Quarterly April 2025 | Volume - I

THE IMMA REVIEW

(Official Organ of the Indian Mine Managers' Association)
IMMA BHAWAN, SARAIDHELA, DHANBAD - 828127
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इंडियन माइन मैनेजर्स एसोसिएशन (इम्मा)
बिलासपुर चैप्टर
अभिनव कार्यशाला
हम-21 दिन


National Centenary Seminar
on
Mining Industry:

INDIAN MINE MANAGERS ASSOCIATION

IMMA BHAWAN

Saraidhela -828127, DIST- Dhanbad (JHARKHAND)

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President's desk

Dear honorable members of IMMA fraternity,

I am glad to inform that Indian Mine Managers Association (IMMA) is going to publish IMMA Review quarterly after a long gap. We tried to endeavor the publication of IMMA Review earlier also but could not make it because of busy schedule of the members whom the task of publication of the review was given. However now Sri Kishor Yadav, Chief Manager, BCCL has agreed to take the responsibility for publication of the same and we hope that the copy of IMMA Review will be soon in your hands.

During last 11 years we have held National Seminar regularly every year except the short stint after the Corona in 2020 we could not hold the Seminar in 2021 & 2022. During the centenary year of 2023 we held the National Centenary Seminar on Mining Industry: Challenges & Opportunities MICO-2023 on 20th & 21st January, 2023 in collaboration with BCCL Dhanbad and International Seminar on UNDERGROUND MINING : AUGMENTATION , NEW – INITIATIVES & GROUND BREAKINGS (UMANG 2023) DECEMBER 23,2023 Organized by IMMA Kolkata Chapter (Supported by COAL INDIA LIMITED). All these National & International Seminar were grand success. It is also heartening to note that our Nagpur Branch is also holding National Seminar regularly every year with large participation.

Our Jharia Branch, Raniganj Branch, Singrauli Branch, Bilaspur Branch & Sambalpur Branch are also functioning but require speed in activity to ensure large participation by Members for enhancing their technical knowledge and keep them abreast with the latest development in mining. Our Bilaspur Branch had held one day workshop on "HUM 21 DAY" HARIT MINING 22 January 2025 and the Members of Bilaspur Branch had visited all the Collieries of SECL in convoy to give a comprehensive message to produce and dispatch quality and size coal in order to maintain its lead from the private sector coal producing corporates. It is matter of pleasure that this workshop was also a grand success.

As we all know that during last 22 years many coal mines have been out sourced and the private parties had been awarded the work of mining coal and overburden and the skill of the workers employed by them is not up to mark and the mine managers have to be very vigilant in order to run the mines safely and produce coal and OB as per target given by the company. The mine managers have to keep themselves abreast with the latest mining technology to produce coal and OB with least danger to safety.

With these words I extend my good wishes to all Members of IMMA with their families and hope for bright future for them.

Yours Sincerely

(K. N SINGH)
PRESIDENT,IMMA

पी० एम० प्रसाद
अध्यक्ष-सह-प्रबंध निदेशक
P. M. Prasad
Chairman-Cum-Managing Director

5 DECADES OF UNEARTHING ENERGY
(एक महारत्न कंपनी)

कोल इण्डिया लिमिटेड
COAL INDIA LIMITED
(Govt. of India Enterprise)
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Action Area - 1A, New Town, Rajarhat
Kolkata - 700 163
CIN : 123109WB1973GOI028844

(An ISO 9001:2015, ISO 14001 : 2015 & ISO 50001:2011 Certified Company)

MESSAGE

We live in an age of rapid technological advancements. Tech dependent industries, especially mining, are increasingly adopting this modernization for improved productivity. The multifarious advantages are efficiency in resource extraction, enhanced safety, real time monitoring, reducing environmental impact, and better economic benefits. Coal India Limited is leveraging modern technologies diligently. CIL is also delving into digitization and automated processes not merely as choice but as an imperative to stay ahead in the evolving competitive market.

I am happy to note that Indian Mine Managers' Association, Dhanbad in its quarterly review is focusing on emerging mining technologies and associated technical papers. I hope these enriched articles would be of use to practicing mining engineers enabling them to keep abreast of latest technological developments for the betterment of the mining industries.

May IMMA continue to bring out such informative publications.

Best Wishes!

(P M Prasad) 12/03

Kolkata
08.03.2025

समीरन दत्ता
अध्यक्ष-सह-प्रबंध निदेशक
Samiran Dutta
Chairman-cum-Managing Director

भारत कोकिंग कोल लिमिटेड
(कोल इण्डिया लिमिटेड की एक अनुषंगी कंपनी)
Bharat Coking Coal Limited
(A Subsidiary of Coal India Limited)
(एक मिनी रत्न कम्पनी / A Mini Ratna Company)
(भारत सरकार का उपक्रम / A Government of India Undertaking)

MESSAGE

I am extremely happy to know that **Indian Mine Managers' Association (IMMA)** is publishing its **IMMA Review**. Like the previously published IMMA Review, this publication will also contain important information on the mining sector, other related matters & highlight the success of the IMMA.

IMMA was established in 1923 and has completed its centenary year and has been safeguarding the interest of mine managers since long. IMMA is very important for the mining sector.

I wish Indian Mine Managers' Association (IMMA) every success in this publication and their **future endeavours.**

Dated: 07/03/2025

(Samiran Dutta)

संजीव कुमार सिंह
अध्यक्ष एवं प्रबन्ध निदेशक
SANJIV KUMAR SINGH
Chairman & Managing Director

हिन्दुस्तान कॉपर लिमिटेड
HINDUSTAN COPPER LIMITED
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(A GOVT. OF INDIA ENTERPRISE)
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MESSAGE

I am glad to note that the Indian Mine Managers' Association (IMMA) is launching its quarterly publication, "IMMA Review," which will showcase the latest advancements in mining technology and feature insightful technical papers on cutting-edge mining innovations and related topics.

In today's mining scenario, the role of mine manager is multifaceted, encompassing operational efficiency, safety compliance, resource management, and environmental responsibility. This role requires a blend of technical expertise, leadership skills, and a strong understanding of regulatory frameworks. Mine managers must effectively manage teams, optimize production, and ensure sustainable practices while navigating complex market dynamics and evolving technologies.

Thus efforts of IMMA in this direction by publishing IMMA Review apart from hosting annual conferences, various committee to cater the interest and needs of Indian Mine Managers is praiseworthy and commendable.

I hope that 'IMMA Review' will shed light on the current challenges facing the Indian mining industry and offer solutions that inspire and empower young and dynamic Mine Managers.

I wish and congratulate for all success.

With warm regards,

Sanjiv Kr. Singh

(Sanjiv Kumar Singh)
Chairman & Managing Director

Dated : 28th May, 2025

Kolkata

Uday Anant Kaole
Chairman-cum-Managing Director
Office of the CMD, MCL
At/Po: Jagruti Vihar, Burla
Sambalpur-768020(Odisha)

MCL

ମହାନଦୀ କୋଇଲଫିଲ୍ଡସ୍ ଲିମିଟେଡ୍
महानदी कोलफील्ड्स लिमिटेड
Mahanadi Coalfields Limited
(A Subsidiary of Coal India Ltd.)

MESSAGE

It is a pleasure to extend my best wishes to the Indian Mine Managers' Association (IMMA) for the publication of the IMMA Review Periodicals. This initiative will serve as a valuable platform for disseminating the latest advancements in mining technology and fostering knowledge exchange within the industry.

At MCL, we remain committed to innovation, safety, and sustainable mining practices, and we appreciate IMMA's efforts in driving technological progress. I am confident that this periodical will significantly contribute to the growth and modernization of the mining sector.

Wishing IMMA continued success in this endeavor.

(Uday Anant Kaole)
Chairman-cum-Managing Director

जय प्रकाश द्विवेदी
अध्यक्ष-सह -प्रबंध निदेशक
Jai Prakash Dwivedi
Chairman-cum Managing Director

वेस्टर्न कोलफील्ड्स लिमिटेड
(भारत सरकार का मिनी-रत्न श्रेणी I उपक्रम)
WESTERN COALFIELDS LIMITED
(A Miniratna - Cat I Government of India Undertaking)
कोल ईस्टेट, सिविल लाईन्स, नागपुर- 440 001
Coal Estate, Civil Lines, Nagpur - 440001
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Message

The mining sector has undergone significant reforms in recent times, emerging as a crucial driver of the country's economy. To sustain this momentum and drive further economic growth, the sector must navigate critical challenges, including environmental sustainability, land availability, increasing mining depths, and enhancements in productivity and safety standards.

The Indian Mines Managers' Association (IMMA) plays a pivotal role in this context. The IMMA has been instrumental in shaping the Indian mining industry by providing a platform for knowledge-sharing and networking, organizing national and international workshops and conferences, advocating policy reforms, and promoting sustainable practices. These efforts have significantly contributed to the industry's growth, development, and adoption of responsible mining practices. As the industry continues to evolve, IMMA remains committed to fostering innovation, collaboration, and sustainable growth.

I am delighted to learn that the IMMA is publishing its quarterly review magazine, 'The IMMA Review'. This publication will offer the latest updates on mining technology, technical insights into emerging trends and innovations, and expert perspectives on health, safety, and related issues impacting the mining industry. Through its various initiatives, IMMA empowers mining professionals by enhancing their skills and competencies, providing them with cutting-edge knowledge, best practices, and expertise to excel in their roles.

I am confident that this publication will serve as a valuable resource, promoting knowledge sharing, innovation, and excellence in the mining industry.

I wish IMMA every success with this publication and look forward to the valuable insights and contributions it will bring to the mining community.

(Jai Prakash Dwivedi)

सतीश झा
Satish Jha
अध्यक्ष-सह-प्रबंध निदेशक
Chairman-cum-Managing Director

ECL

ईस्टर्न कोलफील्ड्स लिमिटेड
Eastern Coalfields Limited
(भारत सरकार का एक उपक्रम)
(A Govt. of India Undertaking)
(कोल इंडिया लि. की एक अनुषंगी)
(A Subsidiary of Coal India Limited)

MESSAGE

It gives me immense pleasure to note that the Indian Mine Managers' Association (IMMA) continues the initiatives that enrich the mining fraternity with valuable knowledge and contemporary insights.

The mining industry today is witnessing rapid transformations driven by technological advancements, environmental considerations, and enhanced safety standards. In this context, the **IMMA Association** plays a pivotal role in disseminating technical knowledge, promoting new technologies, and addressing crucial matters related to health, safety, and allied subjects.

I firmly believe that such initiatives not only contribute to the professional growth of individuals but also strengthen the collective capabilities of the industry as a whole. I congratulate the **IMMA Association** for its commendable efforts and wish its members continued success in their endeavours.

May the **IMMA Association** continue to serve as a beacon of knowledge, innovation, and professional excellence in the mining sector.

Warm regards,

Satish Jha
Chairman-cum-Managing Director
Eastern Coalfields Limited

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Sanjay Kumar Singh
Director Technical (OP)
BHARAT COKING COAL LIMITED

MESSAGE

I am delighted to extend my sincere congratulations to the Indian Mine Manager's Association (IMMA) on the launch of the IMMA Review Periodicals. This initiative will provide an excellent platform for sharing the latest advancements in mining technology and promoting knowledge exchange across the industry.

At BCCL, we remain dedicated to innovation, safety, and sustainable mining practices, and we commend IMMA for its efforts in driving technological progress. I am confident that this periodical will play a key role in the growth and modernization of the mining sector.

Wishing IMMA continued success with this impactful and engaging publication.

sd/-
Sanjay Kumar Singh

Date: 02.04.2025

भारत कोकिंग कोल लिमिटेड
(एक मिनी रत्न कंपनी)
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Manoj Kumar Agarwal
Director (Technical) Project & Planning
Bharat Coking Coal Limited

MESSAGE

It gives me immense pleasure to convey my best wishes to the Indian Mine Managers' Association (IMMA) on the occasion of publication of the IMMA Review Periodicals.

This year's focus on “Advancement and Sustainability in Mining Technology” is both timely and vital. As the mining sector undergoes rapid transformation, embracing innovation and sustainable practices has become imperative. The IMMA Review serves as an excellent forum to share knowledge, promote research, and highlight practical advancements that are shaping the future of the industry.

At BCCL, we continue to align our planning and project development with cutting-edge technologies, efficiency, and environmental responsibility. I commend IMMA for its consistent efforts to foster technical growth and professional collaboration through such meaningful publications.

Wishing the IMMA Review all success and a far-reaching impact in the mining community.

Date: 04.04.2025

(Manoj Kumar Agarwal)
Director (Tech.) P&P, BCCL

INDIAN MINE MANAGERS' ASSOCIATION

IMMA BHAWAN

Saraidhela -828127, DIST- Dhanbad (JHARKHAND)

Rabindra Kmar Sharma,
Honorary General Secretary,
rabindrasharma1953@gmail.com

Message from Honorary General Secretary, IMMA…….

This decision, made during the recent council meeting, marks a significant step in IMMA's commitment to fostering knowledge sharing, research, and innovation within the mining industry and accordingly assigned Shri Kishore Yadav, Chief Manager (Mining), ISO, BCCL HQ with the editorial responsibilities for Publication of IMMA Review.

IM MA was established in 1923 and for over a century it is dedicated for The protection of the interests of Mine Managers in India and the improvement of the social and intellectual position and status of the profession and Establishing cordial relations within the industry.

IMMA under the leadership of Shri KN Singh, President has voiced for the benefit for the mine managers in different forums such as Standing Committee on Safety in Coal Mines, Coal India Safety Board and also Rajmahal Court of Inquiry. IMMA and its branches also hosted Intenational, National Seminars and workshops for the benefit of the Mining fetterntity.

IMMA invites all interested individuals and organizations to contribute to the IMMA Review and support this initiative to promote excellence in the mining and metallurgy industry, It will be published regularly in future.

Rabindra Kumar Sharma,
Honorary General Secretary,
Email; rabindrasharma1953@gmail.com

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IMMA BRANCH NEW

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International Centenary Seminar on Underground Mining: Augmentation, New Initiatives & Ground Breakings (UMANG 2023) Organised by IMMA and Supported by Coal India Ltd.

Recognizing the need to evolve, Coal India Limited prepared its Underground Coal Mining Vision, which was released by the Hon'ble Cabinet Minister for Coal, Mines & Parliamentary Affairs, Shri Prahlad Joshi in June 2023. As part of the vision, CIL plans to produce 100 MT coal from underground mines by FY2027-28 and ramp it up to 125 MT by FY2029-30. The vision plan encompasses infusion of cutting-edge technology, sustainable practices, and a commitment to environmental stewardship. The vision for underground coal mining is rooted in the understanding that transitioning from surface mining to underground mining can have multifaceted benefits. Underground mining minimizes the impact on local ecosystems and reduces the carbon footprint associated with coal extraction. By minimizing the ecological impact associated with surface mining, mitigation of land degradation, reduction of water pollution, improvement in the air quality of coal mining areas and preservation of biodiversity is possible. The vision stands as a testament to the determination to strike a harmonious balance between economic growth and environmental preservation.

Against the backdrop of the present scenario, an international seminar on Underground Mining: Augmentation, New Initiatives & Groundbreakings (UMANG 2023) was organized by the Indian Mine Managers' Association (IMMA) and supported by Coal India Limited (CIL). This significant event took place at Coal Bhawan, New Town, Kolkata, on the 23rd of December 2023, in commemoration of the centenary year of the establishment of IMMA.

The underground coal mining sector faces a multitude of challenges that impede its growth. Addressing these challenges requires the urgent development of a conducive ecosystem, encompassing strategic policy decisions, the promotion of indigenous manufacturing, cultivation of in-house expertise, and the creation of a technically skilled workforce. Additionally, the acquisition of expertise in state-of-the-art technologies is imperative for India. The indigenization of equipment assumes a pivotal role in fostering underground mechanization, facilitated by the introduction of Continuous Miners, Highwalls and Powered Support Longwalls (PSLW), among other innovations. Recognizing the critical need for comprehensive solutions, IMMA has taken the initiative to organize the UMANG 2023 international seminar with support from Coal India Limited, marking a pivotal step towards addressing and overcoming the challenges faced by the underground mining sector.

Principal objectives of the seminar

In the context of Mass Production Technologies, the seminar sought to unravel the complexities and innovations that define the future of underground mining. Participants, comprising industry leaders and innovators, immersed themselves in discussions not just to adopt technologies but to redefine the very fabric of underground mining practices. The central theme aimed at fostering an environment where the industry could collectively envision and pioneer new methodologies for enhanced productivity and operational efficiency beneath the Earth's surface.

The theme of advanced global technologies embraced a global perspective, weaving in insights from international experts hailing from Australia, South Africa, Poland, and beyond. The seminar, as a melting pot of ideas, facilitated a collective understanding of challenges and prospects associated with the adoption of advanced technologies in underground mining. The spotlight on emerging blasting technologies for both underground and opencast mines underscored the forward-looking ethos ingrained in the seminar's design.

The final thematic pillar, innovation & digital mining solutions, served as the heartbeat of the seminar. Here, the focus was not merely on outcomes but on nurturing a transformative mindset. Discussions on Research & Development (R&D) and the integration of automation and digital solutions in the unique context of underground (UG) mining embodied the seminar's aspiration to be a crucible for innovation, pushing the boundaries of what's achievable in underground coal mining.

In essence, the seminar was a deliberate exploration into the future of underground mining, where the chosen themes were not outcomes but guiding lights illuminating a path toward a more innovative, safe, and environmentally conscious underground mining industry.

Panel Discussion

The conference witnessed one panel discussion involving the various notable speakers of the conference and was moderated by Shri. Tushar Chakraborty, Director, Deloitte. The discussions of the panel revolved around the future roadmap of UG mining in India.

Table 1: List of Panelists & Topic for Panel Discussion

#	Panellist	Designation
	Panel Discussion on **Future Roadmap of UG Mining in India**	
1	Dr. B Verra Reddy	Director (Technical), CIL & Chairman-cum-Managing Director, CCL (Additional Charge)
2	Shri. N C Jha	Former Chairman-cum-Managing Director, CIL
3	Shri. B N Pan	Former Chairman-cum-Managing Director, BCCL
4	Shri. Smarajit Chakrabarti	Former Chairman-cum-Managing Director, ECL
5	Shri. M P Dikshit	Former Chairman-cum-Managing Director, SECL

The panel discussion unfolded as an intellectual tapestry, weaving together multifaceted insights that cast a visionary light on the future of underground (UG) mining operations. At the core of these deliberations was the resounding call for the integration of cutting-edge technologies into the fabric of UG mining, highlighting their potential to revolutionize operational efficiency and foster sustainability. The discourse resonated with a shared understanding among panellists that the judicious infusion of technological advancements is not merely a choice but a necessity for the industry's evolution.

A recurrent theme throughout the discussion was the emphasis on collaboration as an engine for knowledge exchange and innovation. The panel recognized the interdependence among industry leaders, government bodies, and research institutions, portraying them as integral components of a collaborative ecosystem essential for propelling UG mining towards a technologically driven and sustainable future. The narrative shifted seamlessly to the crucial role of regulatory support, portraying it as the linchpin for the sector's progression. The panel advocated for continuous support through robust policy frameworks and financial incentives, envisioning them as catalysts that would accelerate technological adoption and the incorporation of sustainable practices. Environmental sustainability emerged as a cornerstone, with the panel engaging in thoughtful discussions around strategies and responsible mining practices.

These considerations delved into ways to mitigate the ecological footprint of UG mining, reflecting a conscientious commitment to harmonize industrial activities with environmental preservation. The discourse then seamlessly transitioned to the critical importance of human resource development.

Panellists underscored the significance of cultivating a skilled workforce through targeted skill-building initiatives, recognizing that a competent human capital is pivotal for steering the industry through evolving demands and technological advancements.

Addressing challenges head-on, the panel offered collaborative approaches as effective solutions. The spirit of unity and collective problem-solving underscored the industry's resilience and adaptability. The valedictory session, a culmination of these insightful discussions, provided a reflective platform. Expressing gratitude to participants, it underscored the pivotal role of collaboration, technological innovation, and sustainable practices in shaping the future trajectory of UG mining. The event stood not merely as a symposium but as a beacon illuminating a path towards a more sustainable, efficient, and technologically advanced UG mining industry.

Table 2: Summary of Major Insights from Panel Discussion

#	Focus Area	Insights
1	Integration of Technological Advancements	The panel highlighted the importance of integrating cutting-edge technologies to enhance efficiency and sustainability in UG mining operations.
2	Collaboration for Knowledge Exchange	Emphasis was placed on fostering collaboration among industry leaders, government bodies, and research institutions to facilitate knowledge exchange and technological innovation.
3	Regulatory Support	The need for continued regulatory support, including policy frameworks and financial incentives, to propel UG mining initiatives forward was emphasized
4	Environmental Sustainability	The panel discussed strategies for ensuring environmental sustainability in UG mining, considering the importance of responsible mining practices.
5	Human Resource Development	The role of skill development and human resource initiatives to meet the evolving demands of UG mining was highlighted, ensuring a competent workforce for the industry.
6	Addressing Challenges	The panel acknowledged the challenges faced by the UG mining sector and proposed collaborative approaches to address them effectively.

Key outcomes from the seminar

Background

UMANG 2023, stands as a testament to the collective pursuit of excellence in the field of underground mining. The event acted as a platform to bring together industry stalwarts, experts, and enthusiasts from across the globe to delve into an exchange of cutting-edge insights, innovative approaches, and emerging technologies that are reshaping the landscape of underground mining. With a primary focus on augmenting existing methodologies, introducing novel initiatives, and commemorating significant groundbreakings, UMANG 2023 aspired to foster a collaborative environment that will propel the industry towards sustainable growth and enhanced efficiency. Against the backdrop of a rapidly evolving mining landscape, this seminar promises to be a pivotal event, facilitating dialogue, networking, and knowledge-sharing among the trailblazers of the underground mining community.

Key Recommendations

1 Rebate in revenue share (Bid Price) for UG mining

Incentivizing large scale underground mining through a rebate in revenue share/bid price up to 50% for coal blocks being auctioned for early operationalization and coal production would be beneficial for commercial miners. This would encourage companies to invest in underground pit mining. Underground mining also has a lower environmental impact.

The rebate would help to offset the higher costs of underground mining and make it more competitive with open-pit mining. This would lead to an enhancement of number of underground mines being operated that finally would accrue several benefits:

- Mining of coal in a socially and environmentally manner.
- Gradual depletion of open castable coal at shallower depth shall compel increase in UG mine production
- Reduced land acquisition for underground mines as compared to opencast projects. UG mining requires lower area on surface (~4 to 5 Ha.) which shall reduce R&R issues.

Almost no land degradation, lower dust emissions, less deforestation and no impact on biodiversity and wildlife.

Further, growth in UG mining shall be instrumental in extracting good quality coal lying in depths of more than 300 m with minimum contamination. This shall also aid in the substitution of imported coal in the country.

2 Encouraging Make in India for sustained growth of equipment used in UG mining segment

- The prohibitive cost of imported equipment along with long lead times for spare parts procurement contributes to a large extent in the non-viability of underground coal mining projects.
- The contribution of imported equipment is very high in the total project cost of UG mine and can thus be sustainable if the equipment used is produced domestically. Further the easy availability of spare parts for maintenance would obviate the downtime of machinery, loss of manhours and loss of revenue.
- Hence, it was recommended to encourage equipment manufacturers in from of Production Linked Incentive (PLI) schemes in line with other sectors such as automobiles, white goods, advanced cell chemistry batteries etc. or with the aid of capital subsidies. An indigenous manufacturing ecosystem shall be instrumental in rapid adoption of underground coal mining in the country.

3 Enhanced use of Paste fill technology for better recovery

- Currently large quantity of good quality coal is available below the depth of 300 m and below dense surface features which can be mined with greater recovery without disturbing the surface or vicinity by using Paste fill technology. Paste fill technology is a relatively new method of filling mined-out areas in underground mines.
- Paste fill technology has several advantages over traditional methods of mine filling. It is more environment friendly. The slurry used in paste fill technology is a waste product from existing processes, i.e., fly-ash produced by power plants from burning of coal. Usage of fly ash generated from coal fuelled power plants is a challenge, which can be symbiotically utilized for paste filling technology in underground mines.
- As against traditional methods such as sand stowing, paste fill can be more effective in filling larger volumes of voids per unit time. Therefore, it is more compatible with use of mass production technology.
- The enhanced use of paste fill technology in mines can lead to several benefits, including:
    - Increased recovery of coal, which otherwise would have been lost or locked below surface features.
    - Paste fill method improves safety as it lends support to the roof/strata which otherwise caved in causing severe stress condition in the working area.

It is estimated to provide access to more than a billion tonne of coal in the country which includes high and very high-quality coal without effecting its surroundings.

4 Introduction of Mass Production Technology (MPT)

- Mainly three types of mass production technology were focused upon: namely, Longwall, Board & Pillar with Continuous Miner and Highwall Mining.
- In longwall mining, coal is being extracted from a single faced panel of coal with a width of more than 150 m. It is a non-cyclic method where the flow the coal is continuous and is a method which is complies to total system safety.
- In the Indian conditions, which has traditionally worked its underground mines with board & pillar method, Continuous Miner is the most suited equipment and finds wide applicability. Here a continuous coal cutting machine cuts coal to develop board & pillar galleries or "de-pillar" the developed areas/areas standing on pillars.
- Highwall mining is mostly used at the batters of the opencast mine where the coal is usually lost forever. It also finds application at places or areas where there is restriction due to surface features in the highwalls of the opencast mines. It involves continuous getting of coal from the batter of the mines using a remotely operated continuous miner.
- The application of MPT can have a significant impact on the production and productivity of underground mines. it also increases the possibility of viability of underground projects.

5 Planning and Implementation of large UG mines

- Increasing the sizes of mines is a positive step but proper planning and strategy is required to ensure it serves its purpose of greater efficiency and does not dwindle due to safety issues.
- The high-capacity mines with a production of 2 MTPA and above may thus be planned to enhance the productivity and viability of such projects by achieving economies of scale.
- Wherever feasible, the use of continuous miners (CM) and Powered Support Longwall (PSLW) technology would be an added advantage.
- These strategies will also lower the man-machine interaction and aid in enhancing safety, thereby also promoting 'Zero Harm' in underground mines.

6 Digitization in Mining Operations

- By using digital technologies, coal mines can improve safety, productivity, and environmental performance.
- Some key initiatives which shall aid in rapid digitization of underground coal mines are enumerated below:
    - Real-time data collection and analysis: Fleet management system, Drill & Blast optimization solution, connected workers platform with robust digital communication network can be used for real-time data capture, performing advanced analytics towards quick decision-making.
    - Remote monitoring centre: Remote monitoring centre can be used to monitor coal mining operations and visualization of KPIs from a central location. This can help to improve safety & productivity of mining operations.
- Further, digitization of mines shall be instrumental in improving communication systems for underground mines. For example, coal mine safety monitoring system based on SCADA system can timely and accurately reflect dynamic situation of workers in the underground regions to above ground systems and personnel.
- Digitization would benefit in improved decision making & safety, reducing costs, increased quality control and enhanced process output.

Recommendations from National Seminar held on 20th and 21st January, 2023

1. The gap between demand and availability has been steeply going up, the declining trend of underground production is matter of serious concern although sustained growth in coal production can be envisaged by right mix of technology for underground and opencast mining for optimum and balanced exploitation of coal reserve while addressing the social and environmental issues.

2. The Indian coal sector needs to act fast in building its image on the environmental front so that it may continue to fuel the country's energy requirement for ensuring long-term energy security and also keep its ESG score at an acceptable level.

3. The economy, environment and energy should be interwoven suitably and managed strategically such that overall economic prosperity on national scenario may be achieved vis-à-vis ESG management.

4. A committee with all concerned subject experts need to be formed at national level to recommend as to what would be the appropriate mass production tech for u/g working in view the maximising of coal recovery, safety, productivity and production and economics. If required, the committee would recommend to do the needful to manufacture the equipments and products. The CMD of BCCL and ECL may form such committee for their specific company subject to the specific geo-mining conditions, the projection of production programme and other related issues.

5. It is recommended to use unmanned aerial vehicle (UAV) with artificial intelligence (AI) for the fastest-growing technologies utilised in the field of geotechnical engineering smart design and management of geo-structure like estimation of slope failure potential and projected range of effected zone.

6. Methane in coalbeds is synonymous with fire and explosion hazards and a source hazard to miners. Recently, methane associated with coalbeds has been recognized as an economically producible resource. Coalbed methane (CBM) should be extracted "scientifically" as an "unconventional" source, a more cleaner and "eco-friendly" energy form.

7. The low-profile dump trucks' (LPDT) fleet increases with deepening of the mechanised underground metalliferous mines, and consequently, the heat, diesel exhaust, and airborne dust generation increase. By use of suitable ventilation models, total airborne dust (TAD) as well as simulated portions of dust particle size portions of range 0.23-10µm, if assessed scientifically, may provide to adopt suitable measures to prevent spreads into the downstream workings and also into the ventilating air current belowground.

8. A bespoke computational fluid dynamic (CFD) based numerical simulation may be a handy tool to better understand the delineation characteristics of PM_{10} emitted from coal mining regions, posing adverse health risks. It can further be used as the basis for identifying the targeted population.

9. Use of automated pumping operation system is recommended to ensure safe pumping operation and monitoring of any mechanical or electrical abnormalities during opencasting.

10. The concerns about the productivity and profitability of mining operations as well as maintenance issues of high value equipment including the likely breakdown during operation may gainfully be addressed by applicable innovative and disruptive digital technologies (ML, AI). The predictive maintenance solutions, as presented in detail in this seminar has been found to provide quantitative positive results and therefore should be adopted.

11. Deep sea mining has an immense potential for meeting the demand of a host of the metals such as Ni, Li, Cu etc. in national scenario. These metals are required for modern economy in this digital era.

12. Mining company as well as other government agencies shall work to prevent illegal mining and theft of coal.

13. The social and political issues are required to give attention in interest of proper utilisation of national property, the coal specially in fiery areas near thick populated zone.

14. India has huge untapped potential for underground (UG) coal mining. Mechanisation and automation using continuous miners & shearers; adopting continuous cutting and transporting methodologies, etc. may help UG coal mining industry revive in India. Geo-mining conditions and site-specific parameters need to be considered specific to achieving higher production and productivity with better economy.

15. Existing pillar strength formulating are valid up to 300m of depth. More study is required to formulate pillar strength guidelines for horizons deeper than 300m of depth.

16. RMR alone is not sufficient for design of supports in deeper horizon. Comprehensive site characterization including in-situ stress measurement is the need of the hour.

17. Overburden removal is a major activity of surface coal mining and accounts for over 60-70% of the costs. Cast blasting is integral in dragline excavation. This presentation promotes deep domain knowledge of cast blasting combined with data analytics and machine learning algorithms (ML) to predict cast blast performance.

18. The success story of Jhanjra u/g coal mining, though a torchbearer to show scalability of u/g mass production technology with safety and conservation, should be understood by mining fraternity and all stakeholders to be "a small step but a giant leap of mining mankind.

19. Mining leaders, the world over, are concerned about the productivity and profitability of their mining as well as maintenance issues. Innovations and the application of disruptive digital technologies would be a handy tool in this respect in future. Maintenance data analysis during production process can save a lot of downtime of the machines with the help of predictive maintenance solutions which will lead to the extended productivity.

इम्मा बिलासपुर चैप्टर:
विकसित और आत्मनिर्भर भारत की ओर प्रतिबद्ध एक सशक्त आध्यात्मिक पहल

चैप्टर अध्यक्ष श्री रमेश कुमार सिंह की कलम से

आजादी का अमृतकाल और इम्मा स्थापना के शताब्दी वर्ष 2023 में, एसईसीएल के सम्मानीय सीएमडी डॉ. प्रेम सागर मिश्रा के संरक्षण में इम्मा (IMMA)बिलासपुर चैप्टर का गठन सितंबर 2023 में हुआ। " विभा और माखन"— अर्थात विकसित भारत और मानवता के लिए खनन — की प्रेरणादायक संकल्पना के साथ, माइन मैनेजर्स की प्रासंगिक भूमिका को सशक्त बनाते हुए यह चैप्टर न केवल विकसित और आत्मनिर्भर भारत के लिए माननीय प्रधानमंत्री श्री नरेंद्र मोदी जी के पंच प्रण को आत्मसात कर रहा है, बल्कि धरातल पर उसे साकार करने का आध्यात्मिक प्रयास भी कर रहा है। खुदाई के लिए खुदाई (Mining For Divinity) की संकल्पना को यह चैप्टर अपने मूल मंत्र " चरै वेत्ती चरै वेत्ती " के साथ सफलिभूत करने में सकल प्रयासरत है।

चैप्टर की उल्लेखनीय उपलब्धियाँ: सदस्यता अभियान में गति के साथ साथ अपने मौलिक लक्ष्य को मिशन मोड में हासिल करने की योजना से निरंतर बिलासपुर में यह चैप्टर सक्रिय और सतर्क है।

1. अभिनव कार्यशाला 'हम 21 दिन' (2024):

चैप्टर अध्यक्ष के संकल्पना आलेख "हम-21 दिन" (प्रकाशित: एसईसीएल त्रैमासिक ई-पत्रिका, जनवरी 2024) के आलोक में, 22 जनवरी से 11 फरवरी 2024 तक संपूर्ण एसईसीएल में इस कार्यशाला का सफल संचालन हुआ। हरित दलों के गठन के साथ, मस्तिष्क-उद्वेलन द्वारा चयनित उत्पादकता व पर्यावरण-संवेदनशील कार्यों को व्यवहार में लाया गया जिसके फलस्वरूप, 12 फरवरी से मार्च 2024 तक, कंपनी ने अभूतपूर्व उत्पादन मानकों को हासिल कर हरित माइनिंग का अनुकरणीय उदाहरण प्रस्तुत किया।

2. सामूहिक चिंतन वार्ता:

दीपका क्लब में इम्मा के महासचिव श्री आर के शर्मा साहब का गर्मजोशी से हार्दिक स्वागत तथा समसामयिक उभरते विषयों तथा हरित माइनिंग पर सामूहिक चिंतन - वार्ता से चैप्टर के कार्यों को गति मिली।

3. स्थापना दिवस समारोह और विचार गोष्ठि :

23 सितंबर 2024 को दीपका परियोजना में आयोजित प्रथम स्थापना दिवस पर "हम माइनिंग" की सफल यात्रा और एआई आधारित खनन एवं डिजिटलाइजेशन जनित वर्चुअल माइन से खनन संचालन पर तकनीकी परिचर्चा हुई। इस अवसर पर वर्चुअल और प्रत्यक्ष रूप से जुड़े सभी खनन अधिकारी, विशेषज्ञ और एसोसिएशन प्रतिनिधियों ने इसमें भाग लिया। इम्मा अध्यक्ष श्री के एन सिंह साहब वर्चुअल माध्यम से जुड़ते हुए इस कार्यक्रम में अपनी गरिमामय भागीदारी से अहम योगदान दिया।

4. संपन्न अभिनव कार्यशाला में विशिष्ट योगदान तथा स्थापना दिवस का सफल आयोजन हेतु सम्मान :

वर्ष 2024 में अभिनव कार्यशाला हम -21 दिन */ हरित माइनिंग - 21 दिन* के सफल संचालन के लिए एसईसीएल के सभी क्षेत्रों तथा मुख्यालय के औद्योगिक अभियांत्रिकी विभाग ,मानव संसाधन विभाग तथा सीएमडी के तकनीकी सचिव श्री मनीष श्रीवास्तव को स्थापना दिवस समारोह में मुख्य अतिथि सीएमडी एसईसीएल तथा निदेशक तकनीकी श्री सत्य नारायण कापरी,निदेशक योजना परियोजना श्री एन फ्रैंकलिन तथा निदेशक वित्त श्री डी सुनील कुमार के कर कमलों से शील्ड प्रदान कर सम्मानित किया गया ।साथ ही उम्दा तकनीकी पेपर प्रस्तुति के लिए रायगढ़ क्षेत्र के महाप्रबंधक श्री हेमन्त शरद पाण्डेय और उनकी टीम तथा क्षेत्रीय संस्थान सीएमपीडीआई आरआई V विलासपुर के क्षेत्रीय निदेशक श्री मनोज कुमार और महाप्रबंधक माइनिंग श्री बादल मन्ना साहब को सम्मानित किया गया।समारोह के उम्दा आयोजन के लिए दीपका क्षेत्र के महाप्रबंधक श्री संजय कुमार मिश्रा तथा उनकी टीम को भी सम्मानित किया गया।

5. अभिनव कार्यशाला 'हम -21 दिन' (2025):

वित्तीय वर्ष 2024-25 में, कोल इंडिया के चेयरमैन आदरणीय श्री पी एम प्रसाद साहब के आह्वान पर कोयले की गुणवत्ता सुधार हेतु जमीनी स्तर पर जागृति लाने हेतु दूसरी बार हम -21 दिन कार्यशाला का सफल आयोजन हुआ जिसमें कोयले की गुणवत्ता सुधार को केंद्र बिंदु

में रखा गया। 22 जनवरी से 11 फरवरी 2025 तक संपूर्ण एसईसीएल में यह पहल चली, जिसमें इम्मा के अध्यक्ष श्री के एन सिंह साहब,महासचिव श्री रवीन्द्र कुमार शर्मा साहब व कोषाध्यक्ष श्री यूनुस अंसारी साहब की सक्रिय भागीदारी भी रही।इस बार के कार्यशाला का संचालन इम्मा बिलासपुर चैप्टर,इम्मा तथा एसईसीएल के संयुक्त तत्वाधान में सफलतापूर्वक संपन्न हुआ।

6. इम्मा शताब्दी पुरस्कार अलंकरण:

सेवानिवृत्त हो रहे सीएमडी डॉ. मिश्रा को इम्मा द्वारा इम्मा शताब्दी पुरस्कार से नवाज़ा गया। यह सम्मान भौतिक रूप में इम्मा के महासचिव श्री रवीन्द्र कुमार शर्मा तथा कोषाध्यक्ष श्री यूनुस अंसारी महोदय ने अभिनव कार्यशाला हम -21 दिन के उदघाटन समारोह में 22 जनवरी 2025 को शिरकत करते हुए मंच से एसईसीएल के मुख्यालय बिलासपुर में नवनिर्मित सभागार के मंच पर अपने कर कमलों से प्रदान किया जिसका साक्षी उपस्थित सभी निदेशक मंडल मुख्य सतर्कता अधिकारी एसईसीएल तथा अधिकारियों कर्मचारियों के साथ साथ वर्चुअल माध्यम यूट्यूब से जुड़े सभी देश दुनियां के खनन प्रेमी और संघ पदाधिकारी भी रहे।

7. हरित रथ परिभ्रमण :

"हरित रथ" का सभी एसईसीएल के क्षेत्रों में परिभ्रमण से कामगारों को उनके कार्यस्थल पर ही कोयला उत्पादन की गुणवत्ता व पर्यावरण संरक्षण विषयक जागरूकता संदेश और जुड़े विभिन्न निर्देशों को उपलब्ध कराई गई। इससे पर्यावरण हितैषी क्रियाकलापों द्वारा आत्मनिर्भर भारत का संकल्प और भी मजबूत हुआ।इस रथ को हम कार्यशाला के उद्घाटन समारोह के अंत में एसईसीएल सीएमडी डॉक्टर प्रेम सागर मिश्रा,निदेशक वित्त , एसईसीएल श्री डी सुनील कुमार,मुख्य सतर्कता अधिकारी श्री हिमांशु जैन साहब, इम्मा महासचिव श्री रवीन्द्र कुमार शर्मा ,कोषाध्यक्ष श्री यूनुस अंसारी तथा बिलासपुर चैप्टर के अध्यक्ष श्री रमेश कुमार सिंह के करकमलों द्वारा हरा झंडा दिखाकर एसईसीएल के सभी 13 क्षेत्रों के विभिन्न कार्यस्थलों के लिए पूरे 21 दिनों के परिभ्रमण के लिए रवाना किया गया।

8. कार्यशाला समापन समारोह:

हरित रथ की वापसी पर आयोजित समापन समारोह में दीपका क्षेत्र महाप्रबंधक श्री संजय कुमार मिश्रा की अध्यक्षता में कार्यक्रम संपन्न हुआ, जिसने इस पहल की सार्थकता को और भी बल प्रदान किया।

9. राजभाषा हिंदी का तकनीकी क्षेत्र में सफल प्रयोग:

चैप्टर ने अपने सभी संदेशों और तकनीकी प्रस्तुति को राजभाषा में प्रस्तुत कर एक नया बहुजन हिताय चुनौतीपूर्ण जिम्मेदारी निभाने का प्रयास भी किया है जिसके लिए चैप्टर के प्रयासों की सराहना गृह विभाग के राजभाषा अधिकारी द्वारा भी की गई है।यह जमीनी स्तर पर तकनीकी संदेशों को सफलतापूर्वक पहुंचाने और मिशन को सफल बनाने में सहायक बना है साथ ही राष्ट्रीय स्मिता और राष्ट्रीयता जी भावना को भी मजबूत किया है।

10. मीडिया एवं सोशल मीडिया में चर्चा:

मानवीय संवेदनाओं से ओतप्रोत और राष्ट्रीय उत्थान में समर्पित इन प्रयासों की व्यापक चर्चा विभिन्न मंचों, समाचार माध्यमों और सोशल मीडिया पर भी रही है।

11. नववर्ष पर सौजन्य भेंट:

नववर्ष पर चैप्टर की सीएमडी, निदेशक मंडल व मुख्य सतर्कता अधिकारी से सौजन्य मुलाकात ने संगठन को एक पहचान दी और भविष्य की राह को प्रशस्त किया।

अंतिम विचार:

इम्मा बिलासपुर चैप्टर अपने समर्पित माइन मैनेजर्स की सक्रिय सहभागिता में आज एक ऊर्जा सिपाही की भूमिका से आगे बढ़ते हुए ऊर्जा सेनानी बनने की दिशा में अग्रसर है। यह चैप्टर अपने अभिनव, समर्पित और दूरदर्शी प्रयासों के माध्यम से 2047 तक विकसित और आत्मनिर्भर भारत बनाने के लिए प्रतिबद्ध है और अभी उसकी नींव को मजबूती प्रदान कर रहा है।

चैप्टर का आध्यात्मिक माइनिंग का अभिनव अलख जिसमें आत्मनिर्भर और विकसित भारत के साथ साथ मानव अस्तित्व संरक्षण हेतु खनन का नवीन प्रारूप हरित माइनिंग जो राष्ट्रीय माइनिंग (राम) के लिए हरित नुस्खा से माइनिंग के नायक (हनुमान) रूप में माइन मैनेजर्स की एक नई भूमिका में एक मिशन मोड में सार्थक यात्रा है।इसी के साथ यह चैप्टर अपने एक नयी इवादात लिखने के लिए कृत संकल्प है।

Coal Fire in India and remedies

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In India, coal is the most abundant available fossil fuel and provides a substantial part of energy. It is used for power generation, to supply energy to the industry as well as for domestic needs. India is highly dependent on coal for meeting its commercial energy requirements. The principal deposits of hard coal are in the eastern half of the country, that is, ranging from Terenggana, bordering the Indian Ocean, to Arunachal Pradesh in the extreme north - east: the States of Jharkhand, Orissa, Madhya Pradesh, Chhattisgarh and West Bengal together account for about 85 per cent of reserves.

Causes of Coal Fire Coalmine fires are caused due to spontaneous combustion of coal and carbonaceous matter-in the rocks. All coals when exposed to air undergo natural oxidation of carbon forming CO and/or CO2 and producing heat. Occasionally, due to bacterial action some heat is generated which when reaches 35°C, coal is automatically set to fire. This phenomenon is generally considered as spontaneous combustion of coal.

Thermal capacity of coal is inversely proportional to its ash content, that is, greater the ash content, lesser is its thermal efficiency and vice-versa. In this reaction, so long as the heat produced is dissipated, the temperature of coal does not increase. Concentration of heat, when dissipation does not occur, causes coal to catch fire. Most of the fires in coalfields have taken place due to spontaneous heating of coal, which depends on mining, geological, and coal factors. Certain exogenous factors that have contributed to mine fires are frictional sparks, electrical short-circuiting, dumping of hot ash etc.

Mine fires have existed in coal mining areas and have also been observed in non-coal mines having carbonaceous shale or any other form of carbonaceous matter in the strata. Areas where coal mine disasters could occur, due to fire, are as follows:

- ❑ Fire prone underground mines.
- ❑ Mines where sealed off areas exist due to fire.
- ❑ Mines where sealed off areas exist in which fire may occur due to breathing in of air.
- ❑ Mines which have extensive old workings and not sectionalised.
- ❑ Mines which have thick seam workings and not sectionalised.
- ❑ Coal fires have also been found in the following situations:
- ❑ Underground fires, which have remained underground.
- ❑ Underground fires, which have become surface fires.
- ❑ Fires in over-burden dumps.
- ❑ Fires in coal benches in open coalmines.
- ❑ Fires in overlying rock mass, specially having thin coal bands and carbonaceous shale.
- ❑ Fires in coal stacks.

Impacts of Coal Fire:-

Mine fires give rise to environmental problems, safety hazards and economic losses like gas poisoning, difficult geo-mining conditions, sterilisation of coal, hindrance to production, explosions, and damage to structure and properties. Un-burnt hydrocarbons (from coal fire) in presence of nitrogen oxides and other photo-sensitive oxidants can cause eye irritation due to the formation of smog like conditions. Burning of coal during coal fire produces carbon monoxide (CO) and carbon dioxide (CO2) in large quantities. CO is produced due to incomplete combustion of coal, which is common in Jharia coalfield. A considerable depletion of oxygen in air has been observed in fire areas compared to non-fire areas. Sulphur dioxide and sulphur trioxide are generally emitted from fire areas. Sulphur dioxide (S02) is partly converted to sulphur trioxide or to sulphuric acid by reactions with atmospheric constituents. The oxides of sulphur in combination with particulates and moisture produce damaging effects. Amount of S02 released from coal fire depends on the sulphur content of coal. S02 has low residence time and may contribute to classical smog and acid rain formation. Sulphur dioxide has been associated with respiratory diseases and increased mortality rates. Inhalation of sulphur dioxide can cause increased airway resistance by constricting lung passages. The amount of S02 emissions is higher in fire areas than in non-fire areas in view of increased pyrite oxidation. Oxides of nitrogen are formed as a result of oxidation (burning) of coal at high temperatures. Coal contains about 2 per cent nitrogenous compounds and produces oxides of nitrogen during Coal fire burning. Out of total nitrogen oxides, 90-95 per cent is nitrogen monoxide (NO). It is a fairly stable gas but reacts photo-chemically with hydrocarbons and radicals in air to form nitrates and smog. It reacts with moisture present in the air to form nitric acid.

Large amount of saturated and unsaturated hydrocarbons are emitted from coal combustion due to coal fire. At higher temperature a variety of hydrocarbons are generated from the fires due to distillation of coal. The compounds released are mentioned below:

- ❑ Volatile Organic Compounds
- ❑ Semi Volatile Organic Compounds; and
- ❑ Condensable Organic Compounds

The pollutants released from mine fires comprise gases, such as, carbon monoxide (CO), carbon dioxide (CO2), nitrogen oxides (NOx), sulphur dioxide (S02)' saturated and unsaturated hydrocarbons, hydrogen sulphides (H2 S) and other photosensitive oxidants and suspended particulate matter (SPM). Suspended particulate matter contains harmful trace elements beyond threshold limit values (TLV) that adversely affect the health of the people. Fire areas have high sulphating and dust fall rates. Smoke and particulates affect visibility and form smog resulting in eye irritations and nasal discharges.

Sl. No.	Air Pollutants	Effects on Human Health
1.	CO	CO poisoning, coma, death, reduces oxygen carrying capacity of lungs, exacerbates heat disorders.
2.	CO_2	Laboured breathing, headache, eventual loss of consciousness.
3.	SO_2	Irritation of respiratory tract, eye irritation, increased morbidity and mortality rates
4.	NO_x	Bronchial disease, emphysema, tissue damage in animals, pneumonia, lung diseases.
5.	H_2S	Neurotoxin, eye and throat irritation, headache, sleeplessness.
6.	Hydrocarbons	Cancer, anaemia, skin problem, eye irritation, odour problem, nerve damage

Being mining engineer all we know the detailed physiological effects of above pollutants as per their concentration in environment and length of exposure

Impact on the Environment

In case the fire is restricted to underground, the impact is limited but when it extends to the surface the surroundings are adversely affected. The adverse impacts of mine fires are observed on all the basic components of the environment, that is, air, water, and population. Mine fires give rise to continuous and uncontrolled emissions of greenhouse gases, such as, CO2, (carbon dioxide) NOx, (nitrogen oxides) and CH4 etc. These gases may contribute to global warming. Release of S02 NOx, CO2 into the atmosphere mostly cause acidic precipitation in the mining areas in the form of sulphuric acid (H2SO4, nitric acid, (HNO3) and carbonic acid, (H2CO3). In fire areas, as already stated, CO, CO2 concentrations are high and oxygen is low. Smoky conditions are serious in winter months, which can affect visibility and cause eye irritation leading to accidents. The affected area has high evapo-transpiration rates, which affects the region's climate.

COAL MINE FIRE: DISASTER MANAGEMENT

The most crucial factor while managing coal fire disaster in coal mine would be using the right lifesaving equipment immediately, and deploying rescue personnel within the least possible time. The safety of the personnel in coal mine envisages that the miners working, underground, should immediately wear escape apparatus (Filter type self-Rescuer) and escape from the deadly Carbon Monoxide or other irrespirable atmosphere. The oxygen available in the atmosphere is to be utilised to survive. For survival a man needs at least 17 per cent oxygen in the air inhaled. The filter of self-rescuers has limitations, that is, the atmosphere should not contain less than 17 per cent of oxygen and not more than 1 per cent of Carbon Monoxide. In new Kenda disaster, 55 miners died due to fire. As per the enquiry, held after the disaster, it has been observed that self-rescuers were not provided adequately or were not carried by the miners. A major constraint in provision of self-rescuers is the prohibitive cost of equipment. In this context, if the customs duty is exempted the cost will be reduced that will encourage the mine management to make adequate provision. Local industry should be encouraged to develop an indigenous product so as to reduce the cost and now a days several types of self-rescuers are available in market particularly self-contained type which are independent to the atmosphere. If the atmosphere have less oxygen percentage they will work to save lives. After fire occurs, the mine is filled up with deadly Carbon Monoxide, Carbon Dioxide increases and Oxygen declines significantly. However, the self-rescuers provide protection only from Carbon Monoxide but offer no protection from lack of oxygen. Therefore, to provide complete protection to miners' self-contained self-rescuers should be provided at strategic locations. These strategic points are known as Rescue Chambers. Rescue Chambers are:

- ❑ Mobile chambers having charged oxygen self-rescuers;
- ❑ Established at strategic points underground;
- ❑ provide for replacement of depleted self-rescuers, healthy atmosphere, safe drinking water, telephonic communication and first-aid facilities; and
- ❑ A place of safety for trapped miners. !

The self-contained self-rescuer (SCSR) is of two types:

a) Compressed Oxygen Cylinder Type - oxygen is provided from a cylinder and the exhaled air is recirculated after

cleaning the CO2 in the exhaled air by CO2 absorbent placed within the self-rescuer.

b) Chemical Type – potassium super oxide is used, which continuously provides oxygen for about half an hour or for one hour depends on model of self-rescuers.

After adopting self-rescuers, the miners should know where to proceed to safety and as such escape routes should be clearly marked to be used in case of emergency from each and every working district. Without this, the workers may not proceed to safety but in turn might proceed further towards danger. In the case of new Kenda disaster, the victims proceeded towards the Intake air (air on the intake side) assuming to be the safest but instead proceeded towards the poisonous carbon monoxide filled air as the fire itself was on the Intake side. In the new Kenda disaster a simple decision of reversal of fan by the senior most officer available at the mine, at the time of disaster, would have saved the life of persons as the fire was in the intake side and the carbon monoxide was filling the complete mine along with the intake air. Had this fan been reversed the poisonous gas would not have filled the mine but would have been cleared out of the mine and the workers would have been saved and evacuated from the return side, which would have had clean air in case the fan was reversed. In such cases, the provision of a third Air Lock Door is necessary. According to the location of the fire, standing orders are-to be formulated as to when the fan is to be reversed. The Emergency Action Plan should be immediately activated in case of a coal fire disaster. Mock rehearsal should be conducted by simulating fire in working district; and use of alarm signal, self-rescuers and escape routes. In this process, access to rescue chambers; and activation of the emergency action plan should be rehearsed and tested. Immediately after fire occurs, the Rescue Station should be informed for rescue and recovery work for which they are trained under mines Rescue Rules 1985 with the use of breathing apparatus like BG -174, BG-4, BIOPAK-240R, Travox-120 etc.

Disaster Management: Basic Needs.

Coal- mine fire causes damage to coal mines and structures on the surface and directly affect the safety of inhabitants through subsidence of land and pollution. The information needs, during the different phases, are as follows:

- ❑ Preparedness: Zonation of existing coal mine fire affected regions, preparedness drills through modelling/simulation of potential land subsidence and related impact, and assessment of loss of property / energy.
- ❑ Warning/ Prediction: real time monitoring of coal fires, prediction of spread and depth and pollution extent.
- ❑ Relief Delineation of affected areas, ways to arrest spread of fire, and provide support to affected population.
- ❑ Rehabilitation: long-term measures to control spread of fires, awareness creation among local people, and relocation of affected people.

CONCLUSION

The literature has revealed that coalmine fire is one of the serious problems of Indian Coal Mining industry and needs serious attention both for resource conservation, worker safety and minimising the harm to the environment resulting from unattended disasters. This literature has emphasised on' causes, impacts, and management of coal fires in India. It suggested the need to put in concerted efforts to minimise the economic losses and loss of life resulting from coal fires.

History of fire in Jharia Coal Field

Jharia coalfield is a large coal field located in the east of India in Jharia, Jharkhand. Jharia represents the largest coal reserves in India having estimated reserves of 19.4 billion tonnes of coal. The coalfield is an important contributor to the local economy, employing much of the local population either directly or indirectly.

The fields have suffered a coal bed fire since Yr. 1916, resulting in 37 million tons of coal consumed by the fire, and significant ground subsidence and water and air pollution created in local communities including the city of Jharia. The resulting pollution has led to a government agency designated for moving local populations, however, little progress has been made in the relocation.

The Coal field

The coal field lies in the Damodar River Valley, and covers about 280 square km, and produces bituminous coal suitable for coke. Most of India's coal comes from Jharia. Jharia coal mines are India's most important storehouse of prime coking coal used in blast furnaces.

History

The mining activities in these coalfields started in 1894 and had really intensified in 1925. The first Indians to arrive and break monopoly of British in Coal mining were Gujarati railway contractors from Kutch some of whom decided to plunge into the coal mining business and were thus the pioneers in starting coal mining in Jharia coalfields belt around 1890–95. In Jharia-Dhanbad belt Seth Khora Ramji Chawda was the first Indian to break monopoly of Europeans and founded Khas Jharia, Golden Jharia, Fatehpur, Balihari, Khas Jeenagora, East Bhagatdih Collieries with their brothers Teja Ramji Chawda, Jetha Lira Jethwa, Akhoy Ramji Chawda, Pachan Ramji Chowra between 1894 and 1910. In Pure Jharia Colliery Khora Ramji and brothers were partners with Diwan Bahadur D.D. Thacker. The Encyclopaedia of Bengal, Bihar & Orissa (1920) by British Gazetteer mentions about Seth Khora Ramji as under:-

"At that time (in 1890s) the Jharia coal fields were being exploited by Europeans and Seth Khora Ramji was first Indian to seize the opportunity. He purchased two collieries to begin with. Gradually others from Kutch and Gujarat followed suit and now Jharia has been changed into a Gujarati settlement with about 50 Kutchi out of 92 Gujarati collieries proprietors with Seth Khora Ramji as head of them all. He is now sole proprietor of two collieries and a financing member of about eight collieries. Several district officials have remarked him as multi-millionaire, one of the first class parties in Jharia".

The life sketch of Govamal Jivan Chauhan is also another miner mentioned by the British in Gazetteer who founded collieries at Teesra, Bhadrichuck and Pandeberra around 1908–10, Jagmal Raja Chauhan owned Rajapur colliery with Manji Jeram of Madhapar,[7] while Khimji Walji owned Tisra mines The migrants took on lease the coal mining fields from Raja of Jharia at various locations to start collieries at Khas Jharia, Jamadoba, Balihari, Tisra, Katrasgarh, Kailudih,Kusunda, Govindpur, Sijua, Sijhua, Loyabad, Joyrampur, Bhaga, Matadih, Mohuda, Dhansar, Bhuli, Bermo, Mugma, Chasnala,Bokaro, Bugatdih, Putki,Pandibri,Rajapur, Jeenagora, Gareria, Chirkunda, Bhowrah, Sinidih, Kendwadih, Dumka, etc.

The all the mines of Jharia coal fields was nationalized in two phase 1st in 1971 all the coking coals mines and in 2nd phase in 1973 rest of mines were nationalized. But before the nationalization fire already detected in 1916 at Khas Jharia colliery and it was ignored by than colliery owner as they have abundant coal properties to escape from fire and to run mines another location.

History of fire in Jharia Coal field

Jharia Coal mine with smoke and burning embers coming from the underground since 100 years causing displacement of thousands of people from their habitats.

Jharia is Known for a mine fire that has burned underground for nearly a century. An estimate,

described 37 million tons of coal consumed by the fires since their start.

The first fire was detected in 1916. According to records, it was the Khas Jharia mines of Seth Khora Ramji Chawda, who was a pioneer of Indian coalmines, whose mines were one of the firsts to collapse due to underground fire in 1930. Two of his collieries, Khas Jharia and Golden Jharia, which worked on maximum 80m deep shafts, collapsed due to now infamous underground fires, in which their house and bungalow also collapsed on 8 November 1930, causing 18 feet subsidence and widespread destruction .The fire never stopped despite sincere efforts by mines department and railway authorities and in 1933 flaming crevasses lead to exodus of many residents. The —1934 NepalBihar earthquake led to further spread of fire and by 1938 the authorities had declared that there is raging fire beneath the town with 42 collieries out of 133 on fire.

In 1972, more than 70 mine fires were reported in this region. Now a days, more than 400,000 people who live in Jharia are living on land in danger of subsidence due to the fires, and according to inhabitants of Jharia is on the brink of an ecological and human disaster. The government has been criticized for a perceived lackadaisical attitude towards the safety of the people of Jharia. Heavy fumes emitted by the fires lead to severe health problems such as breathing disorders and skin diseases among the local population.

In recent years a organization namely JRDA constituted by the Jharkhand Government to execute a mega plan called Jharia master plan for the displacement and rehabilitation & resettlement of the people affected by the fire.

The BCCL carried out different activities and operations to dig out the fire coal which is the best method to deal with the fire.

Scope of applicability of Highwall Mining Technology in Indian Coal Seams with special emphasis on Thick/Combined Seams of Bharat Coking Coal Limited vis-à-vis present Socio-Technical scenario.

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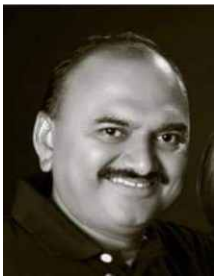


Abstract

Coal is the most important and abundant fossil fuel in India. It accounts for 55% of the country's energy need. Commercial primary energy consumption in India has grown by about 700% in the last four decades. The current per capita commercial primary energy consumption in India is about 350 kgoe/year, which is well below that of developed countries.

Driven by the rising population, expanding economy and a quest for improved quality of life, energy usage in India is expected to rise. Considering the limited reserve potentiality of petroleum & natural gas, eco-conservation restriction on hydel project and geo-political perception of nuclear power, coal will continue to occupy centre-stage of India's energy scenario.

Highwall mining is a hybrid of surface mining and underground mining methods, and is often the only feasible method to recover the additional coal after the economic strip limit is reached in surface mining. ***It involves remote deployment of a Highwall Miner machine in openings beneath the final highwall. The highwall mining method can reduce the environmental impacts, increase the recovery ratio of coal reserves, and enhance mine safety as well as productivity.***

Mining down dip presents challenges related to the machine's maximum pulling capacity, traction of the cutting head, and material conveying, all which limit penetration depth. Maximum penetration is greater for flatter slopes and decreases for slopes nearing the threshold of the maximum machine-operating angle.

With the challenges faced in Land Availability (due to dense habitation and presence of Surface Infrastructures) for Open Cast Mining in BCCL and other subsidiaries of CIL, Highwall Mining technology presents the best available technology in current times to extract the coal safely and with minimum ecological disturbance.

Presence of Thick-Coal seam and presence of combined-seams requires detailed planning in application of the Highwall mining technology, which requires the extraction of maximum coal reserve while maintaining the proper safety parameters.

Highwall mining of thick seam, poses geo-technical & Operational challenges as well as allows more flexibility when designing for maximum recovery, which requires careful planning and execution, including close cooperation between those responsible for geotechnical design, the mining company, and the highwall mining contractor.

This paper will focus on the applicability of Highwall Mining Technology in coal Seams special emphasis on Thick/Combined Seams of Bharat Coking Coal Limited & Central Coal Field Limited considering the existing Socio-Technical Scenario.

Keywords— ***Highwall Mining, Thick/Combined Seam***

I. INTRODUCTION

With India's power demand expected to double in the coming decade, coal power generation may not yet have reached its peak. Historically, coal plants have accounted for 70 to 80 per cent of the country's total power generation. This share is estimated to remain above 50 per cent even in 2030

Abundant in India, Coal is considered important for the nation's energy security and is a key source of revenue for the government. The state-owned Coal India Limited (CIL) is the largest coal miner in the world; it pays around INR 40,000 crore annually in royalties, cesses, and levies, besides rich dividend payouts to the government. Coal production also benefits the Indian Railways (IR), which cross-subsidies passenger fares with high freight rates for coal transportation.

Coal is key to alleviating energy poverty. Approximately 860 million people across the globe currently live without access to electricity. Nearly 2.6 billion people do not have clean cooking facilities. The problem is spread across the developing world, but it is particularly severe in sub-Saharan Africa and developing Asia, which together account for 95% of people in energy poverty.

The most economical method of coal extraction from coal seams depends on the depth and quality of the seams, and the geology and environmental factors. Many coal deposits are extracted from both surface and underground mines. Surface mining and deep underground mining are the two basic methods adopted

for mining coal.

The choice of mining method depends primarily on depth of burial, density of the overburden and the thickness of the coal seam. Seams relatively close to the surface are usually surface mined. Coal that occurs at depths of 100 to 200 m are usually mined by Underground method of mining.

Coal Mining Methods -

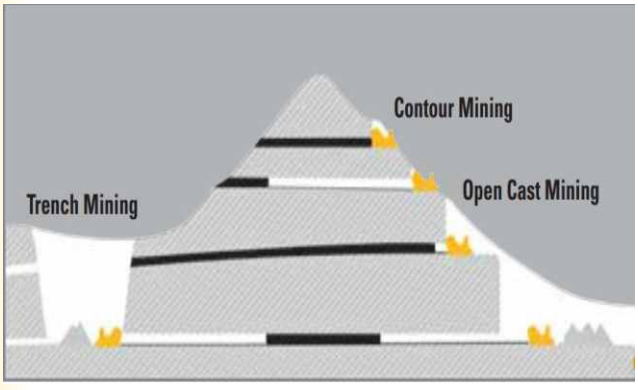
1. Surface Mining
   - Strip
   - Slice
   - Horizon
2. Underground Mining –
   - Bord & Pillar
   - Long-Wall
3. Highwall Mining

Many coal seams that are presently uneconomical or technically unsuitable for conventional surface mining techniques can be recovered using the highwall mining systems. Final Highwalls of open cut coal mines can form the starting point for other mining methods, such as highwall or underground mining. Currently, the highwall mining systems are capable of handling coal seam thickness as from

2.6 to 16 ft. with a dip up to 8 degrees.

Methods of Highwall Mining –

- **Final Highwall mining** is used to mine coal from underneath the final highwall, when the strip limit is reached due to economic reasons or surface conditions.
- **Contour mining**: In a mountainous area, the Cat highwall mining system can follow a coal seam along the side of the hill.
- **Trench mining**: The unit mines coal from both sides of a purpose-prepared trench; this mining method is used when an open pit is not an option



REMOTE DETECTION SYSTEMS IN HIGHWALL MINER

Video-Imaging (VI), Gamma Ray Sensor and **Geo-Radar** could be mounted on the CM unit for the following two purposes:

- Locating roof and floor rocks to avoid cutting into such rock.
- Determining the pillar width left between the previous and current entries to maintain the pillar design width.

Once a production entry, between 9.5 and 11.5 ft. wide, is completed, the machine will move to another predetermined location to start another production entry. A continuous solid coal pillar with a pre-determined width will be left between the two adjacent production entries.

Potential for Improving Mining Safety and Health -

In a highwall mining operation, only the continuous miner and the push-beam/conveyor system go underground while the miners and other mining and haulage equipment are on surface. Therefore, the miners are not exposed to common safety hazards associated with underground mining operations such as-

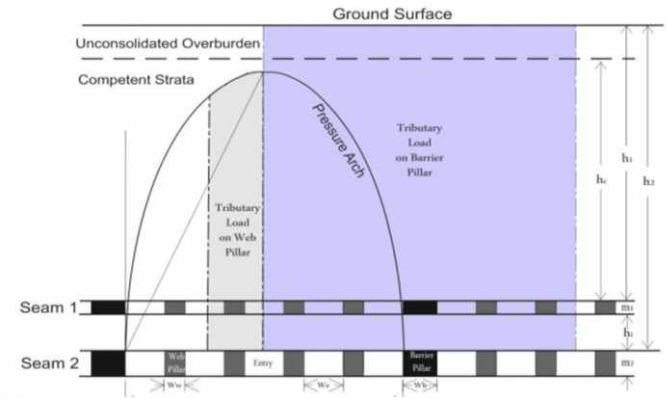
- Roof and rib falls,
- Hazards with mobile mining equipment,
- Mine fires and explosions, etc.
- Exposure to coal dust that causes coal miner's pneumoconiosis (CWP) - the most serious health problems in coal mining industry.

INFLUENCE OF MULTI SEAM MINING OPERATIONS

Between 20 and 40 percent of highwall mining operations are conducted in closely spaced coal seams. The strata deformations and stress concentrations created by the past and current mining activities in the underlying or overlying coal seams could affect the stability of the mine structures in the active highwall mine. When the thickness of the inter- burden strata is smaller than one entry width, the **Multi- Seam Mining (MSM)** interactions would be often strong enough to affect the mining operations.

In order to minimize the undesirable MSM interactions when the coal seams are closely spaced, it is recommended to vertically align the highwall miner holes

and pillars as shown in Fig.-



Scenario –

· If the soft and thin inter-burden is unable to carry its own weight and the weight of the mining machine, downward mining sequence would be preferred. In this case, water accumulated in the previous mine holes in the upper seam(s) could create some problems to the mining operations in the underlying coal seam.

· When the inter-burden strata are sufficiently competent, the design of the web and barrier pillars can be carried out assuming that the highwall mining is conducted in each of the individual coal seams alone.

· If the mining heights in the seams are considerably different, the resulting sizes of the web and barrier pillars for one seam could differ significantly from those in the other seams, too. The larger pillar sizesshould be used in the design for the pillar alignment vertically as it is suggested in Fig above

PRODUCTION OPTIMIZATION IN THICK SEAM / MULTIPLE SEAM MINING

There are many challenges in maximizing recovery for very steep and thick seams with moderately dipping highwalls. Penetration of the mining machine is typically limited for steeper operating slopes. For example, the ADDCAR miner routinely achieves maximum penetrations of 365.76 m or more when working on grades of less than 16°. As the grade increases past 16°, the maximum penetration decreases, to an ultimate limit of 182.88 m at a 20° slope.

· For thick seams, production may be increased by mining cross-seam, cutting vertically across the seam at a flatter dip, to obtain greater penetration depth. The machine may ultimately contact the seam roof before maximum penetration is achieved; therefore, the opening should be initiated at the base of the seam to optimize penetration.

At some inclination, the penetration at which the machine contacts the roof coincides with the limiting penetration for the given inclination and represents the maximum possible penetration (optimum case). At steeper inclinations, the penetration is reduced, due to machine limitations, resulting in less production.

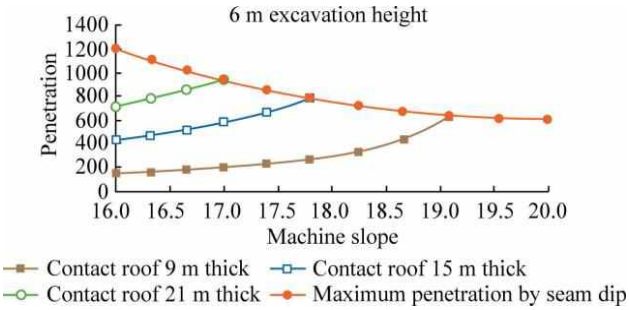


Fig. 1. Maximum penetration depths in a 20° maximum for different machine inclinations and seam thicknesses.

· For steep seams, an angled-hole technique permits increasing penetration, and thus production. By orienting the openings at an angle to the highwall, instead of mining directly downdip, the mining gradient can be decreased somewhat resulting in a greater penetration depth.

Challenge –

Angled holes also result in a wider roof exposure at the collar, potentially resulting in decreased stability.

· Production can also be increased in thick seams by making multiple passes in a single opening to increase the effective mining height or to mine multiple stacked openings. Multi-pass mining has been accomplished for heights of about 8.53 m, and even greater heights are operationally possible. Overall production with a greater mining height is somewhat offset by the requirement for wider web and barrier pillars to maintain stability.

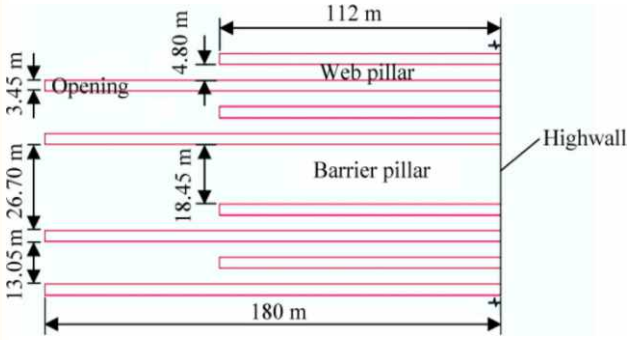
Challenge –

With taller openings, the potential for rib spalling also increases, and needs to be considered.

· Multi-lift mining requires very thick seams in order to accommodate two (or more) openings and the intermediate sill pillar(s). The sill pillar thickness should be determined through numerical analysis. Depending on the seam thickness, multi-pass mining can be combined with multi-lift mining to increase production. Normally, the recovery lost from having to increase pillar widths

associated with higher openings is offset by the increased recovery from the higher openings. Since web pillar widths required for multi-lift mining are only slightly increased versus those of single-lift mining, production from multi-lift mining could double or more, depending on the number of lifts.

· In this method, every other hole is mined to the design penetration, while the holes between the full penetration openings are stopped short. For the shorter holes, the depth of cover under the highwall is less than that at full penetration, permitting the use of narrower web pillars at the highwall. The pillar between the ends of the full penetration holes is typically wider than necessary as it is composed of the widths of two shorter penetration web pillars plus the opening width. Although the coal produced from the shorter holes is reduced, the narrower web pillars at the highwall allow more openings to be mined for a given pit width. This increases overall recovery versus a layout in which all holes are mined to the same penetration.



APPLICABILITY OF HIGHWALL MINING IN COMBINED SEAM – V/VI/VII IN BCCL.

Land acquisition has become a major challenge in BCCL due to high population density of residents above the land that has to be mined.

One such patch in Block-2 area of BCCL has been considered for Highwall Mining in Combined Seam – V/VI/VII. The patch has been awarded to M/s Gainwell JV and expected to start soon after completion of Scientific Study and obtaining necessary statutory permissions.

Design of Highwall Mine profile has been framed in this study for Combined Seam – V/VI/VII of BCCL which is 25 m thick.

Calculation -

Stress on web pillar – LP

= SV (W + WE)/W

Vertical Stress – SV

= 2.5 * 1000 (KG/M^3) * 10 (M/S^2) * 100(M)

= 2.5 MPa

Web pillars strength by CIMFR`S formula -

SP =0.27pc* h-0.36 + (H/250 +1) *(We/h -1) MPaWhile considering the below given parameters for Combined Coal-Seam (V/VI/VII) -

While considering the below given parameters for Combined Coal-Seam (V/VI/VII) -

Pc	compressive strength of sample of 25mm cube	25
h	height of extraction (m)	3.5
H	depth of cover (m)	75
We	equivalent width of web pillar (m)	10
W	gallery width (m)	3.5

Following results were obtained for designing of Highwall Gallery and Web Pillars –

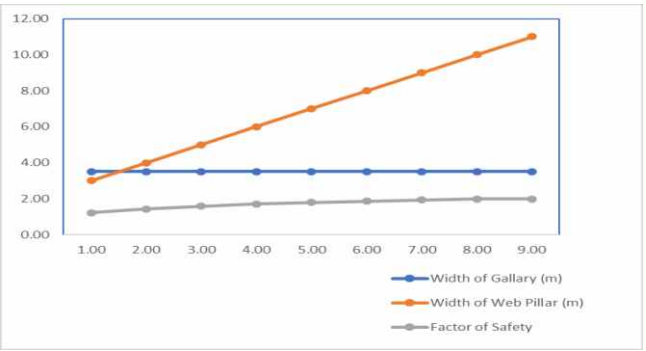
Observations –

Strength of the Rib Pillar calculated using CIMFR's Formula = 6.71 M Pa

Load on Pillar is inversely proportional to the Width of Web Pillar left after gallery drivage.

Sl No	Width of Gallary (m)	Width of Web Pillar (m)	Strength (SP) M pa	Load on Pillar (LP) MPA	Factor of Safety (FOS)
1.00	3.50	3.00	6.71	5.47	1.23
2.00	3.50	4.00	6.71	4.68	1.43
3.00	3.50	5.00	6.71	4.25	1.58
4.00	3.50	6.00	6.71	3.95	1.70
5.00	3.50	7.00	6.71	3.75	1.79
6.00	3.50	8.00	6.71	3.59	1.87
7.00	3.50	9.00	6.71	3.47	1.93
8.00	3.50	10.00	6.71	3.38	1.99
9.00	3.50	10.00	6.71	3.40	1.97

FOS of above 1.5 for 3.5 m wide gallery is obtained for web pillar width of 5 m



SOP devised by Block-2 Area in vernacular language -

हाई वाल मशीन ऑपरेटर का एस ओ पी :-

1. हाई वाल मशीन को चालू करने से पहले सभी महत्वपूर्ण घटकों, सुरक्षा सुविधाओं और विधुत प्रणालियों सहित हाई वाल खनन मशीन का विस्तृत निरिक्षण करंगे
2. सुरक्षा इंटर लॉक, आपातकालीन स्टॉप सिस्टम और अलार्म की कार्य क्षमता को भी चेक करेंगे।
3. किसी भी प्रकार के संभावित खतरों के किसी भी लक्षण का निरक्षण करेंगे।
4. हाई वाल मशीन को चलाने से पहले सम्बंधित सभी उपयुक्त प्रशिक्षण करेंगे।
5. मशीन के संचालन से सम्बंधित विशिस्ट कार्यों के लिए विशेष ट्रेनिंग लेंगे
6. फेस में कही भी झूला, फाल्ट स्लिप को ठीक से जाँच करके मशीन को फेस में लगायेंगे।
7. मशीन में प्रोपर वाटर सेयिंग व्यवस्था को निरक्षण करते हुए मशीन का परिचालन करेंगे।
8. उपयुक्त वंटिलेशन कायम रखने के लिए मशीन के मॉनिटर पर धयान रखेगे।
9. जहा पर मशीन का परिचालन हो रहा है रहा है वहां पर उचित लाइट का इन्तेजाम है की नहीं है देखकर ही परिचालन करेंगे।
10. मशीन में उपयुक्त हाईड्रोलिक प्रेशर, हाईड्रोलिक होज में लीकेज वगैरह को देखकर ही मशीन का परिचालन करेंगे।
11. इलेक्ट्रिकल केबुल का निरिक्षण करके और उसे सुरक्षित पाए जाने के बाद ही मशीन का परिचालन करेंगे ।

इलेक्ट्रीशियन का एस ओ पीः-

1. हाईवाल मशीन से सम्बंधित उपयुक्त ट्रेनिंग (स्पेशल) प्राप्त कर्मी ही इलेक्ट्रीशियन का काम करंगे।
2. बिजली से सम्बंधित खतरों को रोकने के लिए सभी विधुत कनेक्शन और सिस्टम को देखेंगे कि ग्राउंडेड है या नहीं
3. इन्सुलन की जांच लगातार करेंगे कि सभी जगह है या नहीं।
4. विधुत सुरक्षा मानको का भी अनुपालन करेंगे।
5. ट्रेलिंग केबुल की निगरानी रखेंगे कि कही पानी लीकेज न हो।

मैकेनिकल फीटर का एस ओ पीः-

1. ऑपरेटर के साथ संचार व्यवस्था ठीक रहे इसका ध्यान रखें ।
2. हाइड्रोलिक सिस्टम का निरक्षण करंगे।
3. सुनिक्षित करेंगे कि हाइड्रोलिक होज डीक स्थिति में हो।
4. पुश बीम क्रेन के क्लॅप से ठीक से लगा है कि नहीं इमका सुरक्षित निरक्षण करते हुए लगायेंगे और आस पास वहां पर नहीं रहेंगे।
5. हाईवाल मशीन की सहायता से ही पुश बीम को संयुक्त किया जायेगा। इसमें मेनुअल काम नहीं करेंगे।
6. वाटर स्प्रेयिंग, इंटर लॉकिंग प्रणाली को निरक्षण करके ही मशीन को परिचालन करने के लिए दिया जायेगा।
7. डिस्चार्ज चेंज कन्वेयर के निचे कोई खड़ा नहीं हो इसका ध्यान रखेंगे 8. पुश बीम को चेंज करते समय और कोई भी काम नहीं होगा।
9. फ्रोक (पे लोडर) द्वारा पुश बीम को ट्रांसपोर्ट करने के समय आस पास में कोई खड़ा नहीं होंगे
10. सुरक्षित स्थान पर खड़ा रख कर ही पुश बीम को चेंज किया जायेगा ।
11. पी पी ई कीट पहनकर काम करेंगे ।
12. ड्यूटी के दौरान मोबाइल फ़ोन का उपयोग नहीं करेंगे।
13. नशे की हालत में कभी भी काम नहीं करेंगे ।

Results –

1. Numerical Modelling will be required to access the sill pillar width required to be left between 2 levels of highwall galleries.
2. Minimum web pillar of width 5 m should be left between the galleries to maintain FOS above 1.5.
3. Galleries driven in multiple levels must be vertically aligned to better control the stress.
4. While driving Highwall galleries in multiple levels in same thick seam, extraction should be made Top- Downwards.
5. While driving Highwall galleries in different seam which are not contiguous, extraction should be made from bottom-up.
6. Scientific study should be conducted before start of the patch to access the exact stress and strength of web pillar.

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KISHOR YADAV
SR.MANAGER(MIN)
ISO/SAFETY DEPTT.

Cardiopulmonary resuscitation (CPR) is a hands-on emergency intervention used to restore breathing and a heartbeat in a person who has gone into cardiac arrest.1

Common causes of cardiac arrest are a heart attack or near-drowning.

CPR involves performing chest compressions and, in some cases, rescue ("mouth-to-mouth") breathing. These techniques can keep blood flowing to the brain and other organs until medical help arrives. When oxygen-rich blood cannot get to the brain, brain damage can occur within minutes.2

This article explains the basic principles and techniques of how to perform CPR. You can then consider receiving your CPR certification via an online or in-person training workshop.

What to Do If Someone Needs CPR

Ideally, everyone would be trained in CPR. If you're not, you may be afraid to try to help someone in an emergency. Still, it's always better to do what you can than to do nothing at all if it means potentially saving a person's life. The American Heart Association recommends a slightly different approach to doing CPR depending on how well-trained you

are:1

· If you are trained: Check to see if the person has a pulse and is breathing. If there is no pulse or breathing within 10 seconds, use a CPR compression rate of of 100 to 120 per minute, in cycles of 30 compressions followed by two rescue breaths. Repeat the sequence until the person starts breathing.

· If you are untrained, or trained but not too confident in your abilities: If you're not trained in CPR, or are unsure about giving rescue breaths, then use hands-only CPR.3 Hands-only CPR involves uninterrupted chest compressions of 100 to 120 per minute. You do not include rescue breathing with this technique, but you shouldn't stop CPR until an EMT or other healthcare provider arrives, or you're sure a pulse is restored.

What to Do Before Performing CPR

Time is of the essence, but before you attempt CPR on someone, follow these steps:4

1. Make sure the environment is safe. A fire, traffic accident, or other dangers could put your own life at risk.
2. Try to wake the person. Tap on the person's shoulder firmly and ask "Are you OK?" in a loud voice. Move on to the next steps after five seconds of trying to wake the patient.
3. Call 911. Anytime a patient won't wake up, call 911 immediately or ask a bystander to call. Even if you will perform CPR on the spot, it's important to get paramedics to the scene as quickly as possible.
4. Put the person on their back. If it's possible that the person may have had a spinal injury, turn them carefully without moving the head or neck.
5. Check for breathing. Tilt the patient's head back to open the airway and determine if they are breathing. If the patient doesn't take a breath after 10 seconds, start CPR.

How to Do CPR

Once you have followed the above steps, here is how to perform CPR. Techniques vary slightly based on the age of the person. How to do CPR on an adult is different from how to do CPR on a toddler, and a separate technique is used for infants.

Adults

The following steps apply to adults and to children over 8 years old.2

1. Place your hands on the person's chest. Imagine a line between the nipples and put the heel of one hand directly on that line, in the center of the chest (i.e., the sternum). Place your other hand on top of that hand. Center your weight directly over your hands.
2. Perform chest compressions. Push hard, to a depth of at least 2 inches (but no deeper than 2.4 inches) and fast—about twice per second until the person responds. Your hands shouldn't bounce, but you should lift your entire body weight off the patient in between each compression.5

3. Give rescue breaths. If you have had CPR training and feel comfortable performing the steps, push on the chest 30 times, then give two rescue breaths.
4. Repeat. Repeat cycles in the CPR ratio of 30:2 (chest compressions and breaths) until help arrives or the patient wakes up.

Children 1 to 8 years old

The procedure for giving CPRto a child between 1 to 8 is essentially the same as that for an adult.5

1. Place your hands on the child's chest. Place two hands (or one hand if the child is very small) on the child's sternum.
2. Perform chest compressions. Push hard, to a depth of at least 2 inches (but no deeper than 2.4 inches) and fast—about twice per second until the person responds.
3. Give rescue breaths. If you have had CPR training and feel comfortable performing the steps, push on the chest 30 times, then give two rescue breaths.
4. Repeat. Repeat cycles of 30 chest compressions and two breaths until help arrives or the patient wakes up.

Infants

1. Flick the bottom of the foot to elicit a response. This takes the place of shaking the shoulders of an older person.
2. Place two fingers of one hand in the center of the chest.
3. Give chest compressions. Gently use your fingers to compress the chest about 1.5 inches deep. Perform two compressions per second, just as you would when giving an adult CPR.
4. Perform rescue breathing. If you are comfortable giving rescue breaths, give two of them between each series of 30 chest compressions, just as you would with an older person.6

What Each Step Does

Each step of CPR serves an important purpose. Here's what each one does:

Asking If the Person Is OK

Before attempting CPR, it's important to make sure the person actually needs it. If the person wakes up when you shake them gently and talk to them, don't start CPR, but do get medical help right away, especially if they seem confused or are unable to speak.

Calling 911

Even if you end up reviving the person with CPR, they will need to be taken to the hospital by an ambulance as soon as possible.

If you don't succeed, an EMT may be able to resuscitate the person with medical equipment, such as an automated external defibrillator (AED).7

An EMT may also be able to talk you through performing CPR steps while they're en route.

कोल इण्डिया लिमिटेड

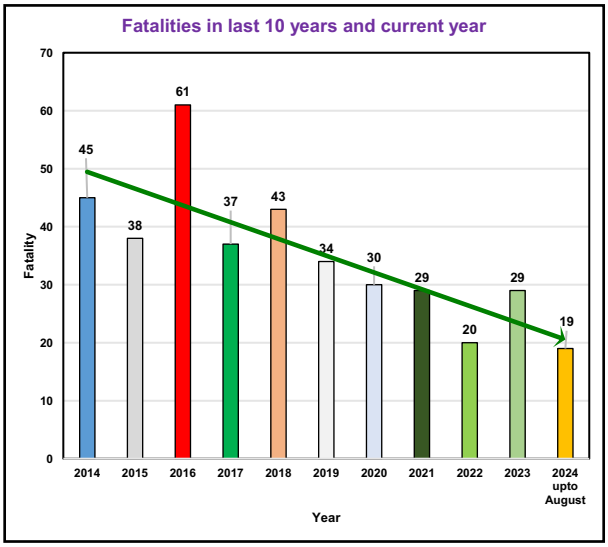
सुरक्षा एवं बचाव विभाग

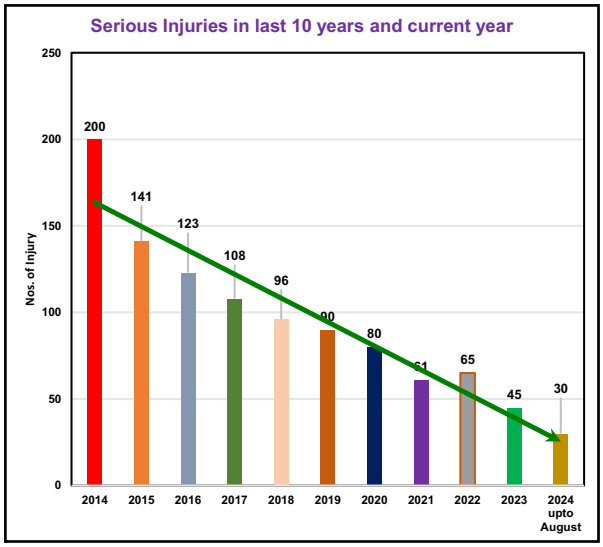
SENSITISATION PROGRAM FOR ALL E&M AND EXCAVATION ENGINEERS

FOR FURTHER REDUCTION OF ACCIDENTS

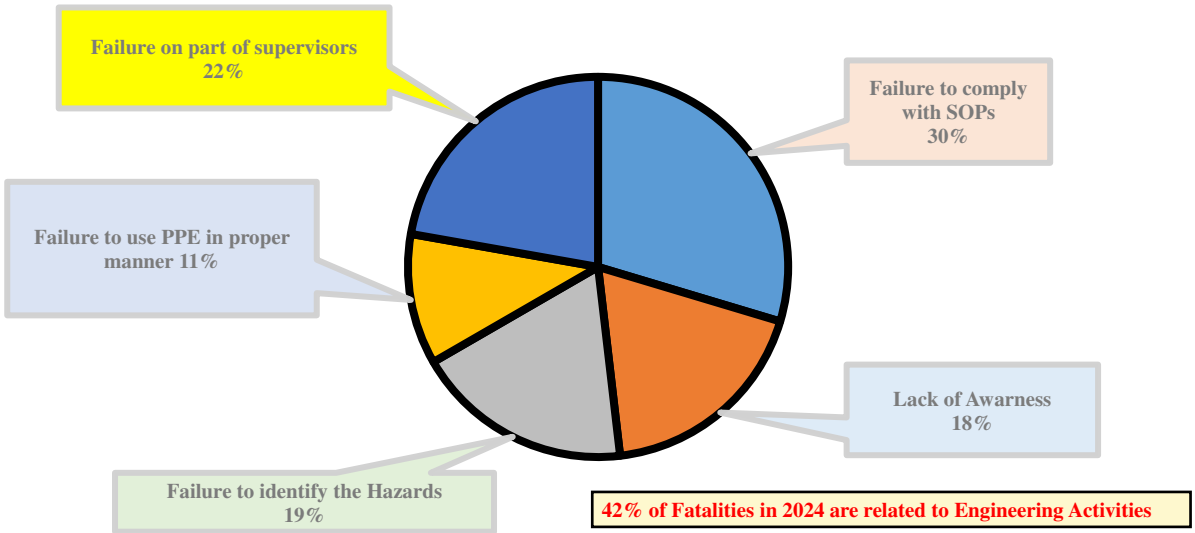
E.KARTHILEYAN GM(S&R), CIL KOLKATA

Fatalities & Serious Injuries Trend in CIL in last 10 years and current year





MAJOR CONTRIBUTORY CAUSES OF FATAL ACCIDENTS 2024



42% of Fatalities in 2024 are related to Engineering Activities

3

ACCIDENTS RELATED TO ENGINEERING ACTIVITIES (EXC & E&M)

- 42% OF THE FATAL ACCIDENTS IN THE CURRENT YEAR IS DUE TO ENGINEERING ACTIVITY

- 22% OF THE FATAL ACCIDENTS IN THE LAST THREE YEARS IS RELATED TO ENGINEERING ACTIVITY

ACCIDENT FIGURES 2024-JAN- OCT- 2024

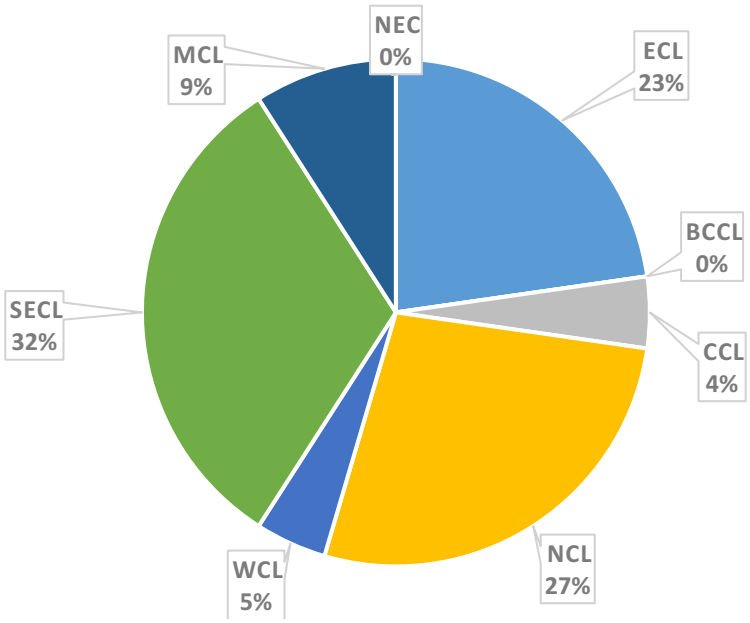
Year	No of Fatal Accidents	No of Fatalities	No of Serious Accidents	No of Serious Injuries
2024	20	22	28	34

A critical analysis of the frequency of accidents reveals that there has been one fatality every 14 days and one serious injury every 9 days. (From Jan 2024 till October -2024).

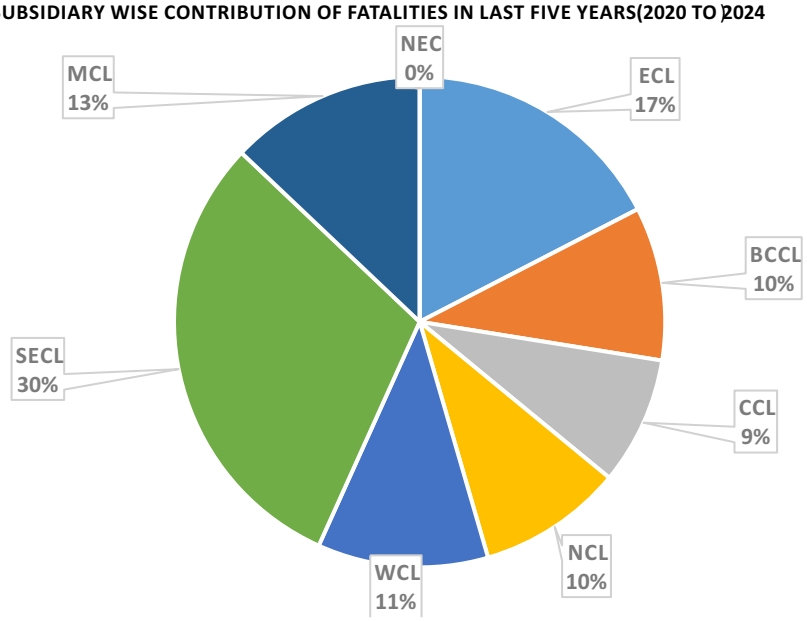
46% of the serious accidents had the potential to convert into a fatal accident

21% of the dangerous occurrences had the potential to convert into a fatal accident

SUBSIDIARY WISE CONTRIBUTION OF FATALITIES IN THE YEAR 2024



SUBSIDIARY WISE CONTRIBUTION OF FATALITIES IN LAST FIVE YEARS(2020 TO 2024)



FATAL ACCIDENTS & FATALITIES OF CIL for the period from Jan Oct' 2024 as compared to the same period last year

Com	FATAL ACCIDENTS & FATALITIES					
	Accidents		Fatalities		Change in FTY	% Change
	2024	2023	2024	2023		
ECL	4	4	5	4	+1	+25%
BCCL	0	4	0	5	-5	-100%
CCL	1	4	1	4	-3	-75%
NCL	5	2	6	2	+4	+200%
WCL	1	2	1	2	-1	-50%
SECL	7	3	7	3	+4	+133%
MCL	2	6	2	8	-6	-75%
CIL	20	25	22	28	-6	-21%
	-5 (20% decrease)		-6 (21% decrease)			

NOTE : Figures are provisional and subject to reconciliation with DGMS.

SERIOUS ACCIDENTS & INJURIES OF CIL for the period from Jan Oct' 2024 as compared to the same period last year

Com	SERIOUS ACCIDENTS & SERIOUS INJURIES					
	Accidents		Injuries		Change in INJ	% Change
	2024	2023	2024	2023		
ECL	3	2	3	5	-2	-40%
BCCL	3	2	4	2	+2	+100%
CCL	1	0	1	0	+1	+100%
NCL	4	10	9	14	-5	-36%
WCL	5	3	5	3	+2	+67%
SECL	11	11	11	12	-1	-8%
MCL	1	1	1	4	-3	-75%
CIL	28	29	34	40	-6	-15%
	-1 (3% decrease)		-6 (15% decrease)			

NOTE : Figures are provisional and subject to reconciliation with DGMS.

CAUSE-WISE Analysis of Fatalities for the period from Jan- Oct' 2024 compared to the same period last year

SN	Causes	2024	2023	Change	% Change
1	Tippers & Dumpers	5	12	-7	-58%
2	Non transport m/c	3	3	0	0%
3	Roof /side fall	1	2	-1	-50%
4	Electricity	0	1	-1	-100%
5	Drowning	1	1	0	0%
6	Fall of object / persons	10	5	+5	+100%
7	Haulage, Conveyor & Winding	1	1	0	0%
8	Fire, Gas & Dust	0	2	-2	-100%
9	Strata / Dump failure	0	1	-1	-100%
10	Explosives	1	0	+1	+100%
	Total	22	28	-6	-21%
54% of the fatal accidents are due to FOP/FOB/NTM/Tipper and dumpers					

CAUSE-WISE Analysis of Serious Injuries for the period from Jan– Oct' 2024 compared to the same period last year

SN	Causes	2024	2023	Change	% Change
1	Fall of object / persons	14	14	0	0%
2	Roof /side fall	5	4	+1	+25%
3	Tippers & Dumpers	12	8	+4	+50%
4	Non transport m/c	1	5	-4	-80%
6	Explosives	0	2	-2	-100%
7	Haulage, Conveyor & Winding	0	2	-2	-100%
8	Miscellaneous	2	5	-3	-60%
	Total	34	40	-6	-15%

AGE-WISE Analysis of Fatalities for the period from Jan– Oct' 2024 compared to the same period last year

SN	Age-Wise	2024	2023	Change	% Change
1	18 – 30	9	4	+5	+125%
2	31 – 35	6	5	+1	+20%
3	36 – 40	1	6	-5	-83%
4	41 – 45	2	1	+1	+100%
6	46 – 50	2	4	-2	-50%
7	51 – 55	1	5	-4	-80%
8	56 – 60	1	3	-2	-67%
	Total	22	28	-6	-21%
72% of the fatalities are in the age group between 18 to 40Yrs					

AGE-WISE Analysis of Serious Injuries for the period from Jan– Oct' 2024 compared to the same period last year

SN	Age-Wise	2024	2023	Change	% Change
1	18 – 30	5	5	0	0%
2	31 – 35	5	4	+1	+25%
3	36 – 40	4	7	-3	-43%
4	41 – 45	2	6	-4	-67%
6	46 – 50	3	6	-3	-50%
7	51 – 55	5	3	+2	+67%
8	56 – 60	8	8	0	0%
	Total	34	40	-6	-15%
41% of the serious injuries are in the age group between 18 to 40Yrs					

EMPLOYMENTWISE for the period from Jan– Oct' 2024 compared to the same period last year

SN	Fatalities	2024	2023	Change	% Change
1	Dept.	5	14	-9	-64%
2	Cont.	17	14	+3	+21%
	Total	22	28	-6	-21%
77% of the fatalities are contractor persons as compared to 50% last year(2023)					

SN	Serious Inj.	2024	2023	Change	% Change
1	Dept.	23	26	-3	-12%
2	Cont.	11	14	-3	-21%
	Total	34	40	-6	-15%
32% of the serious injuries are of contractor persons as compared to 35% last year					

MONTH WISE ACCIEDNTS

Jan 2024	29.01.2024	Krishnashila OC	Fatal	Hit by tipper
F-0 SI-01	07.01.2024	Chirimiri OC	Serious	Toppling of WT
Feb 2024	06.02.2024	Basantimata OC	Serious	Fell down while getting down the dumper
F-02 SI-02	15.02.2024	Narasamunda UG	Serious	Fall of roof
	17.02.2024	Kusmunda OC	Fatal	CHP
	19.02.2024	Kurja UG	Fatal	Hit by CM

Mar 2024	04.03.2024	Chirimiri OC	Serious	Hit by rolling stone during heavy rain
F-01 SI-03	06.03.2024	Churcha UG	Fatal	
	12.03.2024	Delwadih UG	Serious	Fall of roof
	12.03.2024	Munidih UG	Serious	Breakage of winch
	30.03.2024	Chhal OC	Serious	Toppling of OB tipper in dump yard
April 2024	02.04.2024	Chinakuri UG	Fatal	
F-03 SI-01	23.04.2024	Nigahi OC	Fatal	Dumper hit LV
	23.04.2024	Nigahi OC	Serious	Dumper hit LV
	24.04.2024	ILBL	Fatal	Hit by road sale vehicle
May 2024	**04.05.2024**	**Adasa UG to OC**	**Serious**	**Abrupt uncoiling of power cable**
F-04	05.05.2024	Jamuna 1&2 UG	Serious	Fell down from ladder
SI-05	10.05.2024	Parasea UG	Fatal	Stone fall from shaft
	12.05.2024	Kabribad OC	Fatal	Uncontrolled oprn of dozer
	15.05.2024	Jambad UG	Fatal	Hit by projectile
	20.05.2024	Jhilimilli UG	Serious	Fall of roof
	22.05.2024	Dudhichua OC	Fatal	Fall from CHP
	26.05.2024	Sirka OC	Serious	Fall from ladder
	27.05..2024	Rampur batura OC	Serious	Drill rod fell down
June 2024	**11.06.2024**	**Kulda OC**	**Fatal**	
F-01 SI-03	11.06.2024	Umrer OC	Serious	Toppling of diesel bouser
	11.06.2024	Narasamunda OC	Serious	Side fall
	28.06.2024	Jayanth OC	Fatal	Dumper collision with LMV
	28.06.2024	Amlohiri OC	Serious	Head to tail collision
July 2024	13.07.2024	Amlohiri OC	Serious	Hit by tipper during reversing
F-01 SI-05	16.07.2024	Rajpura OC	Serious	Dumper rolling forward
	23.07.2024	Churcha RO	Serious	Fell down on tracks
	25.07.2024	Nigahi OC	Serious	Hit by crane
	27.07.2024	Kusmunda OC	Fatal	Swept away in flowing water
	31.07.2024	Bhatgaon UG	Serious	Slipped and fell down

Aug 2024	13.08.2024	NM UG to OC	Fatal	During maintence of dozer
F-03 SI-02	21.08.2024	Block B	Fatal	During handling of pump motor
	23.08.2024	Jhanjra UG	Fatal	Side fall in CM section
	28.08.2024	Singhali UG	Serious	Joining of flanges in pipeline
	30.08.2024	Durgapur Extn OC	Serious	Fall from CHP platform
Sep 2024	05.09.2024	Nigahi OC (NS)	Fatal	Toppling of road sale truck
F-04 SI-2	15.09. 2023	AKWMC(NS)	Fatal(from SI)	Fall of person near MTK
	21.09.2024	NM ug to OC	Serious	Toppling of WT
	25.09.2024	Bhatgaon UG	Serious	Fall of rail girder from trolley
	29.09.2024	Chhal OC	Fatal	Fall of pole over person
	30.09.2023	Nigahi OC(NS)	Fatal	Fall from CHP construction work

Oct 2024	**03.10.2024**	**Gevra OC(NS)**	**Fatal**	**Pump truck toppling**	
F-04 SI-2	**06.10.2024**	**Orient 1 &2 UG**	**Serious**	**Fall of roof**	
	09.10.2024	**Magadh OC (NS)**	**Fatal**	**Suspicious death near coal stock**	
	15.10.2024	**Jingurdha OC**	**Serious**	**Fire in WT- optr jumped off**	
	15.10.2024	**Gevra OC**	**Fatal**	**CHP Bunker-Fall of plate**	
	19.10.2024	**Rajnagar OC**	**Fatal**	**Fly rock from blasting**	**F-20/22**
					S-28/34

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भारत कोकिंग कोल लिमिटेड

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