land, land-tenures including the relation of landlord and tenant, and the collection of rents. After Independence, the State legislatures enacted land reform legislation divesting land owners of their sub-soil rights, including rights in the minerals (paras 260 & 261 of majority judgement refers).
- Para 263 of the majority judgement, the Hon'ble Supreme Court observed that “Rights in minerals generally follow ownership of the land”. The right of an owner of land extends to the sub-soil, including the minerals found underneath the soil, which continues until the State deprives the owner by a valid legal process. **Importantly, Section 16(1)(b) of the MMDR Act also recognizes that the rights to minerals does not automatically vest in the State Government.**
- The Hon'ble Supreme Court in para 268 of the majority judgement, gave credence to the fact that, first the owner of a land can be divested of sub-soil rights in minerals only through a valid process of law, which has generally taken the shape of land reform legislation enacted by State legislatures. Second, the MMDR Act does not vest the ownership of minerals or mineral rights in the State. It regulates the exercise of rights to minerals which may be owned either by Government, private persons, or by both the Government and private persons.
- It illustrates certain state enactments where the right to minerals in private lands have been taken over or vests in the State Government/s –
 - i. Section 48 of the Maharashtra Land Revenue Code 1966
 - ii. Uttar Pradesh Zamindari Abolition and Land Reforms Act 1950.

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- iii. Section 3 of the Haryana Minerals (Vesting of Rights) Act 1973.
- iv. Gujarat Land Revenue Code 1879, Section 69A.
- v. Madhya Pradesh Land Revenue Code 1959, Section 247.
- vi. Chhattisgarh Land Revenue Code 1959, Section 247.
- vii. Goa, Daman and Diu Land Revenue Code 1968, Section 36.
- viii. Section 70 of the Karnataka Land Revenue Act, 1964 (not mentioned in the judgement)
- To a question whether the States can come up with a legislation vesting ownership rights in the State Governments despite the field being governed by the MMDR Act, 1957? The Hon'ble Supreme Court referred to its own decision in the State of Haryana vs. Channan Mal [(1977) 1 SCC 340], that lays down the principle that the decision of the States to acquire title to minerals does not fall foul of the MMDR Act because the latter does not control the ownership of minerals.
- The Hon'ble Supreme Court in the light of above discussions has unambiguously held that royalty is paid to the proprietor of the minerals for the exercise of mineral rights. Subsoil minerals can either be legally vested in the States or continue to remain vested with private landowners. Resultantly, the payment of royalty under Section 9 of the MMDR Act is paid either to the State Government or private landowner, as the case may be (para 266 of majority judgement refers).
- A mining lease contemplated under the MMDR Act relates to the mining rights and mineral rights. It does not grant surface rights to the mining lessee (para 320 of majority judgement refers).

8. UNION CAN IMPOSE LIMITATIONS ON POWERS OF STATE TO TAX MINERAL RIGHTS UNDER ENTRY 50 OF LIST II

- The expression "any limitations" in Entry 50 of List II is indicative of the fact that Parliament has been provided with ample legislative freedom to conceive limitations or restrictions on the legislative powers of the State to tax minerals. As a matter of fact this is only entry in the Seventh Schedule where the powers have been given to the Parliament to restrict or impose limitations on a taxing entry reserved for State Government/s. Hence Entry 50 of List II is SUI-GENERIS i.e. unique or class apart in the Scheme of Seventh Schedule to the Constitution.
- The legislative domain to tax mineral rights vests with the State. The legislative power of Parliament to impose "any limitations" is traced to Article 246(1) read with Entry 54 of List I. Parliament can impose limitations

and not levy taxes on mineral rights itself. The subject of taxing mineral rights continues to remain with the States. This understanding also ensures that there is no overlap or conflict between the powers of Union and the taxing field of the States.

- To question posed to the Hon'ble Supreme Court, does the expression "any limitations" include the power to prohibit States from taxing mineral rights? The Hon'ble Court asserted that, we are of the opinion that the answer must be in the affirmative (para 244 of the majority judgement refers).
- Para 245 of the majority judgement - The overall scheme of Article 246 read with Entry 54 of List I and Entry 50 of List II makes it clear that Parliament, in the interests of mineral development, can impose "any limitations." The purport of the expression "any limitations" is wide enough to include the imposition of restrictions, conditions, principles, as well as prohibition. Parliament has the constitutional power to determine whether and if so the manner in which limitations may be imposed.
- In para 224 of the majority judgement, the Hon'ble Supreme Court mentions that there is no specific provision in the MMDR Act which imposes limitations on the power of the States to tax mineral rights.
- Entry 50 of List II does not result in the field of taxing mineral rights being conferred on Parliament. This is clear also because there is no specific entry in List I giving the field of taxing mineral rights to the Union.
- **Exception to the Sundararamier principle** - Entry 50 of List II is not an exception to the Sundararamier principle (supra) which is that taxing entries are enumerated separately from the general entries in Lists I and II of the Seventh Schedule. The field of taxation cannot be derived from regulatory legislative entries and has to be derived from a specified taxing entry.
- Entry 50 of List II is subordinated only to the extent of any limitations that may be imposed by Parliament by law relating to mineral development. Unless Parliament imposes a limitation, the plenary power of the state legislature to levy taxes on mineral rights is unaffected.
- The question of an overlap between the taxing entry and general entry does not arise because Parliament cannot impose taxes on minerals under Entry 54 of List-I.

9. RESIDUARY POWERS OF PARLIAMENT – ENTRY 97 OF LIST I

- As per the Scheme of Seventh Schedule to the Constitution r/w Article 248, the parliament has powers to legislate on any matter including imposing of taxes when there are no specific entries in List II and List III.

Eg. Service tax, Expenditure tax, Gift tax, etc. under Entry 97 of List II (Residuary Entry).

- In para 198 of the majority judgement, it was put forth that if Parliament has no legislative competence to tax mineral rights under Entry 54 of List I, can it make use of its residuary powers in Entry 97 of List I to gain legislative competence? The Hon'ble Supreme Court emphatically negated this proposition. It clearly said the answer has to be in the negative.
- In *International Tourist Corporation vs. State of Haryana* [(1981) 2 SCC 318 [6-A]], the Hon'ble Supreme Court held that it is necessary to establish the legislative incompetence of the State legislature before Parliament can claim exclusive legislative competence by resorting to the residuary power. A matter can be brought under Entry 97 of List I only if it is not enumerated in List II or List III and in the case of a tax if it is not mentioned in List II. Importantly, it was also observed that the residuary powers of the Union cannot be interpreted so expansively as to whittle down the power of the State legislatures.
- A subject can be brought under Entry 97 of List I only if it is not enumerated in either List II or List III (*All India Federation of Tax Practitioners v. Union of India*, (2007) 7 SCC 527 [46]).
- The enumeration of taxes on mineral rights in List II is a constitutional entrustment to the states. This Hon'ble Court is bound to abide by the constitutional distribution of legislative powers. The distribution also subserves the principles of fiscal federalism.
- The field of tax on mineral rights vests with the state legislature. Parliament cannot impose a tax on mineral rights under Entry 54 of List I. Parliament cannot resort to its residuary powers to tax mineral rights when the subject matter is specifically enumerated in Entry 50 of the State List. The fixation of the rates of royalty under Section 9 can be validly traced to Entry 54 of List I because royalty is not a tax. The fixation of the rates of royalty falls with the regulatory powers of Parliament under Entry 54 of List I.

10. ENTRY 49 OF LIST II

- The Hon'ble Supreme Court also turned its attention to the Entry 49 of List II which talks about "**TAXES ON LANDS AND BUILDINGS**".
- Taxes on lands and buildings is again under the domain of the State Governments as per the scheme of Seventh Schedule to the Constitution. Definitely this Entry is to the exclusion of all entries in List I to Seventh Schedule that fall in the domain of the Parliament / Central Government.
- The Hon'ble Supreme Court (Constitution Bench) in **Raja Jagannath Baksh Singh v. State of Uttar**

Pradesh [(1963) 1 SCR 220] has held that word "lands" is wide enough to include all lands, agricultural or otherwise.

- A tax under Entry 49 of List II is not only levied on the owner of the land, but also an occupier (*Anant Mills Co. Ltd. v. State of Gujarat* (1975) 2 SCC 175). Similarly, a tax on mineral rights could be levied on any person who has an interest in the minerals.
- Therefore, the Hon'ble Supreme Court concluded that lands shall include mineral bearing land as well. Taxes, if any, can be levied only by the State Government/s and not by the Central Government (Para 325 of the majority judgement refers).
- Para 327 of the majority judgement - the Hon'ble Supreme Court came to the conclusion that royalty is not a tax but a statutory consideration payable by the lessee to the lessor for the exercise of mineral rights and hence is forming part of MMDR Act, 1957 in section 9 of the Act.
- In a challenge before the Hon'ble Supreme Court in *Goodricke Group Ltd v. State of West Bengal* (1995 Supp (1) SCC 707[20]) – 3 Judge Bench, the primary issue before the Hon'ble Court was whether the impugned levy (rural employment cess @ twelve paise for each kilogram of green tea leaves produced at the estate) was a levy on lands within the meaning of Entry 49 of List II of the Seventh Schedule. Justice B P Jeevan Reddy, speaking for the three-Judge Bench, observed that the income or yield of a land or building can be taken as a measure of the tax on land and buildings. Hence, the measure of the tax based on the yield from the land was held to be valid.
- Parliament had enacted the Tea Act in pursuance of Entry 52 of List I of the Seventh Schedule. Section 25 imposes a duty of excise on all tea produced in India @ not exceeding fifty paise per kilogram as the Central Government may notify. The issue was whether the levy under Section 25 (which is measured on the basis of the quantum of tea produced) denuded the State legislature of the competence to impose a cess on land adopting the same measure (para 309 of majority ruling refers).
- The Hon'ble Supreme Court in para 310 of majority judgement, observed that both the levies are different – while excise duty is on the produce of the land, land cess is a tax on land. Section 25 of the Tea Act enacted by Parliament was held not to deprive the State legislature of its power to levy a tax on lands comprised in a tea estate. The declaration in Section 2 of the Tea Act was held not to affect the legislative competence of the State legislature to levy land cess since it did not seek to control the cultivation of tea but sought to tax tea estates. The land cess was construed not to be on

the tea industry, but a cess on land comprised in tea estates.

- After the decision in Goodricke (supra) in particular, it is now well established that the income or yield of land can be adopted as a measure of tax.
- Para 330 of the majority judgement, the Hon'ble Supreme Court held that royalty can be considered as an income if it is paid to a private landowner. In case the minerals are vested in the State, the royalty is paid to the State Government, and hence assumes the form of non-tax revenues.

11. USING SAME MEASURE IN ENTRIES 50 & 49 OF LIST II

- The Hon'ble Supreme Court in para 339 of the majority judgement considered that both the entries 49 and 50 of List II deal with distinct subject matters. Both the entries operate in different fields without any overlap. The fact that mineral value or mineral produced is used as a measure under Entry 50 of List II does not preclude the legislature from using the same measure for taxing mineral bearing land under Entry 49 of List II.
- Para 341 of the majority judgement, the Hon'ble Supreme Court - The words "lands" under Entry 49 of List II includes mineral bearing land. The mineral produce is the yield from a mineral bearing land. Since royalty is determined on the basis of the mineral produce, royalty can also be used as a measure to determine the tax on royalty. The fact that the State legislature uses mineral produce or royalty as a measure does not overlap with Entry 50 of List II.

12. CONCLUSIONS IN THE JUDGEMENT DATED JULY 25, 2024

- Royalty is not a tax. Royalty is a contractual consideration paid by the mining lessee to the lessor for enjoyment of mineral rights. The liability to pay royalty arises out of the contractual conditions of the mining lease. The payments made to the Government cannot be deemed to be a tax merely because the statute provides for their recovery as arrears
- Entry 50 of List II does not constitute an exception to the position of law laid down in M P V Sundararamier (supra). The legislative power to tax mineral rights vests with the State legislatures. Parliament does not have legislative competence to tax mineral rights under Entry 54 of List I, it being a general entry. Since the power to tax mineral rights is enumerated in Entry 50 of List II, Parliament cannot use its residuary powers with respect to that subject-matter;
- Entry 50 of List II envisages that Parliament can impose "any limitations" on the legislative field created by that entry under a law relating to mineral development. The

MMDR Act as it stands has not imposed any limitations as envisaged in Entry 50 of List II;

- The scope of the expression "any limitations" under Entry 50 of List II is wide enough to include the imposition of restrictions, conditions, principles, as well as a prohibition
- The State legislatures have legislative competence under Article 246 read with Entry 49 of List II to tax lands which comprise of mines and quarries. Mineral bearing land falls within the description of "lands" under Entry 49 of List II
- The yield of mineral bearing land, in terms of the quantity of mineral produced or the royalty, can be used as a measure to tax the land under Entry 49 of List II. The decision in Goodricke (supra) is clarified to this extent;
- Entries 49 and 50 of List II deal with distinct subject matters and operate in different fields. Mineral value or mineral produce can be used as a measure to impose a tax on lands under Entry 49 of List II.
- The "limitations" imposed by Parliament in a law relating to mineral development with respect to Entry 50 of List II do not operate on Entry 49 of List II because there is no specific stipulation under the Constitution to that effect; and
- The decisions in India Cement (supra), Orissa Cement (supra), Federation of Mining Associations of Rajasthan (supra), Mahalaxmi Fabric Mills (supra), Saurashtra Cement (supra), Mahanadi Coalfields (supra), and P Kannadasan (supra) are overruled to the extent of the observations made in the present case.

13. CONCLUSIONS IN THE JUDGEMENT DATED AUGUST 14, 2024

- The submission that judgement dated July 25, 2024 (supra) should be given prospective effect is rejected.
- The States may levy or renew demands of tax, if any, pertaining to Entries 49 and 50 of List II of the Seventh Schedule in terms of the law laid down in the decision in MADA Judgement dated July 25, 2024 (supra) the demand of tax shall not operate on transactions made prior to 1 April 2005;
- The time for payment of the demand of tax shall be staggered in instalments over a period of twelve years commencing from April 1, 2026; and
- The levy of interest and penalty on demands made for the period before 25 July 2024 shall stand waived for all the assesses.

PART B: IMPACT OF HON'BLE SUPREME JUDGEMENT ON THE MINING INDUSTRY

For a change the Central Government and the Respondents or Mining Lease holders or Miners were on one side and the State Government/s were on the opposite side demanding

powers to levy cess or other taxes on minerals or mineral bearing lands and the Hon'ble Supreme Court by considering the powers bestowed on the State Government/s under List II of Seventh Schedule to the Constitution has upheld the powers to levy cess or other taxes on grant of mineral rights and also on the mineral bearing lands and using royalty or quantum of minerals excavated as a measure to levy cess or other taxes under Entries 49 & 50 of List II.

In addendum, land is always a state subject (Entry 18 of List I) and the mineral bearing states have started exercising powers under Entries 49 and 50 of List II to Seventh Schedule of the Constitution and have come up enactments to levy cess or other taxes on mineral rights or mineral bearing lands in their state jurisdiction.

Certain state enactments (on illustrative basis) are mentioned as here-below:

- I. State of Jharkhand has promulgated Jharkhand Mineral-Bearing Land Cess Act 2024 (Gazette Notification No. 625, dated 07.10.2024) and is levying cess on mineral bearing land as under:
- II. State of Tamil Nadu has promulgated the Tamil Nadu Mineral Bearing Land Tax Act, 2024 vide Tamil Nadu Government Gazette Extraordinary No. 79, dated 20.02.2025 and is wanting to levy mineral bearing land tax on on the land bearing any mineral as under:
Date of implementation - The Govt. of Tamil Nadu has implemented the above taxes w.e.f. April 4, 2025.
- III. State of Karnataka has recently considered and passed the Karnataka (Mineral Rights and Mineral Bearing Land) Tax Bill, 2024 and is proposing to levy cess on mineral bearing lands along with mineral rights tax as under:

Part A – Rates of tax on mineral right in respect of leases granted through non-auction

In case of Part E – Rates of tax on mineral right in respect of leases granted through auction : The State of Karnataka is proposing to levy Rupee one per metric tonne.

The aforesaid bill is passed by the legislative assembly and is sent to the Hon'ble Governor of Karnataka, who in turn has forwarded the same to the Hon'ble President of India for consideration.

Many more states shall definitely follow the examples of Jharkhand, Tamil Nadu and Karnataka in implementing laws in connection with levy of cess and other taxes on mineral bearing lands and mineral rights tax.

As can be seen above, the rate of cess and mineral right tax are not uniform and varies from state to state. In addendum, with the change in dispensation every five (5) years or less the rates shall drastically undergo a change and definitely shall be on an upward trajectory and this shall make the prices of essential minerals to go up and price differences between states shall be substantial purely on account of state levies viz., cess or other taxes on mineral bearing land and on mineral rights.

The mining lease holders have to mandatorily pay auction premium (where applicable), royalty, Contributions to DMF & NMET and the cess & other taxes levied by the respective State Government. In addendum even GST will have to be paid on all of them.

PART C: WAY FORWARD POST THE HON'BLE SUPREME JUDGEMENT

The judgement/s of the Hon'ble Supreme Court is the law of the land and in a democratic set-up no Government can gloss over the impact of the judgement rendered by the Hon'ble Supreme Court. No one Government at the State or Central level can nullify the impact of the judgement of the Hon'ble Supreme Court by amending any piece of legislation, since the bifurcation of powers are very clearly laid out and this judgement in crystal clear terms has identified who has the powers to regulate and to levy fees / consideration or taxes on grant of mineral rights or on mineral bearing lands.

If at all, the polity chooses to bring in amendments to the extant MMDR Act, 1957 then it calls for no less than a constitutional amendment requiring two-thirds majority in both the houses of Parliament along with ratification by at-least fifty percent of States in the country and definitely no states would want to let go of this opportunity to exercise powers under Entries 49 & 50 of List II to the Seventh Schedule of the Constitution.

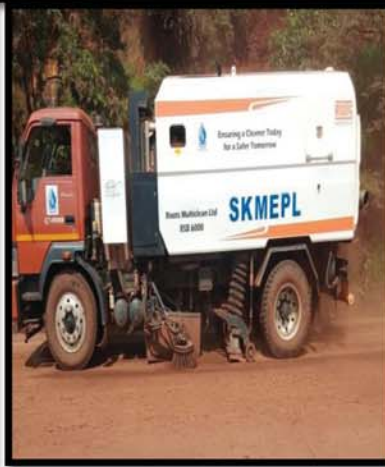
Immediately, the Central Govt. can put in restrictions or prohibition on the states power to levy taxes on mineral rights given to the State Government/s under Entry 50 of List II, but is powerless in reigning the State Government/s owing to Entry 49 of List II. If the Central Government aims to curtail or prohibit powers of the State Government/s under Entry 50 of List II, then the State Government shall ignore Entry 50 of List II and shall exercise powers granted to them under Entry 49 of List II.

In the humble opinion of the writer, the Central Government should take a cue from the way the Goods and Services Tax (GST) is introduced in the country by bringing an amendment to the Constitution (101st Constitution Amendment Act, 2016) and has merged various indirect taxes viz., VAT, Luxury tax, Entertainment tax, Entry tax etc. levied by states in

(Continued on Page 23)



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GLOBAL WARMING, GREENHOUSE GASES, ENVIRONMENTAL POLLUTION DUE TO MINING AND BLASTING - A REVIEW

M.O. SARATHY

Abstract

Global warming and O₃ depletion are a matter of serious concern the world over for both environmentalists and governments alike. Greenhouse gases, carbon footprint are terms which we hear or read about on a regular basis and are being addressed in earnestness by all countries around the world. Important GHGs are CO₂, CH₄, N₂O and few man-made industrial gases. Mining industry too has its share in contributing to the greenhouse gases and global warming through the use of mining and excavation equipment which run on diesel oil and release CO₂. CH₄ is another greenhouse gas trapped in the coal seams which gets released during excavation in surface and underground coal mines. An 'ideal detonation' of AN-based commercial explosives release CO₂, N₂, and H₂O as vapour. 'Non-ideal' detonations release CO, NO, NO₂, N₂O, other nitrogen oxides collectively known as NO_x and few other gases depending on the ingredients used in the formulation. Undetonated remnants of AN explosives in the muck pile or bench causes pollution of ground water. Dust is generated during drilling, blasting and excavation. In an effort to reduce NO_x during detonation, overseas manufacturers of explosives are developing alternative formulations devoid of AN as it would not generate any NO_x. Energy-efficient mining operations have taken center-stage. Crushing and comminution (grinding) consume maximum electricity in ore mining operations and accounts for 40-70% of the energy consumed and total costs. Lesser energy consumption means lower CO₂ emissions where fossil fuel is used for power generation. The 'mine-to-mill' initiative aims at maximizing fragmentation and conditioning them in the primary blast itself so that downstream costs of loading, hauling and more importantly, that of crushing and grinding are significantly reduced. Mining and explosives cause pollution of air, ground water, loss of forest cover, degradation and subsidence of the ground above the mined out underground workings.

List of Abbreviations provided at the end of the article (Page 21)

1. INTRODUCTION

Over the last decade or two, issues related to global warming and clean environment have gained immense importance and awareness. The world over, every nation is addressing the various environmental issues to make the earth a sustainable living place for present mankind and future generations yet to be born. Carbon footprint and greenhouse gases are two key issues that are being discussed in earnest. Pollution control has been addressed to make the air we all breathe cleaner and the water we drink pure, devoid of harmful pollutants and chemicals. A number of harmful gases both toxic and non-toxic are being released continuously into the atmosphere by human activities (anthropogenic) and by nature. With industrialization that began two centuries ago, the volume of greenhouse gases has progressively increased, causing incremental increases in atmospheric temperature leading to global warming. Mining companies are developing alternative mining methods and blasting techniques for reducing electrical power usage and diesel consumption of mining and excavation equipments to reduce polluting exhaust gases. Manufacturers of explosives are developing formulations devoid of AN for eliminating toxic fumes, mainly NO_x during blasting.

2. EARTH'S ATMOSPHERE

Earth's atmosphere essentially consists of N₂ (78%), O₂ (21%), Ar (0.93%) and other gases (0.04%) such as CO₂, CH₄, N₂O, H₂, H₂O as vapour and O₃. Earth's atmosphere consists of many layers and extends up to 10,000 km while some references go even beyond this distance. The layers are:

	NASA [25] (km)	NIWA [22] (km)	NOAAA [23] (km)
Troposphere	0-12	0-10	0-11
Stratosphere	12-50	10-30	11-50
Mesosphere	50-80	30-50	50-85
Thermosphere	80-700	50-400	85-600
Exosphere	700-10,000	> 400	600-10,000

3. CARBON FOOTPRINT

Dictionary defines carbon footprint as "a measure of the amount of greenhouse gases mainly CO₂ and CH₄ released into the atmosphere as a result of the activities of a particular individual, organization or community". Carbon footprint is also a term used to define the per capita generation of greenhouse gases by human activities.

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4. SOURCES OF POLLUTING GASES and THEIR EFFECTS

Industries, power generation using fossil fuels (coal, lignite, natural gas, petroleum products), exhaust from vehicles (running on petrol, diesel, natural gas) all release polluting gases. Burning of fossil fuels release CO, CO₂, SO₂, CH₄, Nitrogen Oxides and ash. Vehicles which run on diesel, petrol, compressed natural gas (CNG) release CO, CO₂, NO, NO₂, SO₂, CH₄, soot and particulate matter. Burning of (i) firewood-coal (ii) agricultural waste-stubble, bio mass (iii) garbage, forest fires, spontaneous burning of exposed coal in mines due to oxidation, decomposing-decaying vegetation, stagnant sewage release smoke and gases such as CO, CO₂, SO₂, CH₄, oxides of Nitrogen and particulates. CH₄ trapped in coal seams get released into the atmosphere during excavation. Wild and domesticated animals which thrive on vegetation release CH₄. Volcanic eruptions spew magma and release lots of ash and gases such as CO₂, H₂O as vapour, SO₂, H₂S, CO, HCl. In the mining scenario, captive power generation and machinery such as shovels, excavators, haul trucks, bulldozers, road graders which run on diesel oil release exhaust gases. Draglines, excavators, drills use power generated with fossil fuels which release polluting gases. ‘Non-ideal’ detonation of AN based commercial explosives generates CO, NO, NO₂, N₂O, CH₄ and NH₃. Explosive formulations containing Sulphur release SO₂ and H₂S. HNO₃ is formed when NO₂ and other oxides of N₂ mixes with O₂ and H₂O. SO₂ mixes with moisture in the atmosphere to form H₂SO₄. Both cause acid rain. The ratio of H₂SO₄ to HNO₃ due to acid rain is 7:3 [20,27]. Some of the gases mentioned above are termed as greenhouse gases, few of which also cause depletion of the O₃ layer.

5. OZONE LAYER

O₃ is a light blue coloured gas with a distinct pungent smell containing 3 atoms of oxygen (O). O₃ does not support life and is less stable than O₂. Ozone was prepared in the laboratory by Christian Friedrich Schnobein in the year 1839, while the presence of the ozone layer in earth’s atmosphere was discovered by French physicists Charles Fabry and Henri Buisson in the year 1913. Ozone layer is present in the upper reaches of troposphere and mainly in stratosphere, 15-30 km above earth’s surface. Ozone has been formed naturally on the earth over millions of years through the interaction of solar ultra-violet radiation with oxygen. Ozone layer acts like a protective cover roof and protects life on earth by effectively (97%-99%) filtering the harmful ultra-violet (UV) radiations emanating from the sun. Absence of this cover can cause skin cancer, cataract, weakened immune systems among humans and animals, reduced agricultural productivity, disruption of marine life eco-system etc. Gases derived from Cl₂, Bromine viz man-made industrial gases such as Hydrochlorofluorocarbon (HCFC), Chlorofluorocarbon (CFC), Hydrobromofluorocarbons

(HBFC), Sulphur Hexafluoride, which were being used previously in refrigerators, air conditioners, aerosol sprays, fire extinguishers, foam generators, electricity transmission and distribution equipments were known to destroy ozone resulting in its depletion. N₂O reacts with O₃ to form O₂ causing O₃ depletion. NO₂ creates O₃ molecule out of O₂ in sunlight and replenishes O₃. One molecule of Cl₂ is known to destroy 100,000 molecules of O₃. O₃ depletion results in what is described as an ‘ozone hole’. This space extends over several thousands of square kilometers in the stratosphere and allows sun’s U-V rays to reach the earth. Manufacturing O₃ on a commercial scale to replenish depleting ozone in the atmosphere requires lot of energy and hence impractical. The ‘Montreal Protocol’ adopted on 16/9/1987 sought regulation of nearly 100 man-made chemicals that cause depletion of ozone including the industrial fluorocarbons. N₂O, a GHG and also an O₃ depleting gas is not regulated by the above protocol [20]. India phased out CFC in the year 2010 and HCFC in 2020.

6. GREENHOUSE GASES (GHGs) and INDIAN SCENARIO

Certain gases are known as ‘greenhouse gases’ since they act like a greenhouse used to grow flowers, plants, fruits, vegetables, which require controlled conditions of temperature and humidity. A greenhouse allows heat into it during the day and keeps the inside warm during the cooler nights as it does not allow heat to escape. The sunrays heat up the earth’s surface during the day and the heat which is absorbed by the earth’s surface gets dissipated during the night releasing the heat back into the atmosphere. The GHGs blanket the earth, absorb the reflected infra-red radiation, trap the sun’s heat and keeps the earth warm. Without this, the earth’s temperature would become too cold (around -20°C) to sustain regular life on earth. But emission of certain gases during the last two centuries, post industrialization, has increased the atmospheric temperature incrementally leading to warmer climates globally. Heat trapping GHGs are mainly H₂O vapour, CO₂, N₂O, CH₄, O₃ and man-made industrial fluorinated gases. The ill-effects of GHGs have been lucidly explained: quote... “*Anthropogenic activities affect ecology, the state of the environment, and climate change, which negatively affects the health of the world population, reducing the healthy life expectancy, increasing mortality, worsening living conditions, and forming social injustice*” ...unquote [27]. Climate change is likely to affect weather patterns viz heat, drought, unseasonal heavy rains, floods, melting of ice, rise in sea level, human health, spread of diseases and social unrest mainly due to hunger [4]. India was the third largest emitter of GHGs after China and USA in 2023, driven by a rising population, a rapidly growing economy and increased energy demand. Per capita CO₂ emissions in India rose from 0.4 MT/person in 1970 to 2.07 MT/person in 2023 [26]. The sources of power generation

in India are (i) Coal and Lignite - 74% (ii) Hydro - 9% (iii) Solar - 7% (iv) Wind - 5% (v) Nuclear - 3% (vi) Diesel and gas - 2% [24]. Global warming potential (GWP) of GHGs are compared with CO₂ taken as 1. GHG emissions from global mining and resource extraction such as fossil fuels, metal ores and mineral resources resulted in \$3 trillion damages world-wide. Environmental costs due to GHG, particulate matter and acidification from coal and steel sectors was \$5 trillion [13].

6.1. Carbon Dioxide

Among all the gases being released into the atmosphere by both human activity and natural phenomena, CO₂ is the largest and accounts for nearly 70-80% of GHGs. It is the main contributor for climate change and global warming. Humans and animals continuously exhale CO₂ during breathing. Plants absorb CO₂, water and through a process known as photosynthesis release oxygen (O₂). Some part of CO₂ is released back into the atmosphere. It is for this reason that cutting trees, deforestation is not encouraged and growing more trees is advocated. Power generation using fossil fuels and vehicles release CO₂. One litre of petrol releases 2.31 kg of CO₂ while diesel oil releases 2.68 kg of CO₂. LPG releases 1.5 kg while CNG releases 2.66 kg [11,16]. Commercial explosives generate 176-200 kg of CO₂/ton [34,10]. Upstream emissions from manufacture of AN can range between one to four tonnes of CO₂ for every tonne of explosive manufactured [10]. Study carried out by Oxford university has shown that CO₂ emission occurs due to oxidation of rocks containing organic carbon. Sulphide minerals produce H₂SO₄ which can release CO₂ from carbon minerals [19]. It is reported that the concentration of CO₂ in the atmosphere has increased by nearly 50% after the industrial revolution began in 1800s. CO₂ has a long life and lasts for centuries. It is a trade-off between CO₂ released by equipment which run on diesel or by electricity generated using fossil fuels to power the drills, shovels and draglines. Hence there is an urgent need for efficiency.

6.2. Methane

CH₄ is another greenhouse gas which is getting added on a daily basis. Decay of degradable organic materials in solid waste landfills, stagnant sewage, agricultural activity, use of fertilizers, burning of biomass releases CH₄. All animals, both domestic and wild which thrive on grass, leaves and plants continuously discharge large volumes of CH₄ during eructation and flatulence. There has been a significant increase in rearing of livestock to meet the food requirements world over. India supposedly has the largest population of cattle in the world. CH₄ trapped in coal seams get released into the atmosphere during excavation of coal in surface mines. CH₄ released in underground coal seams reach the surface through the exhaust ventilation network. 60% of methane release is anthropogenic, while 40% is from natural

sources. GWP of CH₄ is 25-30 times more than CO₂, but has a shorter life and is the second largest contributor to climate change [20]. CH₄ reacts with other gases in harsh sunlight to form water vapour which breaks into other chemicals that destroy O₃. 120 million tons of CH₄ was released in 2023 by burning fossil fuels [20].

6.3. Nitrous Oxide

N₂O is another important ozone depleting gas. Burning of fossil fuel, agriculture, microbial decomposition of organic matter in soil, landfills, waste dumps, decaying/decomposing leaves, stagnant sewage, chemical industries and manufacture of HNO₃ release N₂O. Use of N₂ fertilizers and manure account for nearly 60% of N₂O emissions. Detonation of AN-based explosives release N₂O, NO, NO₂ and other gases though in smaller quantities compared to other sources. After CO₂ and CH₄, N₂O is the most important ozone-depleting GHG and expected to remain so. GWP of N₂O is 270-300 times more than CO₂. India is the world's second largest source of N₂O. Nearly 11% of such global man-made emissions in 2020 were from India, topped only by China at 16% [5,20].

7. ENERGY EFFICIENCY and REDUCTION IN DIESEL CONSUMPTION

Energy efficiency is '*using less energy to achieve the same or higher level of productivity*'. Energy efficiency in mining stems from two important aspects. They are:

- 1) Reduced power consumption by shovels, excavators, draglines and crushing-grinding circuits that run on electricity in metal and coal mines, the power being generated using fossil fuels.
- 2) Good fragmentation - maximizing the percentage of the desired fragment size and introduction of micro fractures in the fragments from the primary blast to facilitate efficient crushing and grinding in ore mining operations. While good fragmentation is normally considered from a loading perspective, micro fractures introduced into the fragments during primary blasting has a significant impact on grinding. In coal mines also good fragmentation effects loading efficiency.

59 years ago, viz in 1966, the concept of optimum blasting was established and demonstrated that better fragmentation in the primary blast significantly brought down the downstream costs of loading, hauling, crushing at the mine site and thus the total ROM cost [28]. Prior to that, probably the emphasis in blasts was reduction in oversize and ease for the excavator to dig and load. Present fragmentation requirements look far beyond ROM and evaluates the effect of fragmentation on grinding and extraction of metal or mineral. The mine-to-mill process has clearly demonstrated the inter-dependence of the downstream functions on the upstream activities such as pre-blast evaluation-characterization of strata-explosive,

drilling and blast design. Better fragmentation can be achieved in a number of ways such as using (i) a drillhole diameter smaller than the one in use (ii) closer burden, spacing (iii) higher specific charge: kg/t or kg/m³ viz lower powder factor. Needless to say, use of higher specific charge also increases quantity of explosives resulting in higher after- blast fumes (iv) stronger explosive (v) proper drillhole patterns and initiation sequence (vi) accurate delay initiator firing times. The above methods have in the last few decades conclusively demonstrated that the blasting engineer can meet the fragmentation and muck pile requirements to optimize downstream functions. Finer fragmentation results in reduced voids and greater packing resulting in increased payload viz greater hauling efficiency. Good fragmentation results in, quote ... *'The effects of fragmentation are first seen in loading; no matter what type of machinery is used, fragmentation plays a leading role in loading efficiency. A well-swollen muck pile with a fragmentation tailored to the type and size of the machinery will yield fewer passes and smoother, more efficient loading compared to an inconsistent and disproportionately fragmented muck pile'* ... unquote [2].

Trials were carried out under identical field conditions of strata, blast design, drill pattern, initiation system etc. changing only the explosives energy. Blasts were carried out using emulsion explosives having energy content of 630, 650, 690 and 720 kcal/kg. After the blast, fragmentation assessment was carried out using Wipware software. Authors concluded that, quote... *'the average fragment reduction size from 644 mm to 220 mm i.e. by about 1/3 has been obtained using bulk emulsion explosives with higher energy levels compared to original low energy emulsion explosives used by the mine. The reduction in fragment size by 66% shall improve the excavator efficiency as well as related maintenance costs'* ...unquote [33]. Using stronger explosive results in better fragmentation.

7.1 In surface ore mines, two factors control energy consumption at the primary crusher viz (a) energy used by crusher to crush the fragments (b) additional energy used for overcoming the initial resistance of the moving parts of the crusher. Higher peaks in power consumption occurs when bigger fragments are crushed. The resistance to comminution is reduced when specific charge (kg/t, kg/m³) is increased. Maximizing the use of delay initiators result in reduction of costs [7]. Depending upon the type of ore being mined, the crushing and comminution cost in ore mining varies. Milling costs can be as high as 49% of total costs [2]. Comminution accounted for 67% of mine processing costs and consumed 53% of total energy in a specific mining operation [30]. If energy factor is 1 for blasting, then it is 10 for crushing and 100 for grinding. Similarly, if cost factor is 1 for blasting, then it is 5 for crushing and 25 for grinding [32]. New blasting

technique such as Ultrablast™ uses very high bulk energy explosive to carry out blasting which not only fragments the material (ore) but also introduces micro fractures in the fragments causing them to crumble more easily at the crusher, consumes lesser energy in crushing-comminution and thus costs. Fragmentation needs to be aligned with the grinding circuit feed. It is common practice to mine shallow deposits and high-grade ores first. As excavations become deeper, larger volumes have to be excavated for achieving the same value, thus increasing energy consumption and GHG emissions [10]. Selective loading is required to ensure that waste rock does not get mixed with ore causing dilution or waste rock reaches the grinding circuit resulting in wasteful energy consumption leading to higher costs of operations.

7.2 In surface coal mines, energy efficiency is achieved through good fragmentation leading to better loading efficiency of excavators such as draglines and shovels which run on electricity generated using fossil fuels. Reduced mechanical handling of overburden, reduced haul distance for dumpers and non-dependance on dumpers for transporting overburden are some of the possibilities for reducing power consumption and reduction in vehicle exhaust. Techniques implemented include:

- 1) Cast blasting of overburden using explosive energy. 30-40% of overburden is directly thrown into de-coaled area thus reducing mechanical handling by dragline or shovel-dumper leading to reduced power consumption and diesel exhaust. Appropriate blasting needs to be adopted so that coal just below OB does not get thrown into the dump during blast leading to coal loss [10].
- 2) In-pit crushing of overburden and conveying the broken material through conveyor belts to the dump yard thus eliminating use of haul trucks-dumpers for transportation [8].
- 3) New blasting technique developed by Orica namely Stratablast™ where multiple coal seams and interburdens are blasted simultaneously in a single blast using electronic detonators. Other inputs remaining the same, up to 25% extra coal recovery through reduced loses translates to reduction in GHGs [4,10]. It also enables reducing surface area of excavation which shortens haul distance traversed by the dumpers, thus minimizing CO₂ emissions [29].

7.3 Trolley Assist System

Haul trucks are known to consume around four times more fuel travelling up an incline (6-10°) than they do on a flat surface. 'Trolley Assist' system works similar to a tram with an overhead power line which connects as the truck approaches and travels up an incline, to power the rear wheels of the truck. The diesel engine is bypassed, but not switched-off, because it controls other systems such as power steering

and electronic circuits. By using trolley assist, approximately 70-90 percent diesel use can be reduced while driving up the ramp and offers huge benefits in terms of CO₂ reduction. By going electric, the vehicles, when on-trolley, only use around 30-50 litres an hour, which equates to a reduction in diesel consumption of as much as 350 litres an hour, making operations much more CO₂ efficient. In addition, the speed of the trucks increase resulting in a higher throughput. [14,18]

8. POLLUTION DUE TO EXPLOSIVES, BLASTING OPERATIONS and EXPLOSIONS

Blasting and explosives usage result in a number of harmful environmental issues and safety concerns. While ground vibrations and airblast noise are normally mentioned, other issues are:

- Airborne dust due to drilling, blasting, excavation, movement of vehicles, dumping and wind.
- Noxious gases in after-blast fumes due to 'non-ideal' detonation of explosive during blasting. Gases include CO, CO₂ and NO, NO₂, N₂O, N₂O₃, N₂O₄, N₂O₅ collectively known as NOx.
- Contamination of soil and mine water due to the presence of unexploded AN-based explosives due to misfire, spillage during charging, flushing the hose pipe on the bench after charging bulk explosives, leaching of explosives in drillholes containing static or dynamic water in the strata.
- Accidents and untoward explosions of explosive material due to fire, heat or impact.

8.1 Dust Generated During Mining and Blasting

Dust generation occurs during (i) drilling - auger, rotary or percussive, configuration of drill bit and speed of drilling (ii) travel of vehicles on haul roads and working benches (iii) loading-discharge by shovels, dragline and dumping by dumpers (iv) screening (v) conveyor belt transfer points (vi) crushing, grinding (vii) blasting (viii) strong winds that kick-up dust from dumps and working areas in mines (viii) when the entire blasted fragments fall on the lower bench after its flight in a blast. Depending on the characteristics of rock and explosive, the crushed zone extends 4-8 times charge diameter (fully coupled drillhole). Weak, soft and brittle materials generate more dust compared to harder ones. Blasts which are highly confined viz excess burden or inadequate delay results in more fines generation. Explosives with high velocity of detonation and borehole pressure generates higher brisance (shock) resulting in an increased crushed zone around the drillhole walls. High specific charge (low powder factor), use of burdens lower than the design burden, drill cuttings as stemming cause fines. Use of low energy explosive, de-coupled charge, providing an air deck in the explosive column, using crushed stone in stemming can reduce fines. Water ampoules in stemming reduce dust [3]. Dust of 10-100 microns size is

visible and least harmful. Dust invisible to naked eye is less than 10 microns (PM10) get trapped in the nose, throat and get ejected by coughing and sneezing. PM 2.5 (2.5 microns) is most hazardous since it reaches the lower regions of the lungs. Lung damage is irreversible if not detected early [20]. Inhaling various types of mining related dusts cause severe lungs-based health issues to personnel such as silicosis, asbestosis and pneumoconiosis. While dust generated in below ground operations affect only those working there, dust generated in surface excavations affects those working at site and also persons living in colonies around the site. Airborne dust dispersion is affected by wind speed and humidity. Dust generation has to be arrested at the point of generation such as drill machines, haul roads, areas where soft, loose material is present mainly operating benches, dump yard where vehicle movement takes place. Water sprays-misting systems and dust stabilizing chemicals are used on haul roads, dumps, areas having loose material to suppresses dust generation. Dust extractors are used during blasthole drilling. Wind screens are used to prevent dust from getting airborne during heavy winds [15]. Blasted muck pile is wetted during loading operations [3]. Water cannons are used to suppress dust during the blast [35 Video].

8.2 Noxious after-blast fumes

An 'ideal' detonation of AN based commercial explosives releases H₂O as vapour, CO₂ and N₂. When AN burns, decomposes thermally or "non-ideal detonation" of the explosive takes place inside the drillhole due to various reasons either fully or in localized pockets, toxic gases such as CO, along with oxides of N₂-O₂ such as NO, NO₂, N₂O in small quantities collectively known as NOx are released. Other gases released are NH₃ and CH₄ [1,5,9]. If explosive formulation contains Sulphur, H₂S, SO₂ are likely to get released. NO mixes with atmospheric O₂ and forms NO₂ identified by the orange to dark purple colour depending on its concentration in the fume cloud. NO₂ is known to react with itself to form N₂O₄ also having orange colour. NO and NO₂ are not GHGs and they help in the formation of O₃ by reacting with O₂. NO₂ is approximately 10 times more toxic than NO and 17 times more toxic than CO [9,20]. Noxious gases are released during surface blasting due to inadequacies in product (malfunction), loading procedures (practices) and field strata conditions. A number of conditions that can cause non-ideal detonations or detonation failure are listed below.

- Incorrect oxygen balance and improper processing result in incomplete detonation of explosive either fully or in localized portions inside drillhole. Excess fuel (-ve oxygen balance) results in increased CO, while less fuel (+ve oxygen balance) results in significant increase in NOx.
- Explosive not sensitized to desired level to sustain detonation.

- Inadequate confinement of charge: poor stemming length or stemming material (drill cuttings).
- Explosive contaminated with drill cuttings, charge separation in drillholes due to borehole collapse, stone/soil falling into drillhole during charging and low-density explosive in watery drillholes causing explosive to float results in sluggish-improper detonation and unwanted fumes.
- Explosive desensitization under a state of static pressure in deep drillholes or when subjected to a dynamic pre-compression of explosive due to shock wave, especially in soft, weak, fractured strata, alluvium or clay. This can happen in adjacent drillhole or between decks in the drillhole.
- Inadequate primer / booster - booster percentage or booster size-weight.
- With ANFO, the FO seeps out due to wicking action or gets absorbed in porous strata resulting in non-heterogeneity in the mix viz reduced FO percentage resulting in improper detonation.
- Use of explosive having poor water resistance such as ANFO in watery drillholes. Strata having dynamic water causes degradation of slurry/emulsion explosive due to leaching effect when kept sleeping for extended durations. Explosives are only water-resistant and not water-proof.
- Explosive that has flowed into cracks, fissures etc. resulting in charge mass lower than product's critical detonation diameter leading to partial or incomplete detonation or deflagration.
- Unexploded explosive remaining in the drillhole or in the blasted muck pile due to misfire, product malfunction, charge cut-off caused by ground movement during delay blasting and few other causes. Causes of malfunction have been explained in detail in Section 8.2.
- For preparing ANFO for blasting, AN prills are used which have micro pores to absorb and retain desired percentage of FO viz 94.5:5.5. In charged drillholes, FO seeps out of the prill due to wicking action. Soft, dry and porous strata in overburden are known to absorb FO. In both situations, FO percentage gets reduced causing non-heterogeneity in the mix resulting in detonation failure and undetonated ANFO remains in the drillhole or in the muck pile [5].
- When ANFO is charged in watery drillholes, AN gets dissolved in the ground water. 25% loss of nitrates in 10 minutes and 50% after 1 hour was observed. ANFO with 25% loss of nitrates is not detonable (31). In the case of slurry/emulsion explosive, leaching occurs slowly and extent of deterioration is dependent on the formulation and sleeping time (duration in the presence of water) in drillholes. Dynamic water in bench causes faster and higher deterioration compared to static water. Water-in-oil emulsions show higher resistance to water ingress due to its structure viz each oxidizer droplet being surrounded by an oil layer. Packaged explosives are less prone to deterioration by water due to the packaging material and its integrity. With emulsion: ANFO blends, product with 50% emulsion offers good water resistance. It is reiterated that AN based slurry-emulsion explosives are not waterproof, but only water-resistant to some extent.

8.2.1. Reactive ground: blasting in pyritic ores - AN in close proximity to pyrites ore inside charged drillholes react resulting in exothermic heat generation and release gases such as NO, NH₃, SO₂ and NO₂. This is a dangerous situation since the sustained heat can set-off a "deflagration to detonation transition" reaction inside the drillhole resulting in an untoward accidental detonation. Detonation reaction can occur after 24 hours or even longer inside the drillhole, with absolutely no indication whatsoever on the surface. Usually, a single drillhole charged with explosive gets blasted in a round.

8.3 Contamination of soil and mine water by ANFO and AN-based explosives

An area of serious environmental concern is the pollution of soil and mine water due to nitrogen-based compounds such as Nitrates, Nitrites and Ammonia caused by the presence of undetonated AN-based commercial explosives such as ANFO, Heavy ANFO, watergel (slurry) and emulsion [5,31]. Main causes of presence of explosive or intermediaries on the bench or in muck pile are:

- With pumpable explosives, it is a common practice to flush out the loading hose pipe after charging on the bench itself resulting in the presence of undetonated material mix on the bench.
- Spillage during handling of AN and other raw materials at the support facility near the mine where non-explosive matrix is manufactured. Spillage can occur during transfer of intermediaries onto the pump trucks or road tankers at the facility or from tanker to pump truck at the blast site. During charging, spillage of explosive occurs mostly around the drillhole collar.

Undetonated AN and explosives release NH₃, Nitrates and Nitrites into the mine water which flows into streams, rivers, ponds, lakes and affects aquatic life. When warm-blooded animals drink this water, nitrates convert to nitrites in the gastro-intestinal track and impairs oxygen transport in the blood stream [31]. Tear-resistant borehole liners are used in watery drillholes to prevent deterioration of explosive in drillhole, though not practiced in our country. Many overseas mine sites prepare 'nitrogen management plans' to control

the release of ammonia, nitrates and nitrites into mine water.

9. ALTERNATIVES TO AN

Need for alternative to AN gained ground during the last decade due to a number of aspects such as:

- Safety concerns of explosion due to fire risk during transport or storage of AN.
- Risk of use by anti-social elements due to free availability of AN.
- Generation of noxious fumes - mainly NO, NO₂ and N₂O.

9.1 Hazardous nature of AN and safety concerns

It was generally considered that Ammonium Nitrate, a fertilizer was very safe to transport and store. Many accidents have occurred during manufacture, storage and transport in the past. The explosive nature of fertilizer was realized in an explosion known as the 'Texas city disaster', when a ship berthed in the harbour carrying 2100 MT of fertilizer in its hold caught fire and exploded resulting in largescale damage and deaths in 1947. Prior to that, there were three incidents involving caked AN which got detonated when workers tried to break it by blasting using explosive, resulting in damage and death. Several accidents have occurred due to fire during transport of AN by truck and also stored AN, followed by an explosion causing damage and death. The most recent accident is the devastating detonation of 2750 MT of AN prills stored in a warehouse in Beirut, Lebanon on August 4, 2020. 218 persons were killed and 7000 injured.

9.2 AN brought under explosive rules

Concerned over subversive activities by anti-national elements setting off explosions using AN which was easily available (after banning of Nitroglycerine explosive), Government of India with a view to regulate, categorized AN as deemed explosive under the Explosive Act 1884 through a gazette notification bearing number S.O. 1678 (E) dated 21/7/2011. It has the potential to form an explosive mixture on the addition of ingredients like fuel etc. AN is an ingredient for manufacture of Class-2 explosives in India and defined in Rule 2(b), AN Rules, 2012.

9.3 Elimination of NO_x in detonation products (after blast fumes) and water contamination

Today in Bharat, only AN based explosives such as ANFO, slurry and emulsion explosives are used for all surface and below ground applications in mining and civil excavations. These explosives are known to release NO_x during detonation under certain adverse field conditions. One approach the overseas manufacturers of explosives have explored is the use of other oxidizers devoid of nitrate such as H₂O₂ which contains only H₂ and O₂. Upon

detonation, it does not release NH₃ or Nitrate by-products like NO_x. H₂O₂ based emulsion explosives release only H₂O as vapour, CO₂ and CO. Further, in case of misfire or unexploded charge remaining in drillhole or blasted muck, there is no risk of aqueous nitrates or NH₃ leaching into the ground causing water pollution. This aligns well with stricter regulations of mine site water discharge limits in few overseas countries. Manufacture of AN is a carbon-intensive process that requires large scale manufacturing plant and capital investment. Also, production of AN is a high energy consuming process and large GHG emissions occur during its manufacture [4,10,21]. Manufacture of finished products are possible at lower temperatures resulting in reduced energy consumption and hence lower carbon emissions. Products are processed at around 65°C with H₂O₂ while it is around 85°C with AN. While 1 kg of AN emulsion explosive releases approximately 2.3 kg of CO₂, H₂O₂ based product emits only 0.23 kg of CO₂ viz a reduction of 90%. Hence, above aspects make H₂O₂ eco-friendly and safer in many ways [1,12,17,21]. While this technology is being used in countries such as Australia, Sweden, South Africa and few others, it has not been introduced in Bharat yet.

10. INITIATIVES TAKEN BY THE MINING INDUSTRY

The mining industry has implemented several initiatives to reduce generation of CO₂ by heavy earth moving machinery (HEMM) such as (i) Using alternatives to diesel such as hydrogen or bio-fuel (ii) in 2 opencast projects of SCCL, use of additive in diesel in HEMM resulted in significant reduction in diesel consumption. Exhaust emissions came down by 40% and 780 MT CO₂ reduction [8] (iii) using in-pit crushing and shifting the broken material through conveyor belt [8] (iv) reducing haul distance from blast site to dump where geo-mining conditions allow [29] (v) Cast blasting of overburden using explosive energy reducing mechanical handling of waste rock by dragline or shovel-dumper combination (vi) using Trolley Assist system [14,18]. For dust control, initiatives include surface miners with water jets, water sprinklers, mist sprayers, fog cannons, dust extractor on drill machines, covered conveyor belts, vacuum road sweeper machine and wind screens [15].

11. THE ONEROUS TASK AHEAD

Global warming has caused chaotic climate changes such as changed weather pattern, heat, drought and floods due to unseasonal heavy rains. The United Nation's initiative to address climate brought together almost all countries of the world to a common platform known as Conference of Parties (COP) organized under the aegis of United Nations Framework Convention on Climate Change (UNFCCC). COP 26 was held in Glasgow, United Kingdom in 2021 and 197 nations participated. They set a target to limit global warming by 1.5°C, reduce global emissions to 50% by the year 2030 and achieve 'net-zero' by the year 2050. It is

urgently required to reduce GHGs by eliminating the use of fossil fuels and adopt 'zero carbon' renewable sources such as wind, solar, hydropower and geothermal. Biomass is a renewable and sustainable alternative to fossil fuels. De-carbonization by planting of more trees and use of technologies such as 'Direct Air Capture' which work like giant vacuum cleaners remove CO₂ from the atmosphere. Facilities established by companies Climeworks and Carbon Engineering capture thousands of tons of CO₂ annually. The process involves chemical reactions that separate CO₂ from other air components, which can then be stored or re-used [6].

12. CONCLUSIONS

The three main GHGs are CO₂, CH₄ and N₂O. Sources of GHGs due to mining industry are electricity generation (for drill, shovel, dragline), diesel (shovel, haul truck, bulldozer, road grader) and explosive (blasting). GHG emissions from explosive detonations are smaller compared to other sources. 80% of world energy comes from fossil fuels which release large volumes of CO₂. CH₄ gets released from both surface and underground coal seams during excavation. 75% of energy generated in India is through coal. AN-based commercial explosives are known to release 800-900 litres of gases per kg of which N₂O forms a small percentage. World over, nearly 20 million tonnes of AN explosives are used annually which can contribute to global warming, environmental and safety concerns. Use of alternative oxidizers such as H₂O₂ in place of AN will prevent generation of NO_x, reduce accident potential associated with AN and not cause contamination of mine water if undetonated explosive is present on the bench or in the muck pile. Good fragmentation improves loading efficiency of various types of excavators which run on diesel or electricity. Finer fragmentation results in reduced voids leading to greater packing density and improves transport efficiency through increased payload. Blasting using stronger explosives result in finer fragments and loose muck piles. 'Conditioning' the fragments in the primary blast by introducing micro fractures in them significantly reduces electricity consumption through reduced crushing and grinding costs which account for a major portion of the total operational costs in ore mining operations. Mining (ROM) and milling (grinding-comminution) were treated as independent operations-cost centers without understanding the effect the former has over the latter. Today, the mine-to-mill initiative holistically analyzes the effect of good fragmentation in primary blasting on the entire downstream operations of loading, hauling, crushing, grinding and final extraction viz inter-dependency of upstream on downstream functions. Electronic initiation has opened new avenues which were hitherto not possible with the use of pyrotechnic delays, through blasting techniques developed by Orica such as Stratablast™ and Ultra High

Intensity Blasting™. Overburden casting, in-pit crushing, trolley assist system are possibilities in mining industry towards reduction in CO₂ generation. There is an urgency to reduce GHGs by phasing out fossil fuels such as coal, oil and gas and explore renewable energy options such as solar, wind, H₂, bio-fuel, geothermal and biomass. Carbon aggregators remove CO₂ from the atmosphere. Reducing the gases that cause O₃ depletion will help in recovery and rebuilding the O₃ layer in the stratosphere over the next few decades. Mining industry should also endeavor to reduce generation of GHGs and global warming.

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ABBREVIATIONS USED IN THIS ARTICLE

AN	Ammonium Nitrate	HNO ₃	Nitric Acid
AN-FO	Ammonium Nitrate-Fuel Oil	N ₂	Nitrogen
Ar	Argon	NH ₃	Ammonia
CH ₄	Methane	NO	Nitric Oxide
Cl ₂	Chlorine	NO ₂	Nitrogen Dioxide
CO	Carbon Monoxide	N ₂ O	Nitrous Oxide
CO ₂	Carbon Dioxide	N ₂ O ₃	Dinitrogen Trioxide
H ₂	Hydrogen	N ₂ O ₄	Dinitrogen Tetroxide
H ₂ O	Water	N ₂ O ₅	Dinitrogen Pentoxide
H ₂ O ₂	Hydrogen Peroxide	O	Oxygen (single molecule)
H ₂ S	Hydrogen Sulphide	O ₂	Oxygen (breathable)
H ₂ SO ₄	Sulphuric Acid	O ₃	Ozone
HCl	Hydrogen Chloride	SO ₂	Sulphur Dioxide

(Continued from Page 13)

different states with different rates of taxes on commodities / goods and taxes on services being levied only by the Central Govt. and truly it has now become one nation one tax for a particular commodity or goods w.e.f. July 1, 2017 and is successfully managed through GST Council owing to introduction of Article 279A by heavily relying on the concept of Co-operative federalism and every decision of rate hikes or rate reduction in GST across the country is put up and debated in the GST Council meetings comprising representatives of all State Governments with the Central Government's Hon'ble Finance Minister as the Chairperson and the voting rights being distributed in the ratio of 1/3 : 2/3 between Central Government and State Government/s and any matter needs to be decided with 3/4th majority if not unanimously.

For example – Iron-ore is taxed i.e. GST levied uniformly @ 18% across the states, irrespective of where the lease is situated. If at all a particular state wants to increase / decrease the rates of GST, then it shall be put up and debated in the GST Council and if all the members agree then the proposal shall be recommended to the Central Govt. for notification in the Gazette along with notifying the date of implementation. Once the Central Govt. notifies then all the State Government/s shall simultaneously issue Gazette Notification on the same lines as the Central Government has done.

The system is working fine with the involvement of GST Council for the last about 8 years and the states have also seen increase in tax revenues after introduction of GST.

On the same lines as GST Council, the Central Government should amend the Constitution and identify mineral bearing states and bring in a concept of Mineral Bearing Land / Mineral Rights Tax Council and get the states to agree on the same so that the disparities in levy of Cess or other taxes on grant of mineral rights or on mineral bearing land is removed and the trade / business entities having mining leases are aware of taxes / levies irrespective of the states / regions in which they operate. Else it shall be very destructive to the industry and shall also lead to arbitrage owing to operations being carried out in states where lower cess or other taxes are applicable when compared to states where cess or other taxes are relatively on the higher side.

This is the need of the hour and as it stands today. There is no way the Central Government can control or restrict or prohibit States from charging cess or other taxes under Entries 49 or 50 of List II to the Seventh Schedule without bringing in amendments to the Constitution.

Disclaimer: The views expressed hereinabove is personal and is that of the author / writer only. It is not made on behalf of Mining Engineers' Association of India (MEAI) or on behalf of the Institute of Chartered Accountants of India (ICAI).

READERS' VIEWS

Dear Editor,

Your editorial in the August issue of MEJ on Dr Vasudev's dual model 1. Auction-based allocation of ML based on proven reserves 2. FCFS for Exploration Licenses (EL), Composite Licence (CL) and Artisanal Mining Licence (AML) is very illuminating and the need of the hour.

Dr Vasudev's detailed explanation of its need and the justification is very well presented. He listed and explained the ill effects of the Auction method of allocation of the Leases.

Many Stakeholders, FIMI and MEAI presented this logic of reversing the auctioning method of natural resources, and it is thoroughly appreciated by policy makers like IBM, the Ministry of Mines in various forums, but is only accepted by the policy makers at the Centre in bits and pieces only.

The Government is following Supreme Court directions regardless of its consequences of slow progress of mining and exploration against the wishful thinking of speedy growth of mining and exploration of mineral resources by all stakeholders.

It is suggested that MEAI may consider approaching the intellectuals and articulate MPs of opposition parties with facts and figures to emphasize the need to deviate from auction-only policy and request them to ask pertinent questions in Parliament, and make valuable suggestions to the Government for necessary changes in the statute. This approach may strengthen the hands of the Government and speed up the process of making changes. Let us understand that how much IBM and the Secretaries may agree with the ground realities prompting changes in the auction policy, they seldom like to go against their boss. Their helplessness in accepting their failure is understandable. So, their hands are to be strengthened by the voice of concern by the Opposition MPs too.

In addition to the several important points raised in his thought-provoking paper, I wish to suggest the following additional reasons for diluting the auction policy

1. There is no harm in by passing the auction route for renewals of MLs to the same lease holder if the lessee secures 4 or 5 star ratings given by IBM, the statutory authority to safeguard environment and mineral conservation by granting first right of refusal after the auction or by charging an additional percentage of royalty based on average of previous auctions of the same mineral in the neighborhoods. This provides security to the workmen, gives incentive to the mineral beneficiation, research and development, and infrastructure development. This also gives stability to captive mines and their associated industries.
2. Large-scale mining is always a better option for sustainability and environmental protection where investment and infrastructure development is possible. But there are minerals whose value is low, and even at higher levels of production, they become unviable due to low demand and high transport costs. Small area mines where the mineral is highly localized and where selective mining is only possible, also do not justify the auction route. The advantage of small-scale mining is that it gives local employment, and environmental damage is localized and minimal. In these cases, the mines can be given on FCFS or by lottery among the qualified applicants.

With kind regards

CS Dhaveji

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MEAI NEWS

MEAI OFFICE BEARERS FOR THE TERM 2025 - 27



Shri. D B Sundara Ramam
President



Shri. Dhananjaya G Reddy
Vice President - I



Dr. Pukhraj Nenival
Vice President - II



Shri. Rachappa M Saradagi
Vice President - III



Shri. M. Narsaiah
Secretary General



Shri. B. Sahoo
Jt. Secretary cum Treasurer

BELGAUM CHAPTER

New Executive body

Belgaum Chapter had its new executive body elected for the year 2025-27, installed at Hotel Woody's, Nanawadi, Belgaum on 24th August 2025.

At the outset, Dr Purandara the outgoing chairman of the Chapter welcomed the members. Several senior members Dr D A Hiremath, Shri D S Malkai, Shri S R Hegde, Shri S Rachappa, Dr A G Ugarkar spoke on the occasion expressing their gratitude and congratulated the outgoing body for their excellent work during the last 4 years of their tenure.

Outgoing Chairman Dr Purandara addressed the members and thanked all the members for their support and help in conducting all the MEAI events. Later he adorned the MEAI Chairman Badge to Dr Pramod Hanamgond and handed over the charge of Chapter's Chairmanship. Mr Amit Ghooly adorned the Secretary Badge to Mr Sagar Waghmare and handed over the charge of Secretary.

The incoming Chairman Dr Hanamgond, addressed the gathering, thanked them and sought the support for the activities of the Chapter to take it to the great heights. He also presented his activities plan to be executed during the year. At the outset Shri D A Hiremath was felicitated for publishing his book "Memories of a Geologist". Shri Rachappa, Dr Purandar and Mr Amit Ghooly were felicitated for getting the Excellence Awards in the Annual Award ceremony held at Bhubaneswar in the Annual General Meeting.

The meeting ended with the vote of thanks proposed by Mr Sagar Waghmare.



BELLARY-HOSPET CHAPTER INDEPENDENCE DAY CELEBRATIONS

The Bellary–Hospet Chapter celebrated Independence Day on 15th August 2025 with great patriotism and enthusiasm at Sai Universal Mining Services, the registered office of the Chapter. The program began with the hoisting of the National Flag by senior members, followed by the singing of the National Anthem that filled the gathering with pride and unity. The occasion was graced by the Past President of MEAI Shri K. Madhusudhana, Council member Shri K. Prabhakar Reddy, current Chairman Shri S.H.M. Mallikarjun, and Secretary Shri P. Venkateshwara Rao, along with life members and several distinguished guests.

Their active participation added dignity to the event and highlighted the strong sense of belonging among the mining fraternity. Members and invitees turned out in large numbers, creating an atmosphere of solidarity and respect for the nation.



The dignitaries addressed the gathering with inspiring messages, emphasizing the sacrifices of the freedom fighters and the responsibilities of every citizen in nation-building. They also highlighted the contributions of the mining sector to India's growth and the importance of sustainable practices for future generations. Cultural activities and patriotic songs by members and guests further enriched the

celebration. The event fostered a deep sense of pride, unity, and commitment to national service.

The program concluded with the distribution of sweets and a vote of thanks leaving everyone with renewed enthusiasm to carry forward the values of independence and collective progress.

BHUBANESWAR CHAPTER

“Technical Conference” conducted by MEAI, Bhubaneswar-Sukinda Chapter on 19th July’25

Theme: “Contribution of Mining & Allied Industry for “Viksit Odisha 2036”

The Bhubaneswar-Sukinda Chapter organized a “Technical Seminar on Contribution of Mining & Allied Industry for “Viksit Odisha 2036 “ on July 19, 2025, at the Welcome Hotel by ITC in Bhubaneswar, conducted in both physical and hybrid formats. The event was honoured by the presence of office bearers and senior members from various chapters across India. Additionally, numerous members of the mining fraternity participated either in person or online.



Honoring tradition with the Inaugural lamp lighting ceremony



In the picture L to R - Shri. Pankaj Satija, Shri. D B Sundara Ramam, Hemant Sharma, IAS, Dr. Pukhraj Nenival & Shri. S N Jha

The ceremony began with the dignitaries lighting auspicious lamps. The following government officials graced the occasion as Chief Guest and Guest of Honor.

- Shri. Hemant Sharma, IAS (Additional Chief Secretary, Industries Department, Govt of Odisha) as Chief Guest

- Dr. Pukhraj Nenival (Controller of Mines, East Zone, IBM) as Guest of Honor.

Welcome address by Chairman BBSR Chapter & EIC, FAMD TATA Steel- Mr. Pankaj Satija



Welcome address by President BBSR Chapter, MEAI & EIC, FAMD TATA Steel- Mr. Pankaj Satija

He delivered an opening address in which he warmly welcomed all guests and attendees, both in-person and virtual. He conveyed his sincere appreciation to the dignitaries for setting aside time for the event and expressed his gratitude to the speakers for contributing their technical expertise to the occasion.

Address by Controller of Mines, East Zone, Indian Bureau of Mines- Dr. Pukhraj Nenival

He underscored the critical importance of knowledge-sharing sessions, which serve as a vital mechanism for fostering both individual and industry-wide advancement. By prioritizing knowledge-sharing, organizations can cultivate a culture of continuous learning and innovation, essential for navigating the complexities of the mining landscape in contemporary times. He emphasised on upskilling and adopting modern techniques to overcome the current challenges in mining industry. He also appreciated efforts made by the lessee in recent years to work towards sustainable mining. He also elaborated on the importance of critical mineral and the initiatives taken by Govt. of India for “Viksit Odisha by 2036 and Viksit Bharat by 2047”.



Address by Controller of Mines, East Zone, Indian Bureau of Mines, Government of India- Dr. Pukhraj Nenival

Address by President, MEAI & Vice President Corporate Services TATA Steel- Mr. D B Sundara Ramam

He advocated for the welcoming of new ideas and perspectives, which are vital for the adoption of best practices within mining operations. The willingness to explore innovative solutions is imperative, especially as the industry grapples with various pressing challenges. These challenges encompass the need for sustainable mining practices, the increasing importance of corporate social responsibility (CSR), the implications of high bid premiums, and the pursuit of cost efficiency. Additionally, he highlighted the significance of maintaining liquidity in auctioned mines, evaluating health indices of mining areas, and reducing per capita CO2 consumption and emissions. He shed light on the impactful role of digitalization in facilitating best practices, alongside the necessity of overcoming the obstacles associated with changing workers' mindsets during the implementation of new strategies. He also elaborated on Tata Steel's existing footprint and future expansion plan in Odisha.



Address by President, MEAI & Vice President Corporate Services TATA Steel- Mr. D B Sundara Ramam

Address by Chief Guest, Additional Chief Secretary, Industries Department- Mr. Hemant Sharma, IAS

He commended the Mining Engineers' Association of India (MEAI) for providing such a big platform for mining professionals to come together and deliberate on development and future perspective in mining in India. Through regular technical sessions and seminars, the MEAI endeavours to keep its members informed about the latest industry trends, challenges, and potential solutions. This initiative not only strengthens the knowledge base within the industry but also empowers professionals with the skills and insights required to adapt effectively to a rapidly evolving environment. The focus on continuous professional development underscores the organization's commitment to addressing contemporary issues while ensuring that its members are well-prepared for the future. He highlighted the importance and contribution of mining and allied industries in the development of Odisha and emphasised upon the opportunities in this sector to achieve the goal of Viksit Odisha by 2036. He also outlined

the efforts being taken by Govt. of Odisha to harness the opportunities in mining and allied industries.



Address by Chief Guest, Additional Chief Secretary, Industries Department- Mr. Hemant Sharma, IAS

Vote of Thanks by Mr Shambhu Nath Jha, Secretary Bhubaneswar Chapter & Chief Mines FAMD, TATA Steel Ltd

The event culminated in a formal vote of thanks to all guests and attendees, both in-person and virtual, during which the speaker expressed gratitude to the dignitaries for dedicating their time and appreciation to the speakers for sharing their technical expertise.



Vote of Thanks by Shambhu Nath Jha, Secretary Bhubaneswar Chapter & Chief Mines FAMD, TATA Steel Ltd.

The technical seminar covered the following topics and presentations by distinguished speakers from Industry, Academia, Research Institutions and OEMs.

Presenter 1: Shri. Mr. Bidyut Chakraborty (M/S KPMG, India)

He presented how digitalization, technology, and innovation can improve operational efficiency and safety in mining.

It focuses on Odisha's mining sector and highlights key technologies like automation, Collision Avoidance Systems (CAS), AI, IoT, and real-time monitoring. Automation enables remote and autonomous control of equipment, reducing human exposure to hazardous conditions. CAS detects and warns of potential collisions, improving safety. AI enables predictive maintenance and optimizes resource allocation. IoT facilitates real-time data collection for equipment health

and environmental conditions. The paper acknowledges implementation challenges like high initial investment, workforce reskilling, and data security.

Presenter 2: Shri. Santosh Behera (IIT Dhanbad)

He presented the current shift from open cast to underground chromite mining in the Sukinda Valley, Odisha, which hosts one of the world's largest chromite deposits. The transition is driven by increasing environmental concerns, regulatory frameworks, land constraints, and depletion of shallow ore bodies. It highlights the technical, environmental, and socio-economic factors driving this change. The paper critically analyses potential underground mining technologies like cut-and-fill, sublevel stopping with backfilling, and blast hole stopping with backfilling, emphasizing their suitability for the complex geotechnical and hydrogeological conditions of the Sukinda ultramafic belt. Finally, it explores challenges associated with backfilling underground stopes in the region.

Presenter 3: Shri. Vijay Singh (Chartered Accountant)

He analyses the Supreme Court's judgement regarding the powers of the Central and State Governments to levy taxes on the mining industry. The court clarified the bifurcation of powers, allowing State Governments to levy cesses and taxes on mineral rights. MMDR Act cannot allow the Central Government to levy taxes/cesses on mines and minerals by exercising powers under Entry 54 of List I. Royalty is a consideration, not a tax. The judgement impacts royalty payments and allows for state levies, mandating changes in state legislation. The central government can bring constitutional amendments to manage the state's tax for mineral rights by bringing a GST council.

Presenter 4: Shri. Vikas Gupta (M/S EPIROC)

He underscores the pivotal role of the mining sector in the evolution of Viksit Odisha 2036. Epiroc is dedicated to achieving its 2030 goals, which include improving safety, health, workforce diversity, halving CO2 emissions, and providing emissions-free products. In India, Epiroc has been active for over 60 years, with a presence in more than 20 locations, and has contributed to major projects like Bengaluru Airport and the Atal Tunnel. The company focuses on strategic growth through acquisitions and emphasizes machine automation, the Rig Control System (RCS), and groundbreaking intelligence solutions that enhance operational connectivity and sustainability. Notably, Epiroc's AutoNav system aims to boost profit by 50%, improve safety by 80%, and enhance productivity by 30%. Its Collision Avoidance System (CAS) enhances safety protocols, while the Asset Performance Management (APM) system facilitates reduced maintenance costs and production losses. Envisioning a fully automated mine by 2030, Epiroc

looks forward to a connected workforce and efficient waste management systems.

Presenter 5: Shri. SRIKANTH YELUVAKA (M/S ORICA)

He shares the comprehensive overview of the screening and crushing methodologies integral to the processing of iron ore. It delves into various material types and their respective properties, as well as the underlying crushing theories that dictate operational efficiency. Additionally, the discussion encompasses the selection of appropriate equipment and the design of crushing systems, including primary, secondary, and tertiary stages. Featured prominently are specific solutions provided by Sandvik for rock processing, which enhance the overall effectiveness and efficiency of the crushing process. Through this presentation, attendees will gain insights into not only the technical aspects of crushing and screening but also the strategic considerations that inform equipment selection and system design.

Presenter 6: Shri. Mohit Kumar Roy (M/S SANDVIK MINING AND ROCK TECHNOLOGY INDIA PVT. LTD)

He elucidates the successful application of high-energy doped emulsion technology within an iron ore mining operation in India. He underscores the strategic utilization of multi-product delivery systems, which significantly enhance blasting efficiency while simultaneously reducing operational costs. Furthermore, the implementation of this technology contributes to improved safety measures by ensuring that energy factors are meticulously tailored to accommodate the diverse geological conditions encountered in the mining process. Through such innovations, the mine has achieved a more effective blasting operation, optimized productivity and minimizing risks associated with traditional blasting methods.

Presenter 7: Shri. P. Sharath Kumar, Asst Professor, Department of Mineral Processing (Vijaynagar Sri Krishnadevaraya University)

He addresses the significant challenges confronting the Indian mineral industry, highlighting critical issues such as regulatory obstacles and a lack of skilled labor. It advocates for a transformative approach that is sustainable and technology-driven, emphasizing the importance of resource efficiency and the integration of artificial intelligence (AI). Moreover, the paper underscores the necessity for collaboration among various stakeholders, including academia, industry, and government entities, to foster innovation and enhance growth prospects within the sector.

Presenter 8: Shri. RAGHUPATRUNI BHIMA RAO

He investigates methodologies for the extraction of rare earth minerals from the sand dunes situated along India's Chilika Lake. It emphasizes the application of various physical beneficiation techniques, including gravity separation,

magnetic separation, and high-tension separation, to effectively isolate valuable minerals such as monazite and zircon. The flowsheets developed through this research are commercially viable, offering a promising avenue for the recovery of rare earth minerals in this region.

Presenter 9: Shri. Santosh Ray (CSIR-Central Institute of Mining & Fuel Research)

He focused his discussion in critical integration of digitalization within coal mining operations, emphasizing the advanced software solutions developed by the Council of Scientific and Industrial Research - Central Institute of Mining and Fuel Research (CSIR-CIMFR) aimed at improving workplace safety and environmental standards. This discourse provides in-depth insights into several key software applications, namely CIMFR-PSYCHRO, FIRE INDICATOR, MINE-EXPLO, and GAS-EXPLO, each of which plays an instrumental role in the monitoring and management of essential safety parameters within mining environments. **CIMFR-PSYCHRO** is designed to analyze and optimize ventilation conditions, thereby ensuring comfort levels that are conducive to the well-being of mine workers. This is crucial in maintaining a healthy work environment that supports productivity. The **FIRE INDICATOR** software serves as a proactive tool for the identification and deterrence of potential fire hazards through real-time monitoring of various environmental parameters, thus playing a pivotal role in preventing disastrous incidents. In the context of explosive risks, **MINE-EXPLO** is specifically engineered to facilitate the recognition and evaluation of hazardous explosive conditions, offering essential data and insights that are integral to risk mitigation strategies. Furthermore, **GAS-EXPLO** highlights the importance of gas detection by continuously monitoring for harmful gases, thus ensuring that the health and safety of miners are prioritized in daily operations. Together, these innovative technological advancements not only enhance the overall efficiency of mining processes but also significantly strengthen safety protocols, culminating in a marked reduction in risks typically associated with coal mining activities. By harnessing these software solutions, stakeholders in the coal mining industry can promote the establishment of a safer and more efficient workspace, ultimately contributing to better outcomes for both workers and organizations.

Presenter 10: Shri. Rakesh MM, Manager SIOM (M/S KSMCL)

The emphasis on skill development and technological adaptation is critical for the advancement of India's mining sector. To remain competitive and effective, there is an urgent need for modernization within this industry, coupled with the enhancement of its workforce's skills. Current trends indicate that India's mining sector must undertake significant efforts to formalize skill training initiatives, aligning them with global

standards. This strategic focus not only targets productivity but also aims to promote sustainability and safety within mining operations. By investing in skill development programs and adopting modern technologies, the sector can better equip its workforce to meet the challenges of a rapidly evolving industry landscape, thereby ensuring long-term viability and success.

Presenter 11: Shri. K Venkata Ramana, Head of Mining Engineering (Department of Technical Education, Govt of AP)

This work critically examines the methodologies of Environmental Impact Assessment (EIA) employed globally to foster sustainable mining practices. EIA plays a vital role in assessing the environmental, social, and economic consequences associated with mining projects. The paper underscores the significance of EIAs in promoting sustainable practices within the mining sector while identifying key environmental parameters that mining engineers must take into account. By integrating these assessments into project planning, stakeholders can better understand and mitigate the adverse impacts of mining activities, ultimately contributing to a more sustainable approach in the industry.

Presenter 12: Shri. Krishnendu Dasgupta (M/S Mapscope)

He presented on the significant role of Geo-ICT and Geo AI in fostering sustainable mining practices. The presentation emphasized the critical need for integrating economic growth with environmental stewardship in the mining industry while showcasing Geo-ICT and Geo AI as essential tools that enhance both sustainability and profitability. MapScope offers innovative software solutions driven by technologies such as GeoAI, machine learning, big data analytics, and the Internet of Things (IoT), with its MineScope Suite serving as a pivotal sustainability solution that enables data-driven decision-making. MineScope's capabilities encompass advanced GIS technologies for effective spatial data management, GeoAI applications for insightful data analysis, utility resource management to reduce waste, and strategies for mitigating environmental impacts. The suite also includes compliance monitoring tools, seamless integration of diverse data sources, and an authentic data repository for reliable information oversight. Additional features involve comprehensive land management insights, compliance and production tracking, efficient utility asset management, and decarbonization initiatives for emissions reduction, including carbon sink tracking. Furthermore, MineScope supports ESG initiatives, providing a multi-functional dashboard for enhanced operational management while ensuring scalability and interoperability to adapt to evolving needs. Ultimately, the MineScope platform is presented as a holistic solution designed to optimize resource management and enhance mining operations while prioritizing sustainability.



Felicitation of 12 members in recognition of their technical paper presentations at the Conference



A glimpse of the attendees during the conference



View of MEAI – Dignitaries at the Conference

NAGPUR CHAPTER

National Seminar on “Indian Mining-Present Scenario and Future Perspective”

The Mining Engineers Association of India, a premier

professional body in the country, has organized a National Seminar on “Indian Mining-Present Scenario and Future Perspective” on 25th and 26th July, 2025 at Radisson Blu Hotel, Nagpur. Around 300 delegates, Industry pioneers,

professionals from Private Sector, Government Sectors, Institutional Agencies, Universities, Research Scholars and the policy makers in the government working in the mining and mineral sector from across the country had attended and actively participated in the Seminar. The participants from Government organizations, Research Institutions, Regulatory bodies, Academic Institutions, State Government organizations and from leading industries viz M/S Lloyds Metals & Energy Limited, M/s UltraTech Cement Limited, M/s FLSmidth Private Limited, M/s Sandur Manganese & Iron Ores Limited, M/s MOIL Limited, M/s MSPL Limited, M/s Pacific Exports Limited, M/s Rungta Sons Private Limited, M/s Sri Kumarswamy Mineral Exports Pvt. Ltd, M/s Hindustan Copper Limited, M/s Anand Mining Corporation, M/s Hindalco Industries Limited, M/s Heidelberg Cement India Limited, M/s J.K. Cement Limited, Panna, M/s ERM Group of Companies, M/S M. P. Birla Group (RCCPL Private Limited, Maihar and Mukutban Units), M/s Dalmia Cement (Bharat) Limited, M/s Nuvoco Vistas Corporation Limited, M/s Fomento Resources Private Limited, M/s National Mineral Development Corporation Limited, M/s Jayaswal Neco Industries Limited, M/s Nirmala Minerals, M/s Katni Bauxite Private Limited, Ms Krishnaping Alloys Limited and M/s Prism Johnson Limited had actively participated in the Seminar. Apart from these, a large number of students also participated in the Seminar.

The Government of India through the Ministry of Mines has introduced various transformative policy measures since 2015, aimed to unleash the potential of the mineral sector and to increase mineral production and employment generation in the mining sector. The Mines and Minerals (Development and Regulation) Act, 1957 [MMDR Act, 1957] was amended through MMDR Amendment Act, 2015 with effect from 12.01.2015. The most important feature of the said amendment was the provision for grant of mineral concessions through auction to bring in greater transparency and remove discretion at all levels in grant of mineral concessions. The provision for establishing District Mineral Foundation for benefit of persons and areas affected by mining related operations, provision for National Mineral Exploration Trust for providing impetus to exploration, mining of critical minerals and ensuring self-sufficiency in supply of critical minerals etc. are the important features of the reforms. Such reforms are considered by the Central Government with an objective of Net Zero' commitment of India by 2070 and inter-alia increasing mineral production and time bound operationalization of mines, increasing employment and investment in the mining sector, maintaining continuity in mining operations after change of lessee and increasing the pace of exploration and auction of mineral resources. Recently the Government of India has initiated several measures to ensure supply of critical minerals so as to shift towards sources of Green Energy. Against this

backdrop, the objective of organizing this two-day's National Seminar was set to deliberate, discuss and debate on the future of the Indian Mining Sector post amendments of the acts and rules and the recent policy and legislative reforms in the mineral sector for the vision 2047.

Shri Peeyush Narayan Sharma, Controller General, Indian Bureau of Mines (IBM) and Chairman, Nagpur Chapter was present as the Chief Guest of the inaugural function of the National Seminar on "Indian Mining-Present Scenario and Future Perspective" at Radisson Blu Hotel on 25th July 2025. Shri Pankaj Kulshrestha, Chief Controller of Mines (MES), IBM and MEAI Vice-President Shri Dhananjay Reddy were present as the Guests of Honour for the programme. MEAI, Nagpur Chapter Honorary Secretary Dr. Yogesh G. Kale was also prominently present and shared the dais. A special Souvenir of National Seminar-2025 was also released to mark the occasion.

While speaking as the Chief Guest at the inaugural session of the two-day National Seminar, Shri Peeyush Narayan Sharma thanked the mining fraternity for giving him the opportunity to spearhead the important seminar that not only discusses the present scenario in the sector but also tries to find where the future of India's mining lies. He encouraged the mining industry to focus on processing of minerals along with mining. He specifically mentioned that "In order to meet the challenges of the future and succeed, the industry must come together and prepare with a 360 degree view." He said that the collective force of various individual efforts often produce desired results. He further emphasized that the mining sector must identify its constraints and challenges and work collectively to find solutions for growth. He highlighted that while forest clearance remains a major hurdle, it should not halt mining operations. He expressed optimism about the sector's future, emphasizing that there is vast potential for expansion. Referring to the development in Gadchiroli District of Maharashtra State, he also praised M/s Lloyds Metals and Energy Limited (LMEL) for their work in Surjagarh, noting that Vidarbha is poised to become a global steel hub.

Shri Pankaj Kulshrestha in his address as a Guest of Honour highlighted reforms undertaken by the Government of India in the mining sector, especially those relating to Critical Minerals with the remarks that "All these initiatives have resulted in streamlining operations, increasing transparency and reducing compliance burden. He however noted that shortfall in operationalization of mineral blocks and adoption of high-tech equipment etc. poses significant challenges in the mining sector. He further mentioned that along with processing, exploration is a must activity for the mining industry. "Whatever resources we have, will not be available after 25 years." He also pointed out that while India

is self-reliant in Coal and Iron, it still depends on imports for manganese and other Critical Minerals. He stressed the need for exploration and the adoption of modern technology to become self-sufficient and sustainable in mineral resources.

Shri Dhananjaya G. Reddy, Vice President - I of Mining Engineers Association of India also addressed the gathering, while Dr. Yogesh G. Kale has given introductory remarks in the inaugural session. He felicitated Shri Peeyush Narayan Sharma and Shri Pankaj Kulshrestha with mementos. Shri Arun Chachane, Joint Secretary, Nagpur Chapter worked hard to organize the programme smoothly. Ms. Shrushti Singh conducted the proceedings and Shri Manish K. Mendiratta delivered the vote of thanks.

The seminar was mainly focused on modern mining practices, technological advances and sustainable mining goals to promote growth in the sector and was also helped in gaining the insights on the key thrust areas of domestic mining industry, provide a roadmap to present and future outlook relating to mining sector, helped discussing new developments and advancements in the mining sector and act as a platform to interact with mining engineers, geologist, economist, technocrats and industry-leaders.

The two-day's National Seminar was included with five technical sessions on Mining-Present & Future, legislative Aspects of Mineral Industry, Underground Mining, New Age Technology for Mineral Industry, Sustainable Mining Techniques and Critical Minerals. Students, currently pursuing courses in Mining Engineering & Geology from across the country were also invited to participate in the Seminar to tap young talent for providing innovative ideas and solutions and given a chance to present their work. Several eminent speakers had given their presentations in each session. About 25 technical papers on various seminar themes were deliberated by eminent authors from all over the country. Few corporate presentations were also organized to interact with the gathering and to promote the technological available avenues.



On the Dais (L-R): Dr. Y. G. Kale, Convener, Shri Pankaj Kulshrestha, Chief Controller of Mines (MES), IBM, Shri Peeyush Narayan Sharma, Controller General, IBM, Shri Dhananjaya Reddy, Vice President, MEAI.

The two-day's National Seminar ended with the Valedictory Session on Saturday the 26th July, 2025 with experts emphasizing on responsible mining and understanding the changing landscape of the sector. Chairman-Cum-Managing Director (CMD) of M/s MOIL Ltd, Shri Ajit Kumar Saxena, who was the Chief Guest on the occasion, spoke on the timely analysis of mining leftovers for identifying the possibility of finding Critical Minerals from mine waste, tailings, or slags. The Chairman-Cum-managing Director (CMD) of Mineral Exploration and Consultancy Limited (MECL) Shri Indra Dev Narayan was the Guest of Honour. He said PSUs like MECL play a crucial role in shaping the future of the country's mining sector. While speaking, he emphasized that MECL is instrumental in discovering reserves of nearly all major minerals across the country. He further highlighted that in recent years, MECL has expanded its role beyond traditional drilling to advanced exploration technologies, data analytics, and remote sensing. MECL is now working as a knowledge partner to both Government and the Private Sector in this decade of Critical Mineral demand and energy transition. The Controller General, Indian Bureau of Mines (IBM) and Chief Patron of the Seminar, Shri Peeyush Narayan Sharma, in his concluding address stressed on the need for responsible mining along with the adoption of new technology. He also said nothing can be written off as waste in the mining sector.

The valedictory function ended with a vote of thanks proposed by Shri Ashish Mishra, Organizing Secretary, National Seminar-2025.



Release of National Seminar-2025 Proceedings (L-R): Dr. Y. G. Kale, Convener, Shri Pankaj Kulshrestha, CCOM(MES), Shri Peeyush Narayan Sharma, Controller General, IBM, Shri Dhananjaya G. Reddy, Vice President - I, MEAI.



Address by Shri Peeyush Narayan Sharma



Address by Shri Pankaj Kulshrestha



Speakers in the Technical sessions



Views of Audience participating in the technical sessions



Valedictory Session: - (L-R): Shri Indra Dev Narayan, CMD, MECL, Shri Peeyush Narayan Sharma, CG, IBM, Shri Ajit Kumar Saxena, CMD, MOIL.



Summing up of the programme by Shri Manish K. Maindiratta, Controller of Mines (TMP), IBM



Vote of Thanks by Shri Ashish Mishra, Organizing Secretary, National Seminar-2025

RAJASTHAN CHAPTER-JODHPUR

National Conference on “Applications, Promises and Challenges of Artificial Intelligence in Mining Industry”

A two-day National Conference focusing on the role, potential, and challenges of Artificial Intelligence (AI) in the mining industry concluded in grand style at Radisson Hotel, Jodhpur, on 30 July 2025. The conference, themed “Applications, Promises and Challenges of Artificial Intelligence in Mining Industry”, was jointly organized by the Rajasthan Chapter-Jodhpur and the MBM Engineering College & University Alumni Association.

Pre-Conference Press Meet & Dinner - 28 July 2025

A pre-conference press meet and dinner was hosted on 28 July 2025 at Hotel Shree Ram International, accompanied by a musical programme. The press briefing was addressed by distinguished dignitaries — Er. Deepak Tanwar (Director, Department of Mines & Geology, Rajasthan), Er. Peeyush Narayan Sharma (Controller General, Indian Bureau of Mines, Government of India), and Dr. Arvind Kumar Mishra (Director, Central Institute of Mining and Fuel Research, Dhanbad) — along with Prof. Sushil Bhandari (President, MBM Alumni Association) and Shri A.K. Jaiswal (Chairman, Jodhpur Chapter). DMG, Rajasthan briefed the symposium is being organized at a time when global competition, resource limitations, and the imperative of sustainable development are compelling the mining sector to transition towards Mining 4.0. Mining, which has already journeyed from manual operations to automation, is now entering a

new era — the era of Artificial Intelligence — where data-driven decision-making, precise geo-assessment, safety, resource efficiency, and waste minimization have become the keys to success.

The meet was attended by around 30 members of the print and electronic media and aimed at drawing the mining fraternity's attention to the latest developments in the use of Artificial Intelligence in the mining sector. Speakers highlighted AI's potential to ensure sustainable growth, align Indian mining practices with global standards, and accelerate the Indian economy's growth rate.

All members of the organizing committee, along with delegates from across the country, joined the dinner in a warm and congenial atmosphere, setting the tone for the conference.

Inaugural Session



The conference was inaugurated on 29 July at 10:00 AM with the ceremonial lamp lighting before Goddess Sarasvati by the dignitaries.

followed by a welcome address from Prof. Sushil Bhandari, a senior personality in mining education and research. Referring to his talk *"Artificial Intelligence Adoption: Way for Transforming the Indian Mining Industry"*, Prof. Bhandari outlined the various aspects to be covered during the two-day event including AI applications in mine monitoring, data analytics, safety, and drone technology through technical sessions, research paper presentations, and expert discussions. As a token of honour, all dignitaries on the dais were felicitated with the traditional Jodhpuri turban, a shawl, a miniature potted plant, and a memento.



The Guest of Honour, Mr. Deepak Tanwar, Director of Mines, Government of Rajasthan, emphasized that AI is no longer a

futuristic concept but a current necessity. He highlighted that in a mining-intensive state like Rajasthan, where vast areas make traditional monitoring challenging, AI can play a pivotal role in improving oversight, regulation, and efficiency.



Referring to his paper *"Harnessing Artificial Intelligence for Mine Surveillance – Applications, Promises, and Challenges"*, he explained how computer vision, machine learning, and drone-based monitoring systems can collect real-time data, making decision-making faster, more accurate, and more transparent.

The Presiding Guest Er. Piyush Narayan Sharma, Controller General, Indian Bureau of Mines (IBM), who not only shared his views on *"AI & IoT in Mining Sector"* but also chaired the conference.



He discussed how real-time data from IoT devices could be analysed using AI to improve decision-making in mineral exploration, mine planning, production, and logistics management, enriching the technical perspective of the event.

The Chief Guest for the inaugural session, Prof. Arvind Kumar Mishra, Director of the Central Institute of Mining and Fuel Research (CIMFR), Dhanbad, spoke on *"Application of Large Data-Based AI/ML Tools for Solving Practical Problems of the Mining Industries"*.



He stated that scientific processing of large datasets generated in mining could bring revolutionary improvements in mine design, fly ash backfilling, stability analysis, and mineral quality control. He stressed that technological innovation is essential for India's global competitiveness.



The Chapter Chairman Mr. A.K. Jaiswal expressed gratitude to all involved, stating that such events play a vital role not just in technical exchange but also in shaping national policies and industry direction. He conveyed that around 250 delegates were registered for the conference by way of sponsors, delegates/ speakers/ paid MEAI or non-MEAI delegates/ students and scholars and around 40 papers shall be delivered in physical and hybrid mode. The conference was put into live mode through a YouTube channel using MEAI HQ access.

A Souvenir cum Proceedings of this conference was unfolded by the honorable dignitaries, its soft copy is available on the google drive of the MEAI HQ website and the conference website. The organizers honored all the key sponsors of the event by safa with dupatta & presented mementos by Chef Guest. The support from State DMG under leadership of Sh Deepak Tanwar, Director was well appreciated to make the event a grand success. Organizers also honored the mining fraternity who attained 75 years' age.



The Er YS Sahiwal Addl Director, DMG-Jodhpur and his zonal engineers have taken pain in organizing the event in a smooth manner and supported the organizers at every stage.

Plenary Session — 29 July 2025

The Session featured presentations from the experts, highlighting how AI can enhance efficiency, transparency, and safety in mining. Each one has presented a case study on the respective theme. However, it also revealed challenges such as lack of quality data, inadequate technical skills, and policy ambiguities in India. Despite all these hurdles, the consensus among speakers was that the future of mining will rely on data-driven, automated, and AI-enabled systems, with active participation from youth, researchers, and academic institutions indicating serious national progress in this direction.

The inaugural session was graced by Prof. K. R. Chowdhary, Former Professor and Head, Department of Computer Science & Engineering, MBM University, who chaired the proceedings. The conference commenced on an innovative note with thought-provoking keynote papers presented by Er. Deepak Tanwar, and Prof. Arvind Kumar Mishra, setting the tone for the technical deliberations ahead.



On this occasion, Prof. Chowdhary's latest book on Artificial Intelligence was ceremoniously unveiled by Dr. Arvind Kumar Mishra (Director, CIMFR) and Prof. Sushil Bhandari, marking a special highlight of the day.

Post-lunch on the opening day, the conference moved into its first two technical sessions, showcasing a blend of strategic vision and practical AI applications in mining.

Technical Sessions— 29 July 2025

Technical Session-I began with a presentation on Hybrid mode from Delhi by Akhilesh Tuteja, Global Head (Cyber Security & TMT), KPMG, who delivered the keynote on "Will the Next Mining Engineer Be an Algorithm?".



Prof. Sushil Bhandari, *Former Dean, MBM Engineering College, JNUV University* presented his Keynote paper on *Artificial Intelligence Adoption: Way for Transforming the Indian Mining Industry* and opined that how AI offers a paradigm shift in mining engineering, promising a future of safer, smarter, and more sustainable mining and firmly believed that with the right approach, AI can truly revolutionize the mining sector for generations to come. The session explored how AI can be seamlessly integrated into mining operations, with Vipul Kochar, an AI expert, presenting on AI interfaces for operational optimization in very simple and logical manner among mining people gathering,



Prof. K.R. Chowdhary discussed AI methods and tools for use in mining, Abhinav Sengupta outlining strategic imperatives for adoption, and Dr. Shrinivas Padmanabhuni addressing test requirements for advanced AI systems.



In Technical Session II, six technical papers from exploration experts and mining leaders presented their viewpoints on real field work with case studies. Among the presenters, the speakers presented Application of Artificial Intelligence: Transforming the Future of the Mining Industry (Bhanu Bhatnagar, Head Mining & Geology, Ambuja Cements Ltd., from Ahmedabad) AI applications in mineral exploration and remote sensing (C.P. Dadhich from DMG-Barmer, Sudheer

Bhatnagar from Udaipur), AI-driven enforcement for illegal transport prevention (Siddhartha Dwivedi & Surabhi Gupta from Lucknow), transformative use cases in operational efficiency (Mitesh M. Umariya, GMDC), and subsidence monitoring using InSAR and GNSS (Md. Shahid Anwar, BCCL).



These sessions collectively set the tone for AI's role in improving exploration accuracy, compliance, and operational productivity.

Day 2 - 30 July 2025

The second day featured three main sessions covering a wide spectrum of AI applications from slope stability to blasting optimization to future potash mining.

Technical Session III Highlights included AI/ML tools for slope stability (R.S. & P.S. Rathore), bridging operational gaps through AI (Rajneesh Purohit), AI/ML in limestone exploration (Nivedita Prajapati & Ajeet Ostwal), and drone-based mining applications (Dr. Hitanshu Kaushal & Prof. Anupam Bhatnagar) and AI-drone integration for safe mining (Ms. Jaya Maheshwari),

Technical Session IV, brought attention to emerging technologies like digital twins (Kansingh Choudhary), AI in solution mining for potash (Dr. J.K. Mohnot), Case studies included AI in metal mining (Dr. Pramod Rajmeny & Maheem Kachhawaha), AI-enabled remote sensing for sandstone mining (S.L. Borana & Dr. S.K. Yadav), and AI-based resource optimisation (Gangaram Sawant & Ajeet Ostwal), AI in blasting (Lalit Kumar Suthar & Dr. Kamal Kant Sharma).



The final Technical Session V featured five hybrid presentations from national and international experts, covering AI in blasting analysis, mining safety analytics,



global mineral exploration innovations, mine production optimization, intelligent automation, AI in mineral movement monitoring, dust management, and automated pumping systems. John Hellewell (AVA IoT, UK) and Sanjay Purohit (MineExcellence, Australia), focusing on advanced fleet intelligence and operational transformation, Lalit Mohan Soni of Infosys advocating Transforming India's Mineral Economy through Technological Advancements Driving Sustainable Mining, Ramesh Murlidhar Bhatawdekar from Malaysia presented Building Information Model for Blastability based on Review of Intelligent Predictions of Environmental Issues in Blasting analysis, Ms Saloni Jagetia (RPCB) from chittorgarh on Harnessing AI for Dust Management in Indian Mining:



A Case Study-Inspired Vision for Sustainable Growth in transforming traditional mining operations into smart, efficient, and safer environment and physical presentation to showcase AI-driven royalty enforcement system (Manish Verma from DMG-R), drone and AI surveillance for illegal mining (Manan Jain et al.),



Overall, the ten hours of technical deliberations across five sessions witnessing total 700 delegates from different sectors and viewers on Air through You tube revealed AI's growing footprint in mining — from exploration and operational efficiency to environmental monitoring and regulatory compliance. The diversity of topics reflected both the breadth of AI's applications and the collaborative spirit between academia, industry, and technology developers. The sessions reinforced the consensus that AI is no longer

an optional innovation but a core driver for a sustainable and competitive mining industry in India. The Mining engineering students and AI interns of the MBM University were present at each stage in back support and anchoring/ regulating the sessions in the conference. Two of the college students also gave an impactful presentation in the conference.

Recommended AI applications discussed included:

- Real-time, system-generated decision-making for process control.
- Operation of AI-enabled excavation equipment in large open-pit mines.
- Haulage management to reduce costs and optimise truck usage.
- Digitalization of mining operations for better control and safety.
- Mine classification based on AI application levels in geomodelling, resource estimation and planning, machinery design, safety and monitoring, supply chain management, environmental sustainability, and quality control, land use/ reclamation and mine closure process.
- Real-time online feedback systems to connect mine workers at all levels for effective communication.

Other notable AI uses recommended:

- Post-mining mineral transport management and royalty/ tax collection.
- AI-based slope monitoring and stability analysis.
- AI-powered drone technology for illegal mining detection and mine surveillance.
- Government policies and guidelines to promote AI-based mining systems.

Valedictory Session



The **Valedictory Session** on 30 July began with a welcome by Prof. (Dr.) R.P. Choudhary, Head-Department of Mining Engineering, MBM University, and MEAI Chapter Secretary, who summarized the two-day proceedings and thanked participants, researchers, and organizers.

Er. Rajneesh Purohit, Conference Convener and former Chief Controller, IBM, presented the conference report, appreciating the contents of the paper's presenters, discussions, and projects, and noting the event's success in giving a new direction to AI use in the Indian mining industry.



The Chief Guest for the closing session, Mr. Deepak Tanwar, in his signature Jodhpur style, remarked: *"Our Rajasthan should lead in data-driven work; the key is to learn the right way to use this new technology."* He added that the ideas, research, and experiences shared here would shape future policy changes, monitoring systems, and transparency in mining. Special Guest Prof. Akhil Ranjan Garg, Vice-Chancellor, Bikaner Technical University, stressed the importance of such conferences to strengthen research innovation, and industry collaboration in mining.



The distinguished Guest of Honour Dr. Pukhraj Nenival, COM(EZ) of IBM Kolkata and Vice-President-III of MEAI shared insights on safety, data management, and adaptive technical infrastructure in mining.



Finally, Conference Convener and newly elected MBM Alumni Association President, Er. Vipul Kochar, thanked guests, speakers, organizers, and volunteers, noting that the event was not just a technical forum but also a starting point for fresh thinking and perspectives.



The conference concluded with the national anthem, symbolizing the commitment to contribute to nation-building through technology.

Thus, this two-day national conference—an excellent blend of ideas, innovation, and technical perspectives—concluded with dignity and enthusiasm, with organizers pledging to continue such enlightening and inspiring events in the future.

RAJASTHAN CHAPTER-UDAIPUR

A Report on Special Seminar for students

A special seminar was organized on 6th August, 2025 at Pacific Polytechnic College, Udaipur (under the aegis of Pacific University) for the students of the Mining branch, aimed at inspiring and guiding future mining professionals.

The event was graced by Shri Asif Mohammed Ansari, Secretary and Dr. Hitanshu Kaushal, Joint Secretary of Rajasthan Chapter – Udaipur, and Mentors of the Student Chapter. They were accorded a warm welcome by Dr. Mukesh Shrimali, Director of the College.



In his motivational address, Shri Asif Mohammed Ansari encouraged diploma mining engineering students to embrace the challenges and opportunities of the mining sector. He highlighted that Rajasthan alone has over 16,000 active mines, each requiring qualified and skilled mining engineers. He emphasized that this industry is not only vital to the state's economy but also offers immense career prospects, both in India and abroad.

Dr. Hitanshu Kaushal focused on the technological transformations in the mining industry, underlining the importance of tenement mapping, GIS (Geographic Information Systems), RMS (Resource Management Systems), and other modern tools in mineral exploration and management. He urged students to continuously upgrade their skills to remain competitive in the global mining sector.

The program proceedings were conducted by Mr. Hemant Vaishnav and vote of thanks delivered by Mr. Sunil Sharma, by expressing gratitude to the guests for their insightful and inspiring talks.

Annual Plantation Programme



In order to embrace key environmental stewardship and enhance larger green spaces, combat deforestation, substantially reduce carbon emission/footprints and mitigate climate change related issues, prevalent pollution and improve overall ecological balance through widespread plantation in our mining areas and also extend sustained support in greening earth through various plantation programs of Government like "Hariyalo Rajasthan" annual Plantation Programme was organized by the Rajasthan Chapter- Udaipur, in association with M/S Khetan Business Corporation Pvt. Ltd. (KBC) Nathdwara and Department of Mines & Geology (DMG), Govt. of Rajasthan, Rajsamand on 13.08.2025 at the M/s Dhanlaxmi Soapstone and Dolomite Mines, Rabacha of M/S Khetan Business Corporation Pvt. Ltd, Nathdwara.



The program was witnessed by the esteemed presence of social, public & bureaucratic presence like Hon'ble MLA Nathdwara Shri Vishwaraj Singh Mewar, Sub-Divisional Magistrate, Nathdwara, Smt. Raksha Pareek, Superintendent Mining Engineer Shri Anil Khamesara, Superintendent Mining Engineer Udaipur, Shri Kamleshwar Baregama, Mining Engineer Shri Jinesh Humad (Rajsamand I) and Shri Lalit Bachhra (Rajsamand II), and several dignitaries and members of the Udaipur Chapter, Officers of Mining Department (DMG) and public representatives and local community. Apart from above various Institutional Members of MEAI Shri R P Gupta, Director of M/S Sudarshan Group of Industries, Shri M L Lunawat, Director of M/S Aravalli Minerals & Chemical Ind. (P) Ltd. & Shri Rajendra R Harlalka, Shri Shaleen Harlalka and Shri Rohit Harlalka Director of M/S Khetan Business Corporation Pvt. Ltd (KBC).

Representatives from MEAI Patron and Former President, Shri Arun Kumar Kothari, Shri Asif M Ansari, Secretary MEAI, Udaipur, Dr SS Rathore, Dr SK Vashisth, Shri RK Nalwaya ex ADM (DMG-R), Shri MK Mehta, Shri SM Ahmed, Shri NK Kavadia, Shri Ashok Paliwal, Shri KL Sharma, Shri CB Purbia and also presence various mining & Geology colleges student marked their strong & visibly vibrant participation by planting trees.



A notable highlight of the event was the appreciation by visitors & dignitaries of the 1800 fruit-bearing plants that were planted by the company in 2023-2024. MEAI members and other guests observed the healthy growth and profuse fruiting of these plants, commending the sustained efforts of the company, dedicated to environmental commitment, as a sectoral leader.

Further, it was brought to the knowledge of MEAI by Shri Rajendra Harlalka of M/s KBC that in alignment with the flagship program Hariyalon Rajasthan Abhiyan and under the guidance of the Rajasthan State Pollution Control Board (RSPCB), Rajsamand, the company took another notable green initiative by funding ~31,000 saplings from the state governments Forest Department's nursery in Piparda in Rajsamand. These saplings were preserved and subsequently distributed among the general public by RSPCB as part of the campaign to promote environmental awareness and promote greenery across the region. MEAI team members appreciated the efforts made by KBC company for the noble cause of pollution control & greening in mining areas.



On this occasion Udaipur Chapter felicitated to Hon'ble MLA Nathdwara, Shri Vishwaraj Singh Ji Mewar, with traditional mewadi pagdi and angwastra (uparna) by Shri AK Kothari, Former President-MEAI and other senior MEAI members.



Shri Asif M Ansari, Secretary of the Chapter expressed heartfelt thanks to M/S Khetan Business Corporation Pvt. Ltd. (KBC) for such a beautifully arranged plantation campaign for environmental contributions, pollution reduction, erosion control to stabilize soil for preventing erosion especially in overburden slopes, larger community participation towards environmental protection etc. He requested for regular watering and maintenance and good surveillance of planted trees. He also expresses his thanks for nice arrangements and hospitality.

CONFERENCES, SEMINARS, WORKSHOPS ETC.

INDIA

10-11 Oct 2025: International Conference on Next Generation Mining (NextGen Mining 2025). Organised by MEAI Bellary-Hospet Chapter. Venue: Hotel Malligi, J.N. Road, Hosapete 583201, Karnataka, India. Contact Email: meaibhconference@gmail.com.

9 Nov 2025: International Seminar on Critical & Strategic Minerals for VIKSIT Bharat @2027. Organised by Hindustan Copper Limited at Hotel Taj Taal Kutir, Kolkata. Eco Contact Email: Park, Eco park Road, DEshbandhu Nagar, New Town, Kolkata 700156. Contact: Mr Umesh Singh, ED (Mining), +91 94701 97256, umesh_s@hindustancopper.com

ABROAD

2-4 Sep 2025: Critical Minerals Conference 2025 (#CMC2025). Perth Convention & Exhibition Centre. Contact by phone at T: 1800 657 985 or +61 3 9658 6100 (if overseas). Po Box 660 Carlton, VIC 3053, Ground Floor, 204 Lygon St, Carlton VIC 3053.

29 Sep - 3 Oct 2025: 5-Day intensive course for mining professionals. Organised by DMT in collaboration with micromine. Venue: Sandton, Johannesburg, South Africa. Contact: +27117814548, johannesburg@dm-group.com. Register online: <https://forms.gle/aZNBXNreGGTwAaM89>.

25-26 Oct 2025: International Conference on Hydrometallurgy and Mining ICHM. Istanbul, Turkey. Website URL: <https://waset.org/hydrometallurgy-and-mining-conference-in-october-2025-in-istanbul>.

28-31 Oct 2025: China Coal & Mining Expo 2025. Organised by China International Exhibition Center (Shunyi Hall), 88 Yuxiang Road, Tianzhu Airport Industrial Zone, Shun Yi District, Beijing, China. Contact 852 28815889 or katherinelee@together-expo.com.

11-13 Nov 2025: Environmental Integration on Sustainable Perspective and Beyond. Manila, Philippines. Website URL: <https://www.ierek.com/events/environmental-integration-on-sustainable-perspective-and-beyond-eispb#introduction>.

25-26 Jan 2026: International Conference on Geological and Earth Sciences ICGES (ICGES 2026). Paris, France. Website URL: <https://waset.org/geological-and-earth-sciences-conference-in-january-2026-in-paris>. Organization: World Academy of Science, Engineering and Technology.

9-12 February 2026: Mining Indaba 2026 in CTICC, Capetown, South Africa. Contact Birgit Hupe, Head of Delegate Registration at registration@miningindaba.com

25-26 Feb 2026: International Conference on Earth Science (ICES 2026). Buenos Aires, Argentina. Website URL: <https://waset.org/earth-science-conference-in-february-2026-in-buenos-aires>.

3 - 7 Mar 2026: CONEXPO-CON/AGG 2026. Las Vegas Convention Center, 3150 Paradise Rd, Las Vegas, NV, 89109, United States. North America's largest construction trade show happens once every three years.

25-26 Mar 2026: International Conference on Geosciences, Mineralogy and Petrology (ICGMP 2026). Madrid, Spain. Website URL: <https://waset.org/geosciences-mineralogy-and-petrology-conference-in-march-2026-in-madrid>. Contact international@conexpoconagg.com.

11-12 April 2026: International Conference on Mining, Material, and Metallurgical Engineering (ICMME - 2026) in Barcelona, Spain. Mail: info@academicsworld.org. Web: www.academicsworld.org.

21-22 April 2026: International Mining Geology Conference 2026. Brisbane Convention and Exhibition Centre, Brisbane, Australia. Contact AusIMM at T: 1800 657 985 or +61 3 9658 6100 (if overseas); <https://www.ausimm.com/conferences-and-events/mining-geology/>.

24-25 May 2026: International Conference on Mining and Economic Geology (ICMEG 2026). in London, United Kingdom. Website URL: <https://waset.org/mining-and-economic-geology-conference-in-may-2026-in-london>.

24-26 June 2026: The 27th World Mining Congress and exhibition in Peru. Contact details: Phone: +48 32 324 66 03; e-mail: wmc@gig.katowice.pl.

29-30 June 2026: International Conference on Geological and Earth Sciences ICGES in Istanbul, Turkey. Website URL: <https://waset.org/geological-and-earth-sciences-conference-in-june-2026-in-istanbul>.

20 - 21 July 2026: Accelerating Commercial Exploration, Discovery and Extraction in Cairo, Egypt. Conference Enquiry: conference@egyptminingforum.com.

CRIRSCO AGM - 2025 IN PERTH, AUSTRALIA

The CRIRSCO AGM will be held between 1st and 5th of September 2025 in Perth in the Perth Convention Centre.

The Meeting Agenda is as follows:

1st Sept: EXCOM Executive Meeting

2nd Sept: Full day closed session for NRA report discussions

3rd Sept: Full day closed session for NRO reports, with potential member interactions

4th Sept: Public feedback session featuring discussions with ICMM, UNECE, and other collaborations

- Afternoon: Possible technical visits
- Evening: Session on ASX & ASIC interaction regarding the 2025 dual code

5th Sept: Full day open technical discussion.

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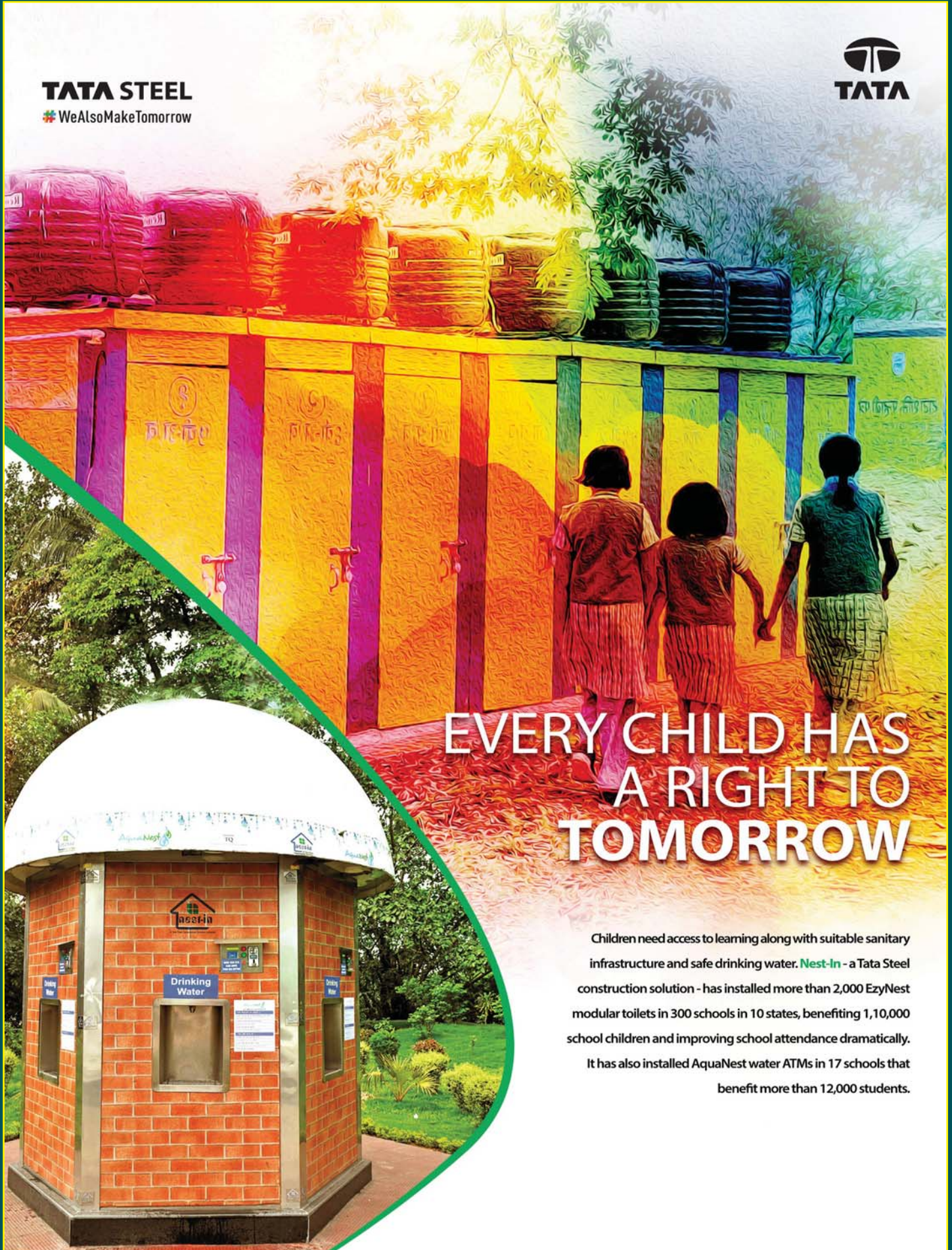


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